

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

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Application of)	
SPACE EXPLORATION HOLDINGS, LLC)	Call Signs: S2983 and S3018
For Modification of Authorization for the)	
SpaceX NGSO Satellite System)	File No. SAT-MOD-20181108-00083
_____)	

**CONSOLIDATED OPPOSITION TO PETITIONS AND RESPONSE
TO COMMENTS OF SPACE EXPLORATION HOLDINGS, LLC**

In this response, Space Exploration Holdings, LLC, a wholly owned subsidiary of Space Exploration Technologies Corp. (collectively, “SpaceX”), opposes the petitions to defer or deny the above-referenced application for modification of SpaceX’s authorization to launch and operate a non-geostationary orbit (“NGSO”) satellite system.¹ Four operators of small NGSO satellites (“smallsats”) and their trade association (collectively, “Petitioners”) raise a set of issues in the petitions and comments about collision avoidance—that they acknowledge are better suited for an industry-wide proceeding. Because SpaceX is already obligated to comply with the results of that proceeding, the Commission should follow its general practice and not delay deployment of this new broadband service for consumers based on issues applicable industry-wide.

Specifically, most of the issues raised by Petitioners combine to form a broad policy proposal to assign disproportionate responsibility to avoid on-orbit collisions among systems

¹ See Comments and Petition to Defer (“CSSMA Comments”); Petition to Defer (“Astro Digital Petition”); Comments and Conditional Petition to Deny of Kepler Communications Inc. (“Kepler Comments”); Petition to Defer (“Planet Labs Petition”); and Petition to Defer (“Spire Petition”). All these filings were submitted in IBFS File No. SAT-MOD-20181108-00083 on January 29, 2019.

operating at 400 km to 600 km altitude principally to propulsive systems like SpaceX, and away from smallsat operators. In effect, this new policy would skew incentives by tilting the benefits of operating at these self-cleaning altitudes to non-propulsive smallsats to the great detriment of systems that invested in more capable collision-avoidance technologies. But regardless of the flaws in the merits of such assertions, these kinds of far-reaching policy claims are not specific to SpaceX and are better addressed within the separate pending proceeding on orbital debris mitigation rules.

Moreover, the Commission already addressed Petitioners' request for a requirement that SpaceX coordinate its physical operations with other NGSO systems at similar orbital altitudes by imposing that very condition as part of SpaceX's original. Because SpaceX satellites are able to dodge other satellites and debris, the Commission appropriately considers the risk of collision between SpaceX satellites and other spacecraft to be zero—obviating the need for any further analysis. Finally, while one Petitioner raises spectral interference concerns, the application for the proposed modification includes analysis that demonstrates that it will not increase interference from the original license. Accordingly, Petitioners have raised no reason to deny or defer the application, and the Commission should grant it promptly.

BACKGROUND

Last year, the Commission authorized SpaceX to construct, deploy, and operate an NGSO constellation consisting of 4,425 satellites operating in 83 orbital planes at five different altitudes ranging from 1,110 km to 1,325 km, using Ku- and Ka-band spectrum.² By its own terms, that authorization “is subject to modification to bring it into conformance with any rules or policies

² See *Space Exploration Holdings, LLC*, 33 FCC Rcd. 148 (2018) (“SpaceX Authorization”).

adopted by the Commission in the future.”³ In addition, SpaceX is subject to “the requirement that it coordinate its physical operations with space stations of NGSO systems operating at similar orbital altitudes.”⁴

To accelerate its deployment schedule, SpaceX has proposed a modification of its license that would relocate 1,584 satellites previously authorized to operate at an altitude of 1,150 km to an altitude of 550 km.⁵ SpaceX demonstrated, among other things, that this move will enhance the considerable space safety attributes of its constellation by ensuring that any orbital debris will undergo rapid atmospheric re-entry and demise, even in the unlikely event that a spacecraft fails in orbit.⁶ Critically, SpaceX did not request relief from the obligations to comply with rules adopted in the future and to coordinate its physical operations in good faith with other NGSO systems.

Petitioners now request that the Commission defer a decision on SpaceX’s application pending the conclusion of the recently initiated rulemaking on orbital debris mitigation.⁷ Petitioners also suggest that the Commission should impose a new obligation that SpaceX submit a collision risk analysis. In addition, one Petitioner (Kepler) asserts that lowering the altitude of SpaceX’s satellites and temporarily using Ku-band for both user terminals and gateways would result in increased interference.

³ *Id.* ¶ 40(r).

⁴ *Id.* ¶ 11.

⁵ *See* Application for Modification of Authorization for the SpaceX NGSO Satellite System, IBFS File No. SAT-MOD-20181108-00083 (Nov. 8, 2018) (“SpaceX Modification”).

⁶ SpaceX also noted other benefits of operating at lower altitude, including reduced signal latency and improved spectral efficiency. *See, e.g., id.* at 8.

⁷ *See Mitigation of Orbital Debris in the New Space Age*, FCC 18-159 (rel. Nov. 19, 2018) (“*Orbital Debris NPRM*”).

DISCUSSION

I. THE COMMISSION DOES NOT DEFER APPLICATIONS BASED ON CONCERNS OF GENERAL APPLICABILITY THAT WILL BE ADDRESSED IN ONGOING RULEMAKINGS

CSSMA is correct that many of its arguments amount to wide-ranging policy proposals. CSSMA notes that these types of “policy issues regarding the sharing of valuable orbital resources . . . are more appropriately addressed in the Commission’s pending proceeding on the mitigation of orbital debris.”⁸ SpaceX agrees, and more importantly, so does the Commission. But insisting that the Commission not act on a specific application because of these broad policy proposals runs wholly counter to Commission precedent—and good policy. Rather than defer applications pending the completion of a rulemaking proceeding, the Commission routinely grants them subject to any new policies or rules that it may adopt. Any other approach would open the door to mischief by competitors and make the regulatory burden on deploying new services nearly insurmountable.

Indeed, that reasoning led the Commission to choose this course with respect to SpaceX’s original application. Several parties (including one of the Petitioners, Spire) raised concerns that touched on larger, industry-wide issues—including some related to orbital debris. As the Commission explained, these concerns did not warrant delay in granting SpaceX’s application.

[G]rant of the SpaceX application will not prejudice any decision, including a contrary action, in any future rulemaking proceedings. Rather, decisions of general applicability in such proceedings will be based on the totality of comments and proposals in those proceedings, including SpaceX’s. Accordingly, in addition to being subject to any future proceedings, SpaceX would have to comply with any new orbital debris requirements.⁹

⁸ CSSMA Comments at 1. Other Petitioners echo this assertion that SpaceX’s proposed modification “raises significant policy issues that are likely to be addressed in the Commission’s pending proceeding on the mitigation of orbital debris.” See Astro Digital Petition at 2; Planet Labs Petition at 2; Spire Petition at 2.

⁹ *SpaceX Authorization*, ¶ 17.

The Commission’s policy wisely ensures that the deployment of valuable services is not unduly delayed while issues that affect the entire industry are debated in the larger context of a proceeding for all operators. Indeed, the Commission may decide in that proceeding to adopt rules that allocate responsibility for collision avoidance maneuvers or rules that dramatically affect smallsats’ collision avoidance capabilities. In this context, physical coordination among NGSO systems in the 400-600 km region could undergo dramatic alterations.¹⁰ Thus, Petitioners’ request for deferral while that larger debate takes place stands on its head both Commission precedent and intentions, and the request should be rejected.

II. PETITIONERS’ PHYSICAL COORDINATION CONCERNS CANNOT JUSTIFY USING SPACEX’S APPLICATION TO ESSENTIALLY RESERVE 200 KM OF SPACE FOR SMALLSATS ONLY

Petitioners focus their concern on the region of space from 400-600 km—altitudes used by many smallsat operators including Petitioners—and on whether moving a portion of SpaceX’s NGSO system to 550 km would introduce a new source of potential complications. As an initial matter, Petitioners’ claims are not specific to SpaceX and apply to any new system applying to operate in these 200 km of space. As such, these arguments are better considered as part of the larger proceeding and should not delay consideration of SpaceX’s application.

Even so, the arguments raised lack merit. CSSMA asserts that the 400-600 km orbital range “is ideal for many cubesat systems and other similar-sized systems that do not have propulsion” because “[a]t these altitudes, such systems would be able to operate for several years before naturally de-orbiting within NASA’s recommended 25-year guideline.”¹¹ Yet this very same characteristic makes this orbital range ideal for other systems as well. As the Commission has

¹⁰ See, e.g., *Streamlining Licensing Procedures for Small Satellites*, 33 FCC Rcd. 4152, ¶ 34 (2018) (proposing that systems operating above the International Space Station be required to have propulsion in order to perform collision avoidance maneuvers).

¹¹ CSSMA Comments at 4.

recognized, satellites deployed below 650 km will typically re-enter Earth’s atmosphere within 25 years, even absent any propulsive or other special de-orbit capabilities. “Thus, the collision risks presented by such satellites are generally lower, even if the satellites fail on-orbit and are unable to perform any affirmative de-orbiting maneuvers.”¹² These favorable orbital debris qualities are one of the primary reasons SpaceX has proposed to operate at 550 km. Moreover, in its *Orbital Debris NPRM*, the Commission has proposed several rules designed specifically to encourage heavier use of orbital altitudes below 650 km in light of the fact that atmospheric drag will quickly result in de-orbit of debris.¹³ Petitioners’ proposals would effectively lay claim to the 400-600 km range of altitudes on behalf of smallsats—a clearly inequitable and unjustified outcome—and undermine the Commission’s larger orbital debris mitigation efforts.

As the Commission has made clear, the 400-600 km region of space has characteristics that are attractive from a wide range of operational and regulatory perspectives. Every NGSO operator has an obligation to coordinate its physical operations in good faith, and thereafter operate in a manner that optimizes safety and minimizes the potential for orbital debris. Only by doing so can the full potential of this valuable region of space be realized. In these circumstances, no one can expect to reserve tens or hundreds of kilometers of space for their own use to the exclusion of other types of NGSO systems. Moreover, doing so would set the wrong incentives. These sorts of

¹² *Orbital Debris NPRM*, ¶ 31. CSSMA argues that SpaceX’s plan to replace de-orbited satellites “completely negates the benefits that a shortening of orbital lifetimes would typically have on the overall risk of collision.” CSSMA Comments, Technical Annex at 1. This argument completely misses the mark, as the benefit of rapid demise applies to passive objects (including malfunctioning satellites), which increases the reliability of de-orbit – satisfying the new, stricter parameters NASA recently proposed for safe operation of large NGSO constellations. See J.-C. Liou, et al., *NASA ODPO’s Large Constellation Study*, ORBITAL DEBRIS QUARTERLY NEWS, at 4-7 (Sept. 2018) (suggesting that post-mission disposal within five years at a 99% success rate would mitigate the debris concern related to large NGSO constellations), available at <https://orbitaldebris.jsc.nasa.gov/quarterly-news/pdfs/odqnv22i3.pdf>.

¹³ See, e.g., *Orbital Debris NPRM*, ¶¶ 31 (requiring explanation for choosing orbital altitude above 650 km), 43 (imposing reliability requirement for satellites operating above 600-650 km), 46 (requiring showing on reliability of post-mission disposal), 48 (requiring initial deployment and testing below 650 km before orbit raise to operational altitude).

policies would benefit those that do not invest in sharing-friendly technology at the expense of those that do. These policies will drive all operators to invest less in collision avoidance, resulting in fewer services for customers and more overall debris. A better approach would be to encourage investment in better technologies, such as by imposing responsibility on systems with limited propulsive abilities to demonstrate how their constellations minimize the risk of collision.

In contrast, SpaceX is committed to working with the Commission, all NGSO operators, the Combined Space Operations Center, and other interested stakeholders to optimize space safety in all altitudes where its satellites operate. Thus, the Commission should not exclude a portion of its NGSO constellation from this desirable operational altitude.

III. THERE IS NO BASIS FOR DEFERRING THIS APPLICATION BECAUSE THE COMMISSION AND SPACEX HAVE ALREADY ADDRESSED THE CONDITIONS REQUESTED BY PETITIONERS

While SpaceX questions the merits of the concerns raised by Petitioners, even if the Commission were to accept those concerns, they still provide no basis for delay because Petitioners already have the relief they request. For example, SpaceX stated in its original application that it “will continue to stay current with the Space Situational Awareness community and technology and, if appropriate, SpaceX will modify this mitigation statement to continue its leadership in this area.”¹⁴ Thereafter, the Commission conditioned SpaceX’s license on a requirement that SpaceX comply with Commission rules adopted in the future and coordinate its physical operations in good faith with other NGSO systems.¹⁵

Petitioners’ other request for relief—that SpaceX be required to submit a collision risk analysis for its proposed operations at 550 km—is not necessary. As the Commission recently

¹⁴ Application, IBFS File No. SAT-LOA-20161115-00118, Technical Attachment A at 50.

¹⁵ See *SpaceX Authorization*, ¶¶ 11 and 40(r).

confirmed, if an operator’s orbital debris mitigation plan includes maneuvering to avoid collisions, the Commission will consider the collision risk to be essentially zero.¹⁶ SpaceX has made clear that it intends to conduct active maneuvers to avoid collisions with both debris and other spacecraft throughout the life of its satellites, even through the de-orbit phase until the spacecraft enters the atmosphere.¹⁷ Accordingly, consistent with the Commission’s licensing practice, the collision risk for SpaceX satellites is deemed to be essentially zero no matter where they are deployed—obviating the need for any further analysis and satisfying Petitioners’ request.¹⁸

Petitioners’ other arguments revisit and re-litigate issues the Commission already resolved. For instance, CSSMA seems to be particularly worried about potential collisions during the period that SpaceX is raising its satellites from orbital insertion to their operational altitude.¹⁹ Yet the proposed modification will actually ameliorate this concern. Under its original license, SpaceX has consistently stated it plans to transition all of its satellites from an insertion altitude of approximately 400 km to their 1,150 km operational altitude.²⁰ In other words, the orbit raise impact of the modified altitude of 550 km lessens that original concern, which itself was not

¹⁶ See *Orbital Debris NPRM*, ¶ 26 (seeking comment on “whether, if a spacecraft’s orbital debris mitigation plan includes maneuvering to avoid collisions, we should, consistent with current licensing practice, consider this risk to be zero or near zero during the period of time in which the spacecraft is maneuverable”). Moreover, contrary to Petitioners’ assertion, SpaceX is not “proposing to operate in ‘identical’ or ‘very similar’ low-Earth orbits as other constellations.” See, e.g., Astro Digital Petition at 2; Planet Labs Petition at 2; Spire Petition at 2. For example, while SpaceX proposes to maintain its satellites at a fairly stable orbital altitude, smallsat operators intentionally allow their satellites’ orbits to degrade over time. In addition, most smallsats are placed in near-polar or sun synchronous orbits, while SpaceX proposes to operate at 550 km with an inclination of just 53 degrees.

¹⁷ See, e.g., SpaceX Modification, Exhibit A at 39.

¹⁸ This ability to maneuver also addresses CSSMA’s concern about greater spatial density of the SpaceX system due to reduced in-track separation distance at 550 km. See CSSMA Comments at 3

¹⁹ See CSSMA Comments, Technical Annex at 2. Because SpaceX will be in contact with its satellites throughout the process of orbit-raising and have access to detailed location information, there is no basis for CSSMA’s assertions that “the accuracy of their positional information is reduced” during such transit periods. *Id.*

²⁰ See SpaceX Modification, Attachment A at 44.

sufficient to draw comments from CSSMA. By orbit raising only to the lower operational altitude for its first deployment of spacecraft, SpaceX will eliminate any risk from physical interaction with these transiting SpaceX satellites for other systems operating across the wide and busy orbits from 550-1,150 km. Indeed, the modified altitude would remove any risk from orbit raise for any smallsats operating from 550-600 km altitude.

CSSMA also asserts, “SpaceX should be required to take active responsibility for collision avoidance during orbit raising and end-of-life de-orbiting through low-Earth orbit.”²¹ SpaceX has already stated that “it will maintain active control of its satellites” and that it will “perform any collision avoidance maneuvers that might be required during this process,”²² which should again fully address CSSMA’s concern.²³ Here again, there is nothing more required.

IV. KEPLER’S INTERFERENCE CONCERNS DO NOT WITHSTAND SCRUTINY

Kepler raises interference arguments similar to those that the Commission considered and resolved in SpaceX’s original licenses, but now adds—without analysis—that SpaceX’s proposed modification would increase interference by moving to a lower altitude and temporarily using the Ku-band for a limited number of gateways. Specifically, because Kepler operates its constellation

²¹ CSSMA Comments at 6.

²² See Letter from William M. Wiltshire to Jose P. Albuquerque, IBFS File No. SAT-LOA-20161115-00118, at 2 (Apr. 20, 2017) (“SpaceX will maintain active control of its satellites as they are gradually lowered to orbits with a perigee of at most 300 km, and allocate propellant budgets so that it can perform any collision avoidance maneuvers that might be required during this process.”).

²³ CSSMA also erroneously cites a SpaceX filing made in opposition to a 125 km “buffer zone” between NGSO systems that OneWeb proposed, in which SpaceX noted that the systems were separated by at least 50 km and argued that this should be more than sufficient to ensure safe operations. See CSSMA Comments, Technical Annex at 2 (citing Letter from William M. Wiltshire to Marlene H. Dortch, IBFS File Nos. SAT-LOA-20161115-00118 and SAT-LOA-20170301-00027 (Dec. 12, 2017) (“SpaceX Letter”). From this, CSSMA reaches the bizarre conclusion that by saying that 50 km is more than enough distance, SpaceX was somehow arguing that 50 km was the minimum sufficient distance. CSSMA Comments, Technical Annex at 2. SpaceX said no such thing. Rather, SpaceX made clear that it opposed the entire buffer zone concept, arguing that “no justification was provided for such enormous separations that would effectively sterilize a large swath of space from further development.” SpaceX Letter at 1.

at altitudes between 500-600 km and operates in the Ku-band,²⁴ it contends that SpaceX's proposed modification would negatively affect its downlink transmissions by operating gateways in that band during the proposed initial deployment phase.²⁵ This assertion is simply not accurate and Kepler fails to provide any demonstration of how a short-term use of a limited number of Ku-band gateways would adversely affect its operations. The petition includes no rationale to indicate that deployment of these few additional gateway earth stations among potentially thousands of user terminals operating in the Ku-band would materially affect the coordination environment.

The Commission already approved SpaceX's deployment of an NGSO system designed to provide broadband services in the Ku-band directly to a wide range of customers, including individual subscribers. SpaceX now proposes to operate temporarily a very limited number of gateway earth stations in the Ku-band as well. SpaceX's interference profile from use of earth stations in the Ku-band will remain virtually unchanged from the original license already granted for SpaceX operations at 1150 km.

Similarly, Kepler has failed to demonstrate how short-lived Ku-band gateway operations would add interference from SpaceX's space stations. SpaceX does not plan to increase the total number of beams in use at any given time and will allocate its Ku-band downlink beams between users and gateways as necessary to optimize traffic. Moreover, as SpaceX noted in its application, at an altitude of 550 km, fewer satellites will be visible above the minimum elevation angle at any particular time throughout the United States,²⁶ reducing instances of in-line events involving the SpaceX and Kepler systems, and thus minimizing the occasions in which frequency coordination

²⁴ See *Kepler Communications Inc.*, FCC 18-162 (rel. Nov. 19, 2018).

²⁵ See Kepler Petition at 2.

²⁶ See SpaceX Modification, Technical Attachment at 24-25.

procedures would need to be implemented. Although Kepler also raises the somewhat conflicting concern that SpaceX might not have enough satellite beams available to mitigate interference via pointing,²⁷ the SpaceX constellation will still have sufficient satellite diversity at every point in its service area to manage in-line events that do occur. Accordingly, gateway operations in the Ku-band should have no material effect on Kepler's operations.

CONCLUSION

Petitioners have provided no basis for deferring or denying SpaceX's modification application. Most of the concerns raised relate to industry-wide issues that even Petitioners recognize are more appropriately resolved in ongoing rulemaking proceedings. In addition, the relief Petitioners request is already in place as part of SpaceX's existing authorization that makes rules adopted in the future applicable and requires good faith coordination of physical operations. Moreover, the addition of a few Ku-band gateways operating among a very large number of Ku-band user terminals should have no material effect on Kepler's operations. Accordingly, the Commission should grant the modification application so that SpaceX can proceed with its plans for expedited deployment of its NGSO constellation.

²⁷ See Kepler Petition at 3.

Respectfully submitted,

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CERTIFICATE OF SERVICE

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