SPACEX

January 17, 2023

BY ELECTRONIC FILING

Marlene H. Dortch
Secretary
Federal Communications Commission
45 L Street, N.E.
Washington, DC 20554

Re: *IBFS File No. SAT-MOD-20211207-00186*.

Dear Ms. Dortch:

In this proceeding,[1] Amazon has repeatedly failed to provide even basic information in response to SpaceX's concerns about whether and how Amazon can safely operate the large constellation it proposes to deploy.[2] Others—including NASA and the National Science Foundation ("NSF")—have also raised concerns about various aspects of Amazon's modification application that remain unresolved.[3] While the Commission must seek additional information to address these concerns before processing Amazon's modification, *if* the Commission ultimately grants the modification, the Commission should impose conditions on Amazon's license that the Commission recently determined were in the public interest as part of SpaceX's recently issued second-generation constellation ("Gen2") partial grant. Further, consistent with the Commission's recent decision in the *Gen2 Order*[4]—and especially in light of the lingering questions Amazon has raised about its ability to physically coexist with other satellite systems—the Commission should follow Amazon's suggestion in another proceeding to limit any authorization to an initial subset of a proposed constellation while deferring action on higher-risk elements of its proposal. This approach is consistent with Amazon's own proposals and will promote competition, innovation, and space sustainability while providing Amazon with time to demonstrate to the Commission and the public that it can operate its constellation safely.

I. The Commission Should Ensure that the Conditions Imposed on Amazon Match Those the Commission Determined Were in the Public Interest in the Gen2 Order.

This proceeding arises from a condition imposed in the *Amazon Order* because Amazon "did not present specific information concerning some required elements of a debris mitigation plan," requiring that Amazon file for modification with a complete mitigation plan.[5] If the

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1 *See* Application for Modification, IBFS File No. SAT-MOD-20211207-00186 (Dec. 7, 2021) ("Amazon Modification").

2 *See, e.g.*, Reply of Space Exploration Holdings, LLC, IBFS File No. SAT-MOD-20211207-00186 (July 22, 2022) ("SpaceX Reply") (discussing inadequacy of Amazon's responses).

3 *See, e.g.*, Letter from Samantha Johnson to Marlene Dortch (June 24, 2022) ("NASA Comments"); Letter from Jonathan Williams (June 23, 2022) ("NSF Comments"); Comments of Viasat, Inc. (June 27, 2022). Unless otherwise indicated, all filings discussed herein were submitted in IBFS File No. SAT-MOD-20211207-00186.

4 *See Space Exploration Holdings, LLC*, FCC 22-91 (rel. Dec. 1, 2022) ("*Gen2 Order*").

5 *Kuiper Systems, LLC*, 35 FCC Rcd. 8324, ¶ 32 (2020) ("*Amazon Order*").

Commission ultimately grants Amazon's modification, it must ensure that the conditions imposed on that license match those it recently determined were in the public interest. When approving SpaceX's Gen2 system, the Commission found that several conditions addressed generalized space sustainability concerns from NASA, NSF, LeoLabs, and others.[6] As Amazon itself argued during that proceeding, the Commission must

> [E]nsure that the conditions imposed on SpaceX match those imposed on Amazon and other similarly situated operators. Balanced rules and conditions on similarly situated operators promote fair competition and cooperation. Disparate conditions distort the playing field, introduce uncertainty and ambiguity that ossifies the licensing process with fighting and advocacy, and make coordination among operators more difficult. Beyond being required by the Administrative Procedure Act, similar treatment of similarly situated operators is necessary to further the Commission's goal of making the licensing process faster and more efficient.[7]

Consistent with Amazon's point, if the Commission is to grant Amazon's modification application, it must put in place the same conditions it recently imposed on SpaceX as set forth in Attachment 1 hereto.[8]

Amazon proposes to operate an NGSO system composed of 3,236 satellites in 98 orbital planes at altitudes from 590-630 km. This number of satellites far exceeds the 1,000 spacecraft threshold that NASA considers sufficient to require higher reliability standards,[9] and such reliability was one of the key aspects of Amazon's original application that the Commission required Amazon to more thoroughly document in its modification application.[10] Not surprisingly, in this proceeding, the Commission specifically asked Amazon for additional information on the reliability of its satellites.[11] Amazon's only response was that "[p]ropulsion system reliability testing is ongoing and will continue throughout the next year."[12] While this answer is insufficient on its face, even Amazon recognized that many other technical systems would be necessary to ensure reliable post-mission disposal yet provided no information about those systems.[13]

Thus, the Commission cannot conclude based on the current record that it has sufficient information to address reliability concerns. However, even if Amazon ultimately provides such

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6 *See Gen2 Order* ¶¶ 135z, 135aa, 135cc, 135ee-hh.

7 Comments of Kuiper Systems LLC, IBFS File Nos. SAT-MOD-20200526-00055 and SAT-AMD-20210818-00105, at 17-18 (Feb. 8, 2022) ("Amazon Comments").

8 To be clear, the conditions proposed in Attachment 1 are necessary but not sufficient. SpaceX has raised other issues related to Amazon's orbital debris showing that must also be addressed, including but not limited to its proposed elliptical deorbit strategy.

9 *See* Letter from Anne E. Sweet to Marlene Dortch, IB Docket No. 18-313, at 6 (filed Apr. 4, 2019).

10 *See Amazon Order* ¶ 32.

11 *See* Letter from Karl A. Kensinger to C. Andrew Keisner, et al. at 2 (May 19, 2022).

12 Letter from Carrie Gage to Karl A. Kensinger at 3 (June 17, 2022).

13 *Id.* at 3-4 ("Components that will enable Kuiper Satellite station-keeping and post-mission disposal include the flight computer, telemetry, tracking and control ('TT&C') communication system, power system, attitude determination and control system ('ADACs'), torque rods, reaction wheels, attitude determination instruments, and propulsion system elements.").

information, the Commission should adopt conditions to monitor Amazon's performance during operations. In authorizing SpaceX's Gen2 constellation, while the Commission found that SpaceX had provided sufficient information in its orbital debris showing to support authorization, the Commission nevertheless imposed two conditions to evaluate,[14] on an ongoing basis, the reliability of SpaceX's Gen2 satellites. First, it concluded that it would monitor future performance by requiring semi-annual reports on collision avoidance maneuvers and satellite disposal, including any difficulties or failures related thereto.[15] Second, consistent with a proposal from LeoLabs to shift toward more performance-based orbital debris requirements, the Commission applied an "object-years" method to evaluate post-mission disposal that it found to be "a useful benchmark, if triggered, for pausing deployment and reassessing spacecraft reliability."[16] Under this method, the data supplied in the semi-annual reports would be used to project the remaining orbital lifetime of any failed satellites, and if the cumulative number of years for all failed satellites exceeds 100, satellite deployment would have to cease "while the sources of satellite failure are reviewed to determine whether there are any adequate and reliable mitigation measures going forward."[17] For the same reasons, these same two conditions are likewise appropriate for any grant of Amazon's application.[18]

As mentioned above, NASA raised several concerns "that have the potential to impact NASA operations and the safety of NASA assets,"[19] and made several proposals to address those concerns. For example, to reduce the potential risk to the International Space Station ("ISS"), NASA proposed that Amazon "maintain[] a conservative separation with respect to human space flight vehicles such as ISS during the ascent and active deorbit phases."[20] NASA also expressed concern about the "increasing unavailability of safe launch windows."[21] As it did to address a similar concerns for SpaceX, the Commission should impose a condition requiring Amazon to collaborate with NASA on safety initiatives and to report on its activities twice a year.[22] In addition, NASA also raised concerns more generally about conjunction screening and collision avoidance maneuvering.[23] Consistent with the requirements adopted in its revised orbital debris mitigation rules and the conditions imposed on SpaceX, the Commission should require Amazon to take appropriate steps to assess and mitigate collision risk upon receipt of a conjunction warning.[24]

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14 *Gen2 Order* ¶ 71.

15 *Id.* ¶ 85. Amazon has argued that "with respect to other constellations, the Commission has consistently found a zero-risk assumption for maneuverable satellites like the Kuiper Satellites to be warranted." Consolidated Response of Kuiper Systems LLC at 10 (July 12, 2022). However, to address NASA's "distinct and broader concern" that "with a constellation of this size, error-free systems and a collision risk of zero should not be assumed," the Commission imposed this reporting requirement. *Gen2 Order* ¶ 75.

16 *Gen2 Order* ¶ 85.

17 *Id*.

18 These conditions are set forth as numbers 1 and 2 in Attachment 1.

19 Letter from Samantha Johnson, NASA to Marlene Dortch, FCC, IBFS File No. SAT-MPL-20200526-00062, at 1 (filed Apr. 22, 2022) ("NASA Comments").

20 *Id.* at 2.

21 *Id.* at 3.

22 *See Gen2 Order* ¶ 135cc. This condition, revised to apply to Amazon, is set forth as number 3 on Attachment 1.

23 *See* NASA Comments at 2.

24 *Mitigation of Orbital Debris in the New Space Age*, 35 FCC Rcd. 4156, ¶¶ 72-74 (2020). The condition previously imposed on SpaceX, revised to apply to Amazon, is set forth as number 4 on Attachment 1.

Both NASA and NSF raised concerns about the potential impact of Amazon's NGSO satellite system on science missions, and in particular the effects of sunlight reflected from Amazon satellites on astronomical observation.[25] To address similar concerns that NASA and NSF raised in SpaceX's Gen2 proceeding, the Commission determined it would be in the public interest to collaborate with NSF to achieve an agreement to minimize the impact of satellites on astronomy and with NASA to minimize impacts on other science missions. [26] These conditions require an annual progress report filed with the Commission on its collaboration efforts. The same reasoning and conditions should certainly apply to Amazon.

II. The Commission Should Limit Amazon's System to an Initial Tranche to Promote Space Sustainability and Allow Appropriate Monitoring, Which is Consistent with Amazon's Proposals in the SpaceX Gen2 Proceeding.

If the Commission ultimately grants Amazon's Modification Application, consistent with the *Gen2 Order* and Amazon's own advocacy,[27] the Commission should limit Amazon to an initial subset of its proposed constellation. This initial authorization would provide Amazon sufficient time to prove out the reliability of its system and demonstrate to the public that its deployment will not come at the expense of competition, innovation, and space sustainability. Specifically, the Commission should limit any initial tranche to Phase 1 of Amazon's proposed constellation, comprising 578 satellites in Amazon's 630 km shell,[28] while deferring consideration of the remainder of the constellation.

As SpaceX has previously pointed out, Amazon has claimed that its system is so fragile that it can only operate if the Commission restricts its competitors to non-overlapping orbital altitudes, yet ignores that it must occupy the same altitudes as thousands of foreign-licensed satellites.[29] Amazon's surprising way to reconcile this inconsistency: it plans to operate a fragile system and hope the foreign satellites will never launch. But merely crossing its fingers is not a plan, especially considering at least some of these foreign systems appear further along in development and less speculative than Amazon's own constellation.[30] Worse, after repeated requests for basic information, Amazon has doubled down on some of the riskiest elements of its plan, including a cavalier elliptical deorbit strategy, while continuing to refuse to commit to take steps to demonstrate that it can implement its plan safely.[31]

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[25] *See* NASA Comments at 2-3; Letter from Jonathan Williams to FCC, IBFS File No. SAT-MPL-20200526-00062, at 1 (filed Apr. 22, 2022).

[26] *See Gen2 Order* ¶¶ 135ff and gg. These conditions, revised to apply to Amazon, are set forth as numbers 5 and 6 on Attachment 1.

[27] *See Gen2 Order* ¶¶ 18-19; *See also* Letter from Michael J. Carlson to Marlene H. Dortch, IBFS File Nos. SAT-LOA-20200526-00055 and SAT-AMD-20210818-00105 (June 24, 2022) ("Amazon Tranche Letter").

[28] *See* Application, IBFS File No. SAT-LOA-20190704-00057 (July 4, 2019) ("Amazon Application"), Technical App'x at 4.

[29] *See* Comments of Space Exploration Holdings at 2-5, LLC, IBFS File No. SAT-MOD-20211207-00186 (June 27, 2022) ("SpaceX Comments").

[30] *See* SpaceX Reply at 2-4.

[31] *See* Letter from David Goldman to Marlene H. Dortch, IBFS File No. SAT-MOD-20211207-00186 (Dec. 14, 2022).

Amazon must still address these significant deficiencies in its orbital debris mitigation plan before the Commission can begin processing Amazon's modification. But if the Commission is ultimately able to process Amazon's modification, granting only a subset of the constellation would mitigate some of the most serious risks associated with Amazon's proposed plan. This partial grant would also give Amazon additional time to gain operational experience and demonstrate its ability to operate safely alongside more proven systems.

Limiting Amazon's authorization to Phase 1 of its deployment finds strong support in the conclusions the Commission reached in the *Gen2 Order*. There, the Commission correctly declined to adopt Amazon's suggestion to limit the Gen2 system to an arbitrarily defined first tranche based on a single ITU filing, instead granting an initial tranche of specific orbital shells based on SpaceX's proposed deployment sequence.[32] The Commission should take a similar approach here. Granting an initial 578 satellites of Amazon's 3,236-satellite system would offer Amazon a path to begin deploying for "many months,"[33] while providing the Commission with time and additional data to assess the serious issues raised in this proceeding. Authorizing Phase 1 of Amazon's system as an initial tranche would also address Amazon's apparent concerns about its ability to coexist with other systems by ensuring its initial nominal operations do not overlap with those of other existing and proposed systems in and around its 590 km and 610 km shells. Further, this approach would "allow continued monitoring of deployment" of Amazon's system based on the conditions set forth in Section I above, consistent with both Amazon's own advocacy and the approach the Commission determined was in the public interest in the *Gen2 Order*. If Amazon ultimately demonstrates to the Commission and the public that it can comply with these conditions and effectively share overlapping orbital altitudes with other NGSO constellations, then the Commission could consider authorizing further tranches of Amazon's system.

The case for limiting Amazon's proposed system to this initial tranche is significantly stronger than that which the Commission found sufficient to warrant a partial grant of SpaceX's Gen2 system. Unlike SpaceX, which by the time of the Gen2 grant had already successfully deployed and operated a global system equivalent to the size of Amazon's entire proposed constellation, Amazon has never deployed a single satellite. Further, in contrast to SpaceX's demonstrated ability to manage a large constellation and physically coordinate with other systems, Amazon has revealed that its planned system is so fragile that it will not be able to coexist with even a handful of other satellites in shared orbital tolerances. And unlike SpaceX's strong, ongoing commitment to transparency, including through semi-annual satellite health reports, Amazon has failed to provide even basic information about how it plans to coexist with other satellite constellations—and even tried to ignore systems it would have insisted competitors take into account[34]—or safely conduct its high-risk elliptical deorbit strategy, and only belatedly and reluctantly has begun physical coordination discussions with other operators.

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[32] *See Gen2 Order* ¶ 19; *see also* Amazon Tranche Letter at 4.
[33] *See* Amazon Tranche Letter at 4.
[34] *See* SpaceX Reply at 2-4.

Ultimately, adopting a phased approach to authorization of Amazon's system, as the Commission found appropriate in the *Gen2 Order* for a significantly more experienced operator, would promote competition, innovation, and space sustainability while ensuring that an unproven operator does not needlessly foreclose orbital resources or impose an undue burden on others.

* * *

Amazon's proposed orbital debris mitigation plans raise several issues that require significant scrutiny. But if Amazon ultimately provides the Commission with sufficient information to approve those plans and grant the pending modification application, it must—for the reasons Amazon itself has found compelling—also put in place the same conditions it recently determined were in the public interest as set forth in Attachment 1 hereto and limit any authorization to Phase 1 of Amazon's proposed deployment, consistent with Amazon's own arguments.

Sincerely,

/s/ David Goldman

David Goldman
Senior Director of Satellite Policy

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Attachment

ATTACHMENT 1
AMAZON SPACE PRESERVATION CONDITIONS

1. Amazon must provide a semi-annual report, by January 1 and July 1 each year, covering the preceding six-month period, respectively, from June 1 to November 30 and December 1 to May 31. The report should include the following information:
   i. The number of conjunction events identified for Amazon satellites during the reporting period, and the number of events that resulted in an action (maneuver or coordination with another operator), as well as any difficulties encountered in connection with the collision avoidance process and any measures taken to address those difficulties,
   ii. Satellites that, for purposes of disposal, were removed from operation or screened from further deployment at any time following initial deployment, and identifying whether this occurred less than five years after the satellite began regular operations or were available for use as an on-orbit replacement satellite,
   iii. Satellites that re-entered the atmosphere,
   iv. Satellites for which there was a disposal failure, i.e., a satellite that loses the capability to maneuver effectively after being raised from its injection, including a discussion of any assessed cause of the failure and remedial actions. For each such satellite, Amazon shall report an estimated orbital lifetime for the satellite following the failure, and for the Amazon constellation the cumulative number of failed satellite object years,
   v. Identification of any collision avoidance system outages or unavailability, either on a system-wide basis or for individual satellites. An "outage" would include any individual satellite anomaly that results in a satellite not achieving targeted risk mitigation via maneuver.
2. In the event of satellite failures resulting in more than 100 post-failure object years, Amazon may not deploy any additional satellites until the Commission has approved a license modification that includes an updated orbital debris mitigation plan addressing reduction in the failure rate or mitigation of the risk of satellite failures.
3. Amazon must communicate and collaborate with NASA to enable safe launch windows to support safety of both Amazon and NASA assets and missions and to preserve long-term sustainable space-based communications services. Amazon must report on the progress of its communications and collaboration efforts to the Commission in its regular reports specified in condition [1].
4. Upon receipt of a conjunction warning from the 19th Space Defense Squadron or other source, Amazon must review and take all possible steps to assess the collision risk, and mitigate collision risk if necessary. As appropriate, steps to assess and mitigate should include, but are not limited to: contacting the operator of any active spacecraft involved in such warning; sharing ephemeris data and other appropriate operational information with any such operator; modifying spacecraft attitude and/or operations.
5. Amazon must coordinate and collaborate with NASA to promote a mutually beneficial space environment that would minimize impacts to NASA's science missions involving astronomy.

6. Amazon must coordinate with NSF to achieve a mutually acceptable agreement to mitigate the impact of its satellites on optical ground-based astronomy. Amazon must submit an annual report to the Commission, by January 1st each year covering the preceding year containing the following information: (1) whether it has reached a coordination agreement with NSF addressing optical astronomy; and (2) any steps Amazon has taken to reduce the impact of its satellites on optical astronomy, including but not limited to darkening, deflecting light away from the Earth, attitude maneuvering, and provision of orbital information to astronomers for scheduling observations around satellites' locations.

CERTIFICATE OF SERVICE

I hereby certify that, on this 17th day of January 2023, a copy of the foregoing pleading was served by first class U.S. mail upon:

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