

FCC Fact Sheet*
Mitigation of Orbital Debris in the New Space Age
Order on Reconsideration – IB Docket No. 18-313

Background: In this Order on Reconsideration, the Federal Communications Commission (Commission) addresses three petitions for reconsideration filed by Boeing, EchoStar, Hughes, Planet, Spire, and Telesat (Combined Petition), SpaceX, and Kuiper in response to the Commission’s 2020 Orbital Debris Mitigation Order. The Combined Petition asks the Commission to reconsider information disclosure requirements relating to satellite maneuverability, large system disposal reliability, the use of deployment devices, and certain types of liquids. SpaceX seeks reconsideration or clarification of the Commission’s orbital debris mitigation rules as applied to non-U.S.-licensed satellite systems seeking U.S. market access. Finally, Kuiper seeks adoption of a new rule addressing issues related to the orbital separation of large non-geostationary orbit (NGSO) constellations.

What this Order on Reconsideration Would Do:

- Clarify the alignment of the Commission’s rules with the U.S. Government Orbital Debris Mitigation Standard Practices (ODMSP) and Space Policy Directive-3 (SPD-3) and address concerns about the burden these disclosures may have on applicants
- Clarify the Commission’s disclosure requirements regarding satellite maneuverability and provide additional resources for satellite operators
- Clarify the applicability of the 0.99 disposal reliability goal for large satellite systems
- Clarify the Commission’s disclosure rules pertaining to the use of “free-flying” deployment devices and provide additional guidance for satellite operators on methods for conducting a re-contact risk analysis
- Clarify the requirements for assessing and limiting the release of persistent liquids in space and provide guidance on additional factors that operators should take into consideration, including containment effectiveness, protection against debris strikes, and operational altitudes
- Clarify our rules regarding non-U.S.-licensed space station compliance with the Commission’s orbital debris mitigation rules
- Clarify the Commission’s decision not to adopt a maximum orbital variance for NGSO systems or a required separation between orbital locations

* This document is being released as part of a “permit-but-disclose” proceeding. Any presentations or views on the subject expressed to the Commission or its staff, including by email, must be filed in IB Docket No. 18-313, which may be accessed via the Electronic Comment Filing System (<https://www.fcc.gov/ecfs/>). Before filing, participants should familiarize themselves with the Commission’s *ex parte* rules, including the general prohibition on presentations (written and oral) on matters listed on the Sunshine Agenda, which is typically released a week prior to the Commission’s meeting. See 47 CFR § 1.200 *et seq.*

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of)
Mitigation of Orbital Debris in the New Space Age) IB Docket No. 18-313

ORDER ON RECONSIDERATION*

Adopted: [] Released: []

By the Commission:

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I. INTRODUCTION

1. In this *Order on Reconsideration*, we address the issues raised in a combined petition for reconsideration filed by the Boeing Company (Boeing), EchoStar Satellite Services, LLC (EchoStar), Hughes Network Services, LLC (Hughes), Planet Labs, Inc. (Planet), Spire Global, Inc. (Spire), and

* This document has been circulated for tentative consideration by the Commission at its January open meeting. The issues referenced in this document and the Commission’s ultimate resolution of those issues remain under consideration and subject to change. This document does not constitute any official action by the Commission. However, the Chairwoman has determined that, in the interest of promoting the public’s ability to understand the nature and scope of issues under consideration, the public interest would be served by making this document publicly available. The FCC’s *ex parte* rules apply and presentations are subject to “permit-but-disclose” *ex parte* rules. *See, e.g.*, 47 CFR §§ 1.1206, 1.1200(a). Participants in this proceeding should familiarize themselves with the Commission’s *ex parte* rules, including the general prohibition on presentations (written and oral) on matters listed on the Sunshine Agenda, which is typically released a week prior to the Commission’s meeting. *See* 47 CFR §§ 1.1200(a), 1.1203.

Telesat Canada (Telesat)¹ in response to the Commission's 2020 *Orbital Debris Mitigation Report and Order (Order)* which comprehensively updated the Commission's existing rules regarding orbital debris mitigation.² Space Exploration Technologies Corp. (SpaceX),³ and Kuiper Systems LLC (Kuiper)⁴ also filed petitions for reconsideration. The Combined Petition asks the Commission to reconsider information disclosure requirements that were adopted by the Commission in the *Order* relating to satellite maneuverability, large system disposal reliability, the use of deployment devices, and the use of certain types of persistent liquids.⁵ SpaceX seeks reconsideration or clarification of the Commission's orbital debris mitigation rules as applied to non-U.S.-licensed satellite systems seeking U.S. market access. Finally, Kuiper seeks adoption of a new rule addressing issues related to the orbital separation of large non-geostationary orbit (NGSO) constellations.

2. As discussed in further detail below, we decline to modify, withdraw, or otherwise change the information collection requirements adopted in the *Order*. We also decline to change our rules as applicable to non-U.S.-licensed systems seeking U.S. market access, or to adopt new rules governing the orbital separation of large NGSO constellations. After reviewing the petitions, we find that the petitioners failed to show any material errors or omissions in the *Order* or raise any new or additional facts that would warrant reconsideration under the Commission's rules.⁶ However, we provide some clarification or guidance as appropriate on some of the issues raised in the petitions for reconsideration.

II. BACKGROUND

3. On November 19, 2018, the Commission released a *Notice of Proposed Rulemaking (2018 NPRM)* in IB Docket No. 18-313 concerning the mitigation of Orbital Debris in the New Space Age.⁷ It represented the first comprehensive look at the Commission's orbital debris rules since their adoption in 2004 and was intended to improve and clarify these rules based on the experiences gained in the satellite licensing process and various improvements in mitigation guidelines, practices, and technologies. After reviewing the record and public comments filed in response to the 2018 NPRM, including individual comments filed by some of the parties involved in the petitions for reconsideration, the Commission adopted the *Orbital Debris Order* on April 23, 2020.⁸ At the same time, the

¹ Petition for Reconsideration of the Boeing Company, EchoStar Satellite Services, LLC, Hughes Network Services, LLC, Planet Labs, Inc., Spire Global, Inc., and Telesat Canada, IB Docket No. 18-313 (Sept. 24, 2020), <https://www.fcc.gov/ecfs/filing/1092466277139> (Combined Petition).

² See *Mitigation of Orbital Debris in the New Space Age*, IB Docket No. 18-313, Report and Order and Further Notice of Proposed Rulemaking, 35 FCC Rcd 4156 (2020) (*Order* or *Orbital Debris Order* or *FNPRM*).

³ Petition for Reconsideration of Space Exploration Technologies Corp., IB Docket No. 18-313 (Sept. 24, 2020) (SpaceX Petition).

⁴ Petition for Reconsideration of Kuiper Systems LLC, IB Docket No. 18-313 (Sept. 24, 2020) (Kuiper Petition).

⁵ The parties to the Combined Petition did not all join in each of the specific requests for reconsideration. Telesat joined only with respect to the disclosure requirement concerning the 0.99 satellite disposal reliability for large constellations. EchoStar and Hughes joined with respect to the use of deployment devices and certain types of liquids.

⁶ Pursuant to § 1.429 of the Commission's rules, parties may petition for reconsideration of the final orders in a rulemaking proceeding. Reconsideration is generally appropriate only where the petitioner shows either a material error or omission in the original order or raises additional facts not known or not existing until after the petitioner's last opportunity to respond. Under § 1.429(b) of the Commission's rules, petitions for reconsideration that rely on facts or arguments that have not been previously presented to the Commission will be considered only under certain limited circumstances. See 47 CFR § 1.429.

⁷ See *Mitigation of Orbital Debris in the New Space Age*, IB Docket No. 18-313, Notice of Proposed Rulemaking, 33 FCC Rcd 11352 (2018) (2018 NPRM).

⁸ See *Orbital Debris Order*, 35 FCC Rcd 4156.

Commission also adopted a *Further Notice of Proposed Rulemaking (FNPRM)*, which sought further comment on adopting rules concerning the probability of accidental explosions, the total probability of collisions with large objects, maneuverability above a certain altitude in low-Earth orbit (LEO), post-mission orbital lifetime, casualty risk, indemnification, and performance bonds for successful disposal.⁹ On September 24, 2020, the petitioners filed their timely petitions for reconsideration¹⁰ and by November 24, 2020, five oppositions and comments to the petitions were filed.¹¹

III. DISCUSSION

4. In the discussion that follows, we first address the issues raised in the Combined Petition. Among those issues, we first address the relationship of the rules adopted to other U.S. government policy and technical documents, then issues raised with respect to each of the specific disclosure rules, and finally the petitioners' general concerns about case-by-case review of the information disclosed, as well as burdens on applicants from providing disclosure. Next, we address SpaceX's request that we reconsider our decision to maintain a rule that allows non-U.S.-licensed space station operators to satisfy orbital debris mitigation showing requirements by demonstrating that the satellite(s) requesting U.S. market access are subject to direct and effective regulatory oversight by its national licensing authority as it pertains to their debris mitigation plans. Lastly, we address Kuiper's request that the Commission reconsider its decision to not establish orbital separation requirements. After reviewing the Combined Petition, oppositions, and comments, we conclude that the petitioners have not offered any substantive issues that would warrant reconsideration of our rules and have not provided an explanation as to how revising our rules as they request would be consistent with the Commission's public interest mandate, which requires that we evaluate the orbital safety implications of the satellites and satellite systems for which we issue authorizations.

A. Combined Petition Issues

1. Relationship to Other USG Technical and Policy Documents

5. The petitioners raise concerns about the consistency of the rules adopted with policies and guidelines developed by expert federal agencies, noting in particular the U.S. Government Orbital

⁹ See *Orbital Debris FNPRM*, 35 FCC Rcd 4226.

¹⁰ The *Orbital Debris Order and FNPRM* were published in the Federal Register on Aug. 25, 2020. 85 FR 52422 (2020).

¹¹ On November 9, 2020, the Commission published a notice announcing the filing of all of the petitions for reconsideration and setting November 24, 2020 as the deadline for submitting oppositions. Petitions for Reconsideration of Action in Proceedings, 85 FR 71296 (2020). Consolidated Opposition to Petitions for Reconsideration of Viasat, Inc, IB Docket No. 18-313, (filed Nov. 24, 2020), <https://www.fcc.gov/ecfs/search/search-filings/filing/11242734224280> (Viasat Opposition); Opposition and Response of OneWeb, IB Docket No. 18-313 (filed Nov. 23, 2020), <https://www.fcc.gov/ecfs/search/search-filings/filing/1125914700201> (OneWeb Opposition); Comments of Maxar Technologies Inc., IB Docket No. 13-313 (filed Nov. 24, 2020), <https://www.fcc.gov/ecfs/search/search-filings/filing/1124796316914> (Maxar Comments); Comments of Kepler Communications Inc., IB Docket No. 13-313 (filed Nov. 24, 2020), <https://www.fcc.gov/ecfs/search/search-filings/filing/1125185066832> (Kepler Comments); Comments of Astrodynamics, Space Robotics, and Controls Laboratory, IB Docket No. 13-313 (filed Nov. 23, 2020), <https://www.fcc.gov/ecfs/search/search-filings/filing/1124897502153> (ARCLab Comments).

Debris Mitigation Standard Practices (ODMSP)¹² and Space Policy Directive-3 (SPD-3),¹³ and allege that the disclosure rules “[diverge] substantially from the recommendations of other expert federal agencies, including, in some cases, disregarding the findings of the recently updated multi-agency Orbital Debris Mitigation Standard Practices.”¹⁴ Both Viasat and OneWeb challenge this assertion.¹⁵

6. The petitioners have failed to identify any respect in which the Commission’s actions in adopting the *Order* are fundamentally inconsistent with the policies, goals, and guidelines identified in SPD-3 and the ODMSP. To the extent they are relying on the fact that the specific technical matters addressed in the Commission’s rules are not addressed at the same level of specificity in SPD-3 and the ODMSP, these arguments are not well-founded, and do not establish a “divergence.” As noted by Viasat and OneWeb,¹⁶ both of these documents invite further action including through the development of additional standards and best practices.¹⁷ The ODMSP expressly states that it may be appropriate to “consider the benefits of going beyond the standard practices and tak[ing] additional steps to limit the generation of orbital debris.”¹⁸ Furthermore, and as discussed in greater detail below, the petitioners have in some instances alleged divergence from these documents only by ignoring other relevant provisions of those documents.¹⁹

7. Even if we were to accept the petitioner’s unsupported allegation of divergence, the Commission observed in adopting these rules that the ODMSP “applies, by its terms, only to government missions that are procured and operated by government agencies for governmental purposes...rather than in the context of regulatory review,” and for that reason “some tailoring” of the ODMSP was necessary to

¹² U.S. Government Orbital Debris Mitigation Standard Practices, https://orbitaldebris.jsc.nasa.gov/library/usg_orbital_debris_mitigation_standard_practices_november_2019.pdf (revised Nov. 2019) (ODMSP). The ODMSP were established in 2001 to address the increase in orbital debris in the near-Earth space environment. As noted in the ODMSP Preamble, the goal of the ODMSP is to limit the generation of new, long-lived debris by the control of debris released during normal operations, by minimizing debris generated by accidental explosions, by the selection of safe flight profiles and operational configurations to minimize accidental collisions, and by post-mission disposal of space structures. The ODMSP were updated in 2019, with participation of both USG agencies that operate satellites, and agencies that regulate non-governmental space activities, including the FCC. As stated in the Preamble, the ODMSP provide guidelines for U.S. Government activities, while also providing a reference to promote efficient and effective space safety practices for other domestic and international operators.

¹³ Space Policy Directive-3, National Space Traffic Management Policy, Presidential Memorandum (Jun. 18, 2018), <https://trumpwhitehouse.archives.gov/presidential-actions/space-policy-directive-3-national-space-traffic-management-policy/> (SPD-3). SPD-3 provides a policy framework for Executive Branch agencies to address increasing space activity. It includes specific tasking for those agencies, in some instances in consultation with the Commission, in areas such as collection and dissemination of data about space objects, prediction of possible collisions between space objects, and orbital debris mitigation.

¹⁴ Combined Petition at 7.

¹⁵ Viasat Opposition at 5-7; OneWeb Opposition at 7-8.

¹⁶ *Id.* at 5-7; OneWeb Opposition 7-9.

¹⁷ *See, e.g.*, SPD-3 at Sec. 6(f) (identifying a Commission role in the development of space traffic standards and best practices); Sec. 5(b)(i) (discussing how the U.S. should incorporate appropriate standards and best practices into Federal law and regulation through appropriate rulemaking or licensing actions); Sec. 4(f) (discussing how regulatory agencies should adopt the standards and best practices identified for development by SPD-3 into domestic regulatory frameworks and use them to inform and help shape international practices and standards). SPD-3 also specifically addresses mitigation of orbital debris through “effective collision avoidance.” *See* Sec. 5(c)(i).

¹⁸ ODMSP, Preamble.

¹⁹ *See infra* III.a.6.

fit into the Commission's existing regulatory structure.²⁰

2. Burden on Applicants

8. Throughout the Combined Petition, petitioners argue that the regulations adopted in the *Order* will be overly burdensome on applicants. Viasat and Maxar challenge this claim.²¹ In raising concerns with burdens on applicants, the petitioners rely on generalized concerns that regulation will be "overly stringent,"²² or that applicants will experience difficulties because of "staff conclusions that the substance of the disclosed information was insufficient or inconsistent with what they thought should be required."²³ These speculative concerns about possible errors in Commission decision-making do not provide a basis for reconsideration. In any event, and in an effort to assist applicants in preparing applications, we offer below additional discussion with respect to some aspects of the specific disclosure requirements adopted.

3. Maneuverability

9. In the *Order*, the Commission adopted a rule requiring applicants to disclose the extent of maneuverability of planned space stations, noting that most commenters addressing this topic, including NASA, agreed with the adoption of this disclosure.²⁴ The Commission provided some examples of the type of information that applicants could include in their disclosure statements, as suggested by NASA in its comments on the topic.²⁵

10. The Commission also revised a separate rule provision on avoiding collisions with large objects to require applicants to state whether the probability that their spacecraft will collide with a large object during the orbital lifetime of the spacecraft is less than 0.001 (1 in 1,000), in line with the ODMSP. As part of that rule, the Commission adopted a presumption that the collision risk with large objects could be assumed zero or near zero during the period of time when the space station is able to conduct avoidance maneuvers, absent evidence to the contrary.²⁶ The Commission noted that in individual cases where there is evidence that a particular system or operator is unable to effectively maneuver or is only maneuvering at a risk threshold that raises reasonable questions about its ability to meet the 0.001 collision risk threshold even with some degree of maneuverability, this assumption will not be applied and further analysis would be necessary.²⁷ The Commission did not adopt a definition of "effective maneuverability" but sought comment in the *FNPRM* on a definition, as well as on whether to adopt a requirement that spacecraft must be maneuverable.²⁸

11. Boeing, Planet, and Spire argue that the Commission should withdraw its "requirements" regarding effective maneuverability until this term is adequately defined.²⁹ These petitioners do not distinguish between the two distinct portions of the rule, and instead argue generally that without a more

²⁰ *Orbital Debris Order* at para. 24 n.74.

²¹ *Id.* at 7-8; see also Maxar Comments at 5, 7 (discussing how the disclosures concerning maneuverability and disposal reliability are not excessively burdensome for satellite operators).

²² Combined Petition at 12

²³ *Id.* at 10.

²⁴ *Orbital Debris Order*, 35 FCC Rcd at 4179, para 51.

²⁵ *Id.* at 4179-80, para 52.

²⁶ *Id.* at 4171-72, para 35. We note Boeing, one of the parties of this petition, initially supported the inclusion of this assumption in its comments. See *id.* at n.98.

²⁷ *Orbital Debris Order*, 35 FCC Rcd at 4171-72, para 35.

²⁸ *Orbital Debris FNPRM*, 35 FCC Rcd at 4233-34, paras. 164-167.

²⁹ Combined Petition at 13.

detailed metric for effective maneuverability, such as the ability to alter the course of a spacecraft by a certain distance in a particular time period, the FCC rules cannot be administered fairly. However, they do not take issue with the assumption of zero or near zero risk for maneuverable spacecraft. Viasat, OneWeb, and Maxar oppose this request, noting, in effect, that pending development of a comprehensive definition, disclosure of maneuverability information serves a valid public interest objective and provides supporting evidence for addressing the Commission's collision risk rule.³⁰

12. As observed in the *Order*, factual information regarding a satellite or system's maneuverability is useful not only to the Commission when it is assessing applications, but to other operators as it helps interested parties to better understand how operators plan to handle predicted collision risks.³¹ Moreover, details about spacecraft maneuverability enhance the Commission's grasp of other data presented in an applicant's orbital debris mitigation plan and is essential information for the administration of our rules in several key areas. For example, the satellite's expected lifespan in orbit can be significantly influenced by its maneuverability and impact an operator's ability to comply with Commission rules. Additionally, the information provided by applicants in these disclosures can also be drawn upon as the Commission works to further refine its rules through rulemaking. As noted by opposing parties, "facilitating a thorough understanding of other operators' ability to maneuver in-orbit is fundamental to responsible orbital stewardship"³² and disclosure fosters a "transparent" and "predictable" operating environment.³³

13. Although the petitioners' request appears to focus on any disclosure concerning maneuverability, to the extent the petition seeks only removal of the "not effectively maneuverable" exception to the zero or near zero collision risk assumption in the Commission's large object collision risk rule, the petitioners have provided no valid arguments in support of this approach. We decline to adopt an approach that could maintain an assumption of zero or near zero risk even in the face of evidence suggesting that such an assumption is not warranted because collision avoidance capabilities are minimal. We expect the precedent that evolves from a case-by-case approach in evaluating factual information regarding a satellite or system's maneuverability will guide applicants and will address petitioners' concerns with subjective and inconsistent licensing determinations. The petitioners have not provided any evidence of a material error, omission, or reasoning that would warrant reconsideration under the Commission's rules.³⁴ Therefore, we decline to modify our rules pertaining to maneuverability.

14. *Additional Resources for Applicants.* During the pendency of this proceeding, NASA developed the "NASA Spacecraft Conjunction Assessment and Collision Avoidance Best Practices Handbook" and issued a revised version in February of 2023.³⁵ The Handbook is a useful resource that applicants may find helpful in developing and documenting conjunction assessment and collision avoidance capabilities, including for maneuverable spacecraft. The Handbook makes some specific recommendations on conjunction assessment and collision avoidance, including

- Designing spacecraft with capabilities to facilitate conjunction assessment and mitigation.³⁶

³⁰ Combined Petition at 15-16; Viasat Opposition at 3-4; OneWeb Opposition at 9-10; Maxar Comments at 5-6.

³¹ *Orbital Debris Order*, 35 FCC Red at 4179-80, para 52.

³² OneWeb Opposition at 9.

³³ Combined Petition at iv; *see also* OneWeb Opposition at 9-10.

³⁴ *See* 47 CFR § 1.429.

³⁵ NASA Spacecraft Conjunction Assessment and Collision Avoidance Best Practices Handbook, (Rev 1, updated February 2023), https://nodis3.gsfc.nasa.gov/OCE_docs/OCE_51.pdf. ("NASA Handbook").

³⁶ *Id.* at 22.

- Provide ephemeris for conjunction screening at adequate intervals and covering adequate duration.³⁷
- When the probability of collision (P_c) estimated for a conjunction exceeds the mitigation threshold (recommended to be $1E-4$) at the mitigation action commitment point, pursue a mitigation action that will reduce P_c by at least 1.5 orders of magnitude from the remediation threshold, and ensure that the mitigation action does not create any additional conjunctions with a P_c value above the mitigation threshold.³⁸

4. Large System Disposal Reliability

15. In the *Order*, the Commission adopted a rule requiring applicants to provide a statement demonstrating that the probability of success for their chosen disposal method is 0.9 or greater for any individual space station.³⁹ The rule also requires that for space station systems consisting of multiple space stations, the demonstration should include additional information regarding efforts to achieve a higher probability of successful disposal, with a goal, for large systems, of a probability of success for any individual station of 0.99 or better.⁴⁰ Drawing on provisions in the ODMSP, the Commission also stated in the *Order* that additional scrutiny will be given to larger deployments, including consideration of factors such as mass, collision probability, and orbital location.⁴¹

16. Boeing, Planet, Spire, and Telesat raise a concern that the rule will result in the 0.99 probability goal for satellites that are part of large systems becoming in effect an enforceable requirement.⁴² They also object to providing “sensitive” commercial considerations, such as satellite mass and orbital location, as part of the Commission’s assessment.⁴³

17. The petitioners have provided no valid basis for reconsideration. With respect to concerns that the 0.99 disposal reliability goal described in the adopted rule is in effect a firm requirement for all large deployments, these concerns are neither justified nor supported by any new information. Since the adoption of this rule, the Commission has authorized several large system deployments, and in doing so has addressed reliability together with other relevant factual considerations, such as collision risk for satellites that are not reliably disposed.⁴⁴ While it appears to be the case based on both authoritative studies⁴⁵ and the experience gained in these decisions that the largest systems will require very high

³⁷ *Id.* at 9, 33, 35.

³⁸ *Id.* at 38, 41.

³⁹ *Orbital Debris Order*, 35 FCC Rcd at 4201, para 94.

⁴⁰ *Id.*. The rule adopted defined successful post-mission disposal for spacecraft in LEO as re-entry into the Earth’s atmosphere within 25 years or less following completion of the mission. Subsequently the Commission has adopted a new rule lowering this benchmark to five years. *See* Second Report and Order, IB Docket Nos. 18-313, 22-271, 37 FCC Rcd 11818 (2022).

⁴¹ *Orbital Debris Order*, 35 FCC Rcd at 4201, para 94.

⁴² Combined Petition at 16.

⁴³ *Id.* at 17. We note that information such as satellite mass and orbital location are routinely provided as part of an application. To the extent that such information is sensitive as the petitioners suggest, applicants can request this information be treated confidentially under our current rules. *See* 47 CFR § 0.459.

⁴⁴ *See, e.g.*, Space Exploration Holdings, LLC, Application for Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System, Memorandum Opinion, Order and Authorization, 33 FCC Rcd 3391 (2018) (SpaceX Gen1 Authorization); Kuiper Systems, LLC, Application for Authority to Deploy and Operate a Ka-band Non-Geostationary Satellite Orbit System, Order and Authorization, 35 FCC Rcd 8324 (2020).

⁴⁵ *See* J.-C. Liou, et. al., “NASA ODPO’s Large Constellation Study” NASA Orbital Debris Quarterly News, Volume 22, Issue 3 at 4-7 (Sept. 2018), <https://www.orbitaldebris.jsc.nasa.gov/quarterly-news/pdfs/odqnv22i3.pdf>

(continued....)

disposal reliability in order to avoid unacceptably high collision risks, the approach to disposal reliability discussed in the *Order* does not foreclose in individual cases the authorization of systems of satellites with individual satellite disposal reliability of less than 0.99. With respect to concerns raised about examination of “sensitive” information, we note that information such as orbital location and satellite mass (as a component of the area-to-mass ratio of the satellite, necessary for calculating residual orbital lifetime and related collision risk) are routinely provided as part of applications, and this information is routinely publicly available in the Commission’s files. Orbital location is included in all licenses. To the extent examination of the orbital debris risks presented by a large constellation requires examination of information for which confidential treatment can be justified, the Commission’s rules provide for such treatment.⁴⁶ We therefore do not consider these concerns as justifying reconsideration.

5. Deployment Devices

18. In the *Order*, the Commission modified a rule requiring applicants to provide a statement that the space station operator has assessed and limited the amount of debris released in a planned manner during normal operations to specifically require an orbital debris mitigation disclosure for any separate or “free-flying” deployment devices, distinct from the space launch vehicle, that may become a source of debris.⁴⁷ The Commission also discussed in the *Order* the scope of any such disclosure, noting that it should address facts such as the orbital lifetime of the device and collision risks associated with the device itself, including an evaluation of collision risk specifically associated with the deployment of multiple satellites from a deployment device (e.g., re-contact analysis).⁴⁸ The Commission stated that such disclosures would be largely assessed on a case-by-case basis, reasoning that this approach provides the flexibility necessary to address new developments in space station design and addresses the difficulty of designing specific disclosure rules for each different type of device that may be used.⁴⁹

19. Boeing, Planet, Spire, EchoStar, and Hughes argue that this disclosure requirement should be replaced with the ODMSP standard, which specified that “[f]or all planned released debris larger than 5mm in any dimension, the total debris object-time product in low-Earth orbit . . . should be less than 100 object-years . . . per spacecraft.”⁵⁰ They also argue that the Commission should not require re-contact risk analyses because no consensus exists on what is considered an adequate re-contact risk analysis, it was not proposed for comment in the 2018 *NPRM*, and there is not enough guidance as to how to conduct a re-contact analysis or how it would be used in the application review process.⁵¹

20. The petitioners’ argument concerning the ODMSP provisions on operational debris relies on a selective reading of those provisions and does not justify reconsideration of the adopted rule. The sentence in the ODMSP immediately preceding the sentence that petitioners rely on states that “[e]ach instance of planned release of debris larger than 5 mm in any dimension that remains in orbit for more than 25 years *should be evaluated and justified*.”⁵² This additional wording would not be necessary if the rationale for this guideline is that any release of operational debris of less than 100 object-years should be routinely considered acceptable. Instead, as a condition precedent to applying the 100 object-year metric, this guideline contemplates a determination that the release is evaluated and justified. The approach

(assuming constellations totaling approximately 8000 spacecraft at operational altitudes above 1000 kilometers maintained over multiple years, post-mission disposal reliability should be no less than 0.99).

⁴⁶ See 47 CFR § 0.459.

⁴⁷ See *Orbital Debris Order*, 35 FCC Rcd at 4191-95, paras 77-82.

⁴⁸ See *id.* at 4194-5, paras 80-81.

⁴⁹ See *id.* at 4194-5, para 80.

⁵⁰ Combined Petition at 19.

⁵¹ *Id.* at 18, 21.

⁵² ODMSP 1-1 (emphasis added).

adopted by the Commission is in no way inconsistent with this approach, which identifies a need, for example, to consider whether alternative methods for deployment might be utilized that do not result in the potential for debris generation

21. With respect to the concerns raised about re-contact analysis,⁵³ we note that since adopting the *Order*, the Commission has authorized multiple deployers on a case-by-case basis.⁵⁴ Applicants provided information detailing the ways in which they plan to mitigate recontact and Commission assessment of each application took into account the specific re-contact mitigation measures and overall mission facts that were unique to each mission in order to condition the licenses accordingly. For example, one applicant provided a report using a high-fidelity approach based on a Monte Carlo analysis of deployment sequence in its application, using the current manifest as the worst-case scenario and incorporating the worst possible change in manifest subsequent to filing to demonstrate that the applicant had taken the relevant re-contact risks into account and the Commission conditioned their license to require the operator to utilize a deployment sequence that will reduce the probability of re-contact and ensure that the risk of re-contact specified in its application does not increase based on this analysis.⁵⁵ Another applicant stated in its Orbital Debris Assessment Report (ODAR) that it would support at least three re-contact mitigation strategies for deployments from the spacecraft, including ensuring that each deployment group will be spaced apart by at least 90 minutes, or one full orbit, optimize deployment orientation and sequence to minimize re-contact, and use on-board propulsion as necessary to use for maneuvers to minimize the risk of re-contact, and the Commission conditioned the license to require the applicant to optimize customer spacecraft deployment orientation and sequency to minimize re-contact and utilize on-board propulsion as necessary for maneuvers to minimize the risk of re-contact as a result.⁵⁶ Each analysis referenced here provides varying levels of specificity and detail concerning their respective re-contact analyses, but still offers important context for mission characteristics unique to each application. As these examples demonstrate, applicants have been able to address these concerns by drawing on available information, and in some instances involving additional analysis and modeling. We anticipate, based on this experience, that this case-by-case approach will continue to provide a flexible and workable framework for applicants. Accordingly, we conclude that the petitioners' assertions about potential difficulties in the licensing process have not been realized and do not justify reconsideration of this particular rule.

6. Persistent Liquids

22. In the *Order*, the Commission updated its rules to require operators to submit a “statement that the space station operator has assessed and limited the probability, during and after

⁵³ We reject the petitioners' contention that there was insufficient notice to require a re-contact analysis. Combined Petition at 21. The 2018 *NPRM* sought comment on the issue of the use of deployment devices and specifically proposed to require “information regarding the planned orbital debris mitigation measures specific to the deployment device, including the *probability of collision associated with the deployment device itself*.” 2018 *NPRM*, 33 FCC Rcd 11352, para. 21 (emphasis added). A re-contact analysis addresses “the probability of collision associated with the deployment device itself.”

⁵⁴ Momentus Space LLC, ICFS File No. SAT-LOA-20220504-00047 (filed May 4, 2022) (Application for authority to deploy and operate the Vigoride-5, a non-geostationary orbit, in-orbit services vehicle) (Momentus VR-5 Application); Momentus Space LLC, ICFS File No. SAT-LOA-20221009-00131 (filed Oct. 9, 2022) (Application for authority to deploy and operate the Vigoride-6, a non-geostationary orbit, in-orbit services vehicle) (Momentus VR-6 Application); Spaceflight, Inc, ICFS File No. SAT-STA-20210812-00098 (filed Aug. 12, 2021) (Application for special temporary authority to deploy and operate the Sherpa-LTC1 for a period not to exceed 180 days) (Spaceflight Sherpa-LTC1 Application).

⁵⁵ Spaceflight Sherpa-LTC1 Application, Attachment 1, Exhibit C, at 91-94; *see also* Spaceflight Sherpa-LTC1 Application, Attachment to Grant at condition 6.

⁵⁶ Momentus VR-5 Application, Orbital Debris Assessment Report (ODAR) at 11; *see also* Momentus VR-5 Application, Attachment to Grant at condition 14.

completion of mission operations . . . of release of liquids that will persist in droplet form.”⁵⁷ The Commission proposed this rule change in response to increasing interest in use by satellites (including small satellites) of alternative propellants and coolants, some of which due to their physical properties might persist in droplet form. The Commission noted specifically ionic liquids that would persist if released in droplet form by a deployed satellite and the substantial debris cloud that resulted from release of such droplets by Soviet-era satellite operation.⁵⁸ At orbital speeds, such droplets can damage active spacecraft. We noted our expectation that the orbital debris mitigation plan for any system using persistent liquids should address the measures taken, including design and testing, to eliminate the risk of release of liquids and to minimize risk from any unplanned release of liquids in droplet form.⁵⁹

23. The Combined Petition asserts that no evidence exists that the use of such liquids is growing in the United States’ space industry while at the same time raising a concern that the Commission did not provide enough guidance on how information about persistent liquids will be assessed.⁶⁰ The petitioners have not provided a basis for reconsideration of the rule adopted or demonstrated how the current rule is unworkable. Contrary to their assertions, there have been license requests involving spacecraft that would utilize the types of ionic liquids that could persist in space if released in droplet form.⁶¹ Ionic liquids offer some benefits such as ease of on-ground handling as compared to the toxic volatiles often used for spacecraft propulsion, and so it is also possible that they may be more frequently utilized in the future.⁶² With respect to criteria to be applied in addressing instances in which use of ionic liquids is disclosed, the *Order* identified some considerations.⁶³ In addition, under a case-by-case approach, we may consider whether, if released, these debris objects would remain in orbit for only a short time, perhaps due to deployment and operation at low altitudes such as those below inhabitable space stations, or whether there are other natural processes that result in dispersion of the droplets.⁶⁴ Other potentially relevant considerations include whether containment of the liquid can be expected to be effective, established as appropriate by design, testing data, or flight heritage, and whether the propulsion system is shielded from micrometeoroid and debris strikes that might result in leakage. These considerations provide some examples of the types of information that might support a favorable public interest finding with respect to individual applications but are not intended as an exhaustive list.

7. “Case-by-Case” Approach

24. Petitioners raise concerns about a “case-by-case” approach for reviewing the information provided in response to disclosure requirements and, and request that all information disclosure requirements be “coupled with guidance provided by the Commission regarding the manner in which the

⁵⁷ *Orbital Debris Order*, 35 FCC Rcd at 4195-96, para 83.

⁵⁸ *Id.* at 11360, para. 22.

⁵⁹ *Id.* at 11361, para. 23.

⁶⁰ Combined Petition 22-23.

⁶¹ See, e.g., California Polytechnic State University, W12XPH, File No. 0042-EX-CN-2016 (filed Sept. 2, 2016) (Irvine 01 CubeSat); California Polytechnic State University, WJ2XLP, File No. 0254-EX-CN-2018 (filed Mar. 16, 2018) (Irvine 02 CubeSat).

⁶² See, e.g., Beth Ridgeway, NASA’s Green Propellant Infusion Mission Nears Completion (Aug. 20, 2020), <https://www.nasa.gov/missions/tech-demonstration/nasas-green-propellant-infusion-mission-nears-completion/>.

⁶³ *Orbital Debris Order*, 35 FCC Rcd at 4196-97, para 85.

⁶⁴ See John D. Desain, John H. Schilling, Andrea G. Hsu Schouten, Thomas J. Curtiss, and Brian B. Brady, Preliminary Calculations to Determine the Potential of the Release of Ionic Liquids in Space to Form Space Debris, AEROSPACE REPORT NO. ATR-2016-01730 (May 10, 2016) (erosion by atomic oxygen lowers risk from ionic liquids in LEO, particularly around the ISS altitude and below). A copy of this report is available in IB Docket No. 18-313.

information can be used and any minimum operation or performance requirements that must be demonstrated in the disclosed information to warrant the grant of a satellite system authorization.”⁶⁵ Viasat and OneWeb, in opposition, support the use of case-by-case analysis. Viasat notes that case-by-case analysis is indispensable part of the Commission’s licensing process and that it would “make little sense for the Commission to ‘withdraw’ its existing information disclosure requirements pending completion of its further work” on additional orbital debris safety standards because doing so “would deprive the Commission of critical information necessary to evaluate the orbital safety implications of NGSO systems.”⁶⁶ Viasat argues that the Commission is obligated to consider the information elicited by these rules in order to make a finding that the proposed operations are in the public interest, and that eliminating the information disclosure requirements adopted in the *Order* would be counter-productive by removing from the Commission’s rules useful guidance for applicants about information that is relevant in seeking a license, thereby increasing uncertainty.⁶⁷ OneWeb supports case-by-case review, observing that in circumstances involving complex and quickly evolving technological debris mitigation capabilities, such review is necessary in order to facilitate a safe space environment, but at the same time affords operators flexibility and avoids overly prescriptive regulations.⁶⁸

25. As observed by Viasat, the added disclosure requirements provide factual information that is relevant in assessing an application and supporting a public interest determination.⁶⁹ The petitioners do not allege that the factual information elicited by the new disclosure requirements would never reveal a substantial or disqualifying concern related to orbital debris, and we disagree with the petitioners’ contention that incorporating such disclosure requirements in our rules will lead to “subjective” or “discretionary” decision-making. To the contrary, these rules serve to ensure that the Commission has sufficient information to only grant those applications that would serve the public interest. While we recognize the potential benefits of identifying specific metrics for evaluation of various aspects of debris mitigation plans, such as providing certainty to applicants, the development of a specific, one-size-fits-all metric on a particular point may in certain cases slow innovation by failing to account for innovative aspects of a particular system design. Moreover, for certain metrics, we do not have a sufficient record to support a “one-size-fits-all” metric on this issue at this time. But, the absence of a specific metric on a particular point does not foreclose the need to gather information and evaluate mitigation plans in light of the larger and well-recognized goals of U.S. government policy in this area—ensuring the future of the commercial space industry by limiting the release of operational debris and avoiding fragmentation events, whether caused by explosions or collisions. The development of metrics and refinement of criteria for evaluating orbital debris mitigation plans is an active and ongoing process. While consideration of the development of a metric or comprehensive assessment method continues, we elect to proceed incrementally and make fact-based decisions on individual applications on a case-by-case basis.⁷⁰ As noted above in connection with several of the specific disclosure requirements to which petitioners object, the case-by-case approach has successfully permitted the Commission to proceed with review and authorization in individual cases, and experience with these cases, along with parallel

⁶⁵ Combined Petition at 4.

⁶⁶ Viasat Opposition at 3.

⁶⁷ Viasat Opposition at 3-4. Viasat also observes that even without the adoption of these disclosure requirements, the Commission could still seek relevant information from applicants on an *ad hoc* basis and the Commission’s public interest mandate compels it to do so. *Id.* at 4.

⁶⁸ OneWeb Opposition at 7.

⁶⁹ Viasat Opposition at 4 (arguing that withdrawing the information disclosure requirements would force the Space Bureau to request information on an *ad hoc* basis, which would be less transparent and consistent than the approach adopted in the *Order*).

⁷⁰ In addition to aiding the Commission in evaluating applications, this process will help inform whether additional rulemaking or policy guidance would be feasible and helpful.

developments in standards development, will inform future decision-making. In applying this case-by-case approach, we are committed to ensuring consistency in application of our rules and to working with applicants to gather additional information as necessary to ensure that applicants are not penalized without a prior opportunity to address potential concerns. We expect the precedent that evolves from a case-by-case approach will provide contours to guide applicants regarding the extent to which metrics or comprehensive methods may aid in facilitating a favorable Commission determination on pending applications.

B. SpaceX Petition - Market Access and Orbital Debris Mitigation Showings

26. In its petition, SpaceX requests that we reconsider allowing non-U.S.-licensed space stations to satisfy the orbital debris mitigation showing requirement by demonstrating that debris mitigation plans for the space station(s) for which U.S. market access is requested are subject to direct and effective regulatory oversight by the national licensing authority.⁷¹ Alternatively, SpaceX says the Commission should explicitly delineate the information an applicant must submit with its application in support of such a demonstration, or disclose where that information may be easily and publicly found. In particular, SpaceX urges the Commission to require applicants to include:

- All materials related to orbital debris mitigation submitted to the foreign regulator in connection with an application for a space station authorization; and
- All authorizations that include conditions related to orbital debris mitigation.⁷²

27. In support, SpaceX argues that allowing non-U.S.-licensed systems to rely on the orbital debris mitigation requirements of other countries to meet our requirements creates a “loophole” that could undermine the Commission’s space safety objectives by allowing operators to evade oversight by choosing forums with less stringent rules and little input from other affected satellite operators.⁷³ In response, Kepler Communications Inc., OneWeb, and Viasat submitted oppositions and comments to the SpaceX petition, stating that there is no “loophole” in the Commission’s rules and in fact, based on their own experience as non-U.S.-licensed market access applicants, they have been subject to the same level of regulatory scrutiny as U.S.-licensed systems.⁷⁴ We agree that the end result is the same whether a market access applicant makes an orbital debris mitigation showing under section 25.114(d)(14)(i)-(iv) or 25.114(d)(14)(v) prior to gaining U.S. market access, the applicant will have had its orbital debris mitigation plan subject to a rigorous review to ensure space safety.

28. While our rules allow market access applicants to satisfy the requirement to describe the design and operational strategies to minimize orbital debris risk by demonstrating that their debris mitigation plans are subject to direct and effective regulatory oversight by the national authority that licensed their space station operations, such a showing requires market access applicants to provide supporting documentation and respond to inquiries from Commission staff in order for the staff to compare the non-U.S. regulatory regime, including its rules and ongoing oversight, and determine whether there is an effective regulatory regime in place. This information, when filed with the Commission, becomes a part of the record, and other interested parties are able to review it too. If the Commission finds additional information is necessary to complete its review, that information also becomes part of the record and available for review. In either case, interested parties will have access to the same information the Commission relies on to determine whether a grant of market access is in the public interest, the only exception being if the applicant is able to demonstrate an overriding public

⁷¹ See 47 CFR § 25.114(d)(14)(v).

⁷² SpaceX Petition at 7.

⁷³ SpaceX Petition at 2.

⁷⁴ Viasat Opposition at 10; OneWeb Opposition at 2-4; *see also* Kepler Comments.

interest need to keep some of the information confidential.

29. Having a one size fits all disclosure requirement as proposed by SpaceX can be more burdensome than necessary for the Commission to determine whether an applicant's debris mitigation plan has been thoroughly reviewed and whether the applicant will be subject to effective regulatory oversight. Using a case-by-case approach provides more flexibility and can serve the public interest better by being less burdensome. For instance, as Commission staff become familiar with the requirements and review process of a particular non-U.S. regulator, they can tailor their information request based on knowledge of how that regulator conducts an orbital debris mitigation review, and what regulatory requirements it imposes. The staff may ask for more information in an area that they have found the regulator does not require the same level of detail as the Commission, or may likewise ask for less information in another area where the Commission has already found sufficient regulatory oversight. In either case, if another party believes that circumstances have changed with a particular non-U.S. regulatory oversight process, or has reason to believe that an applicant is not subject to sufficient regulatory oversight, they can raise those concerns with the Commission and the Commission will factor that in as part of its overall review process. Ultimately, if the Commission finds after its review of either the applicant's mitigation plan or the non-U.S. regulatory regime under which it is licensed, that additional conditions are necessary to ensure space safety, the Commission can so condition the grant of market access, similar to what it does for U.S. licensees in similar situations. We also note while the Commission does accept equivalent regulatory oversight showings under section 25.114(d)(14)(v), it does not preclude applicants from alternatively providing the same orbital debris mitigation showings that are required of U.S. licensees, which are detailed in section 25.114(d)(14)(i)-(iv) of the Commission's rules. And, except for a few cases, applicants have generally found it preferable to just provide the Commission with a description of the design and operational strategies for orbital debris mitigation instead of presenting all of the showings necessary to demonstrate the effective regulatory oversight of another national authority.⁷⁵ Accordingly, we find SpaceX has not demonstrated a need for elimination or changes to section 25.114(d)(14)(v).

C. Kuiper Petition - Orbital Separation of Large NGSO Systems

30. In the 2018 NPRM the Commission sought comment on whether it should adopt an upper limit for variances in orbit for NGSO systems.⁷⁶ After reviewing an extensive record on the issue, including comments on the related topic of whether, and how, the Commission should assign orbital altitude ranges for large constellations of NGSO satellites, in 2020 the Commission said it would not adopt a maximum orbital variance for NGSO systems, nor a required separation between orbital locations, and will instead continue to address these issues on a case-by-case basis.⁷⁷ The Commission found that there were a wide range of considerations in such cases, and while it was concerned about the risk of collisions between the space stations of NGSO systems operating at similar orbital altitudes, it found that these concerns are best addressed in the first instance through inter-operator coordination.⁷⁸

31. Kuiper petitioned the Commission to reconsider its decision to not establish an orbital separation requirement, including for large NGSO constellations, and associated limits.⁷⁹ Kuiper states that the Commission should expressly require a later-filed large NGSO constellation to maintain

⁷⁵ See also *Expediting Initial Processing of Satellite and Earth Station Applications*, Report and Order and Further Notice of Proposed Rulemaking, FCC 23-73 at para 73 (Sept. 22, 2023).

⁷⁶ 2018 NPRM, 33 FCC Rcd at 11365, para. 35.

⁷⁷ *Orbital Debris Order*, 35 FCC Rcd 4156 at para. 47-48.

⁷⁸ *Id.*

⁷⁹ Kuiper Petition at 1.

sufficient orbital separation from an earlier-filed large NGSO constellation.⁸⁰ In support, Kuiper states that since adoption of the *Order*, the Commission has received a number of applications and license modifications for large NGSO constellations to operate in orbits that are already occupied, or proposed to be occupied, by other large NGSO constellations.⁸¹ Therefore, the Commission's "expectation that applicants' own desire for space safety would lead them to voluntarily choose non-overlapping orbits" has proven false, and these new applications constitute facts that did not exist at the time the Commission adopted its *Order* and therefore warrant reconsideration.⁸²

32. OneWeb, ARCLab, and Maxar filed comments in support of Kuiper's petition. OneWeb argues that the time is ripe for the Commission to reconsider the potential for orbital separation rules to help ensure a safe space environment.⁸³ ARCLab argues that operating large constellations with overlapping orbits sharply increases systemic risk, and if those orbits are not explicitly designed for compatibility it would result in sharp increases in conjunctions and collision avoidance maneuvers.⁸⁴ Maxar adds that since adoption of the *Order*, the increase of large constellations with overlapping orbital variances has become an issue of broad applicability and therefore ripe for Commission consideration.⁸⁵

33. Both Viasat and Kepler oppose Kuiper's petition, arguing that Kuiper's proposed rule would undermine the incentive for an operator to engage in the type of inter-system coordination anticipated by the *Order* and in essence create a first-come, first-serve priority system for orbital regions in LEO, which would advantage the largest, most established satellite operators, and potentially lead to a monopolization of certain sections of LEO.⁸⁶ Viasat also states that Kuiper has not established that an orbital overlap rule is necessary to promote space safety, and that there are alternative approaches the Commission could consider.⁸⁷

34. The Commission continues to take space safety issues seriously, and the *Order* recognized that issues may arise with respect to large NGSO systems, and the orbits at which they operate. Notably, the *Order* advises that applicants for large systems may be asked to provide specific information about their planned orbital variance as well as how their system operations would accommodate other spacecraft traveling through or operating in the same region.⁸⁸ While Kuiper supports its petition with the "new" fact that applications for large NGSO systems with competing orbits have been filed since adoption of the *Order*, this circumstance alone is not sufficient justification for the Commission to revisit its decision to allow in the first instance parties to work on an inter-operator coordination agreement. At the time the Commission adopted its *Order* it had already considered that parties may want to use similar orbits, but it also found that inter-operator coordination could resolve any space safety concerns, and no party has introduced evidence that any such concerns remain unresolved. We have continued to monitor the situation since adoption of the *Order* and continue to believe that the best solution for maintaining space safety is for operators to have the flexibility to coordinate in a manner that works best for their situation, rather than have the Commission dictate how that coordination should

⁸⁰ *Id.* at 2 (Kuiper defines a constellation as a group of satellites that are synchronized and under common control, including those groups that are composed of more than one nominal constellation authorized under the Commission's rules.).

⁸¹ *Id.* at 5.

⁸² *Id.* at 3-4.

⁸³ OneWeb Opposition at 5.

⁸⁴ ARCLab Comments at 2.

⁸⁵ Maxar Comments at 4.

⁸⁶ Viasat Opposition at 9, Kepler Comments at 2.

⁸⁷ Viasat Opposition at 9-10.

⁸⁸ *Orbital Debris Order* at para. 48.

proceed. In addition, we review closely applications for new licenses or modifications that may raise overlapping orbital shell issues, and work with the applicants and other interested parties to ensure that either coordination has occurred to minimize space safety issues, or changes are made to the proposed operating parameters to address any remaining concerns.⁸⁹ We will continue to monitor the overall orbital separation environment, and to the extent we see a breakdown in the coordination process or other space safety issues, we will consider at that time whether new general rules are needed to either improve the coordination process or address space safety concerns. Accordingly, the Commission declines to establish an orbital separation requirement, including for large NGSO constellations.

IV. ORDERING CLAUSES

35. Accordingly, IT IS ORDERED, pursuant to sections 1, 4(i), 4(j), and 405 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 154(i), 154(j), 405, and section 1.429(b) of the Commission's rules, 47 CFR § 1.429(b), that the petitions for reconsideration filed by Boeing, EchoStar, Hughes, Planet, Spire, Telesat, SpaceX, and Kuiper in IB Docket No. 18-313, are DENIED.

36. IT IS FURTHER ORDERED that this ORDER SHALL BE EFFECTIVE upon publication in the *Federal Register*.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

⁸⁹ See, e.g., Space Exploration Holdings, LLC, 36 FCC Rcd 7995, 8032-8033 (Apr. 27, 2021) (establishing orbital tolerance levels based on the facts of the situation).