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

In the Matter of	)	
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Viasat, Inc.	)	Call Sign: S2985
	)	
Application for Modification of Authorization for the Viasat NGSO Satellite System	)	File No. SAT-MPL-20200526-00056
	)	

CONSOLIDATED OPPOSITION TO PETITIONS AND RESPONSE TO COMMENTS OF VIASAT, INC.

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September 15, 2020

SUMMARY

Under Chairman Pai's leadership, the Commission's "number one priority has been closing the digital divide and bringing the benefits of the Internet age to all Americans." Viasat has consistently been at the leading edge of these efforts—with well over a decade of experience providing mass-market retail broadband Internet service to millions of consumers throughout the United States, both at home and for their small businesses, and across both rural and urban areas. Where the Commission has taken affirmative steps to expand broadband availability, Viasat has been a vital partner—including in the CAF II auction, where Viasat's winning bids covered approximately 27 percent of the locations awarded for approximately 8 percent of the total funding awarded. And now, with the proposed modification of its authorized non-geostationary orbit ("NGSO") satellite network, Viasat is taking the next step in delivering ubiquitous high-speed, low-latency broadband connectivity to American consumers.

Viasat's modified NGSO FSS system will yield an array of public interest benefits and is fully consistent with Commission policies and precedent. The modified system utilizes extremely-high-capacity satellites, each of which is expected to have up to 4 to 5 times the capacity of any low-earth-orbit satellite proposed to date and supports sub-100 ms latency broadband service to American homes and small businesses. The design of the constellation also allows the highest standards of space safety to be met for this constellation as a whole. And the modified system does so without creating any significant additional interference with respect to other Commission-authorized NGSO FSS systems in the same processing round.

Viasat's modification application fully satisfies Section 25.117 of the Commission's rules. Under the well-established "*Teledesic* standard" used to evaluate modifications under that rule, the Commission applies a presumption in favor of grant unless the modification would create significant additional interference with respect to other same-round NGSO FSS systems or

make spectrum sharing with those systems significantly more difficult. That assessment considers *aggregate* changes in predicted interference over the baseline established by the initial grant, with reference to the Commission's threshold for "band-splitting" events that could reduce the spectrum available to other NGSO FSS systems. If that test is satisfied, the Commission allows the NGSO FSS system to maintain its relative spectrum-sharing status vis-à-vis other NGSO FSS systems authorized in the same round.

Viasat has committed that the actual operation of its modified system will maintain the same expected operating environment with respect to other systems authorized in the same processing round. Viasat has a variety of operational tools available to achieve this requirement, including dynamic power limits, avoidance angles, and the number of co-frequency satellites serving a given location on the Earth at a given time. The modification also provides increased satellite diversity to reduce the potential for band-splitting events, and thus reduce interference potential. Significantly, the flexibility that the Commission provides NGSO FSS operators to employ tools of their choosing to stay within *I/N limits* to protect other NGSO FSS systems is no different than the wide flexibility the Commission provides them to stay within *EPFD limits* to protect geostationary FSS systems. *No NGSO operator yet has been required to detail specifically how it will stay operationally within those EPFD limits or I/N limits, and there is no valid reason for a different approach in Viasat's case*.

The handful of commenters and petitioners provide no credible basis for denying this modification application or deferring it to a later processing round. For instance, some rely heavily—and erroneously—on generalized assertions about the degree to which Viasat's modified system differs from its currently authorized system, including an increase in the number of satellites in its constellation. But as the Commission is well aware, the "magnitude of

change" is not determinative under the *Teledesic* standard. If "counting the satellites" were the test, then having fewer satellites but causing significantly more interference would pass muster, which demonstrably is not the case.

To the contrary, and as one petitioner acknowledges, the determinative factor is "the number of times constellations will be required to reduce spectrum" with other NGSO FSS systems authorized in the same processing round (*i.e.,* whether the number of "band-splitting" events is predicted to increase). As detailed below, no such NGSO FSS operator will be required to reduce spectrum more often as a result of this modification application. Moreover, the Commission has approved modifications involving both increases in the number of satellites, and other far more extensive changes to NGSO systems than Viasat's, upon finding that the modification would not create significant additional interference with respect to other same-round operators. And the Commission has allowed those modified systems to maintain their spectrum-sharing status vis-à-vis other systems authorized in the same round. The same result is warranted here.

Indeed, if changes in orbital configuration—particularly number of orbital planes, orbit altitude, and inclination—alone were a defining factor, then SpaceX's pending third modification application necessarily must be deferred and considered as part of the March 2020 Ka-/Ku-band processing round.

Faithfully applying the *Teledesic* standard shows that Viasat's modification easily passes muster. Viasat's robust interference analysis, along with this Opposition, demonstrates that the modification will not cause significant additional interference with respect to other NGSO FSS systems authorized as part of the 2016/2017 processing rounds for Ka-band and V-band systems.

In contrast, each of the "analyses" provided by the commenters and petitioners suffers from fundamental flaws, including (i) wrongly assuming that eight, or more, Viasat NGSO satellites would be active at a given frequency, at any given moment, and at any given location, and that the Viasat LEO network always would use the maximum power authorized, and (ii) failing to account for Viasat's commitment to undertake operational measures so that its modified system maintains the same expected operating environment with respect to other systems authorized in the same processing rounds.

As to space safety, Viasat has explained that it designed its modified NGSO FSS constellation to be able to meet the highest standards for the constellation as a whole, and Viasat provided a detailed showing in support. In particular, Viasat's showing is consistent with the Commission's proposal to apply a 0.001 large object collision risk metric to an entire constellation, and to measure compliance over a 15-year license term. Viasat thus is capable of meeting the very same requirements that Viasat is asking others to meet.

That SpaceX is the only party to raise any space safety issues is deeply ironic given that SpaceX is already experiencing a catastrophic number of satellite failures, and demonstrably has failed to meet its commitments to the Commission. SpaceX's arguments on space safety also are riddled with misrepresentations and contradictions.

No party has justified denying or deferring Viasat's modification or delaying the public interest benefits that will result. Promptly granting this modification, and allowing Viasat to maintain its spectrum-sharing status vis-à-vis other same-round NGSO FSS systems, (i) is consistent with Commission policy and precedent, and (ii) will enable Viasat to take the next important step in providing ubiquitous high-speed, low-latency broadband connectivity to American homes and small businesses.

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CONSOLIDATED OPPOSITION TO PETITIONS AND RESPONSE TO COMMENTS OF VIASAT, INC.

Viasat, Inc. ("Viasat") submits this consolidated opposition to petitions[1] and response to comments[2] in connection with the above-referenced application to modify its authorization for a non-geostationary orbit ("NGSO") satellite system.[3]

INTRODUCTION

Viasat's proposed modification will deliver substantial benefits to American consumers and is fully consistent with Commission policies and precedent. Among other benefits, the modification:

- Utilizes extremely-high-capacity satellites, each of which is expected to have up to 4 to 5 times the capacity of any low-earth-orbit ("LEO") satellite proposed to date;

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1 *See* Petition to Deny or Defer of Space Exploration Holdings, LLC, IBFS File No. SAT-MPL-20200526-00056 (filed Aug. 31, 2020) ("*SpaceX Petition*"); Petition to Deny or Condition of O3b Limited, IBFS File No. SAT-MPL-20200526-00056 (filed Aug. 31, 2020) ("*O3b Petition*"); Petition to Deny or Defer Consideration of Telesat Canada, IBFS File No. SAT-MPL-20200526-00056 (filed Aug. 31, 2020) ("*Telesat Petition*").

2 *See* Comments of The Boeing Company, IBFS File No. SAT-MPL-20200526-00056 (filed Aug. 31, 2020) ("*Boeing Comments*"); Kuiper Systems LLC, IBFS File No. SAT-MPL-20200526-00056 (filed Aug. 31, 2020) ("*Kuiper Comments*").

3 *See* Viasat, Inc., Application for Modification of Authorization for the Viasat NGSO Satellite System, IBFS File No. SAT-MPL-20200526-00056 (filed May 26, 2020) ("*Viasat Modification Application*").

- Supports sub-100 ms latency broadband service, in response to the Commission's policy goal of encouraging the competitive deployment of infrastructure capable of supporting such service;

- Is optimized to cover American homes and small businesses in the contiguous United States ("CONUS"); and

- Allows the highest standards of space safety to be met for this LEO constellation as a whole, including the ability to satisfy the Commission's proposed collision-risk standard of less than 0.001 on an entire constellation basis over a 15-year license term.[4]

This modification is in keeping with Commission precedent and with a number of other modifications granted in the past year for systems that, like Viasat's, were approved as part of the 2016/2017 processing rounds.[5] As explained in its *Teledesic* decision, the Commission generally "allow[s] licensees to modify their satellite systems when possible," and has explained that such modifications are routinely granted because they "allow[] the licensee to take advantage of the latest technology in providing service to the public."[6] Thus, under this presumption, the Commission "will grant an application to modify a space station license unless [it] determine[s] that the modification requested will not serve the public interest."[7] This public interest analysis, in turn, considers whether a modification would "create any significant interference problems to other systems or make sharing [with] other NGSO FSS systems significantly more difficult."[8]

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4 *See id.*, Exhibit A, at 1.

5 *See, e.g.*, *Space Exploration Holdings, LLC, Request for Modification of the Authorization for the SpaceX NGSO Satellite System*, Order and Authorization, 34 FCC Rcd 2526 (IB 2019) ("*First SpaceX Modification Order*"); *Space Exploration Holdings, LLC, Request for Modification of the Authorization for the SpaceX NGSO Satellite System*, Order and Authorization, 34 FCC Rcd 12307 (IB 2019) ("*Second SpaceX Modification Order*").

6 *See Teledesic LLC, Minor Modification of License to Construct, Launch and Operate a Non-Geostationary Fixed Satellite Service System*, Order and Authorization, 14 FCC Rcd 2261 (IB 1999), at ¶ 5 ("*Teledesic Order*").

7 *First SpaceX Modification Order* at ¶ 9.

8 *Teledesic Order* at ¶ 7.

As Viasat's application demonstrates, the modified system will deliver the benefits noted above without creating any significant interference problems for other NGSO systems authorized in the same processing round or making spectrum sharing with those systems significantly more difficult. Significantly, Viasat has committed to "ensuring that the actual operation of its modified system maintains the same expected operating environment" with respect to other NGSO FSS systems authorized in the 2016/2017 processing rounds that are implemented.[9] Viasat has provided robust analysis, both in its modification application and in this filing, verifying that the modified system will operate within the interference envelope established in Viasat's current NGSO authorization. In addition, Viasat has provided a detailed showing demonstrating the modified system's compliance with the Commission's orbital debris rules and ability to adhere to the highest standards of space safety.[10]

Petitioners and commenters fail to present any valid basis for denying or deferring Viasat's modification application. In urging the Commission to treat this application as part of a new NGSO processing round, rather than as a properly submitted modification of Viasat's 2016/2017 round authorization, these parties mischaracterize the governing standard, fixate on a single aspect of Viasat's request to the exclusion of other important factors, and rely on fundamentally flawed interference analyses. Meanwhile, the only party to object to Viasat's orbital debris showing—SpaceX—misfires badly in its technical analysis and lacks credibility on this issue in any event, given its own system's grave threat to space safety and its practice of

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[9] *Viasat Modification Application*, Exhibit A, at 4. As the modification application explains, references to the "2016 Round" in the application refer to the "processing rounds for Ka- and V-band systems commenced in 2016 and 2017." *Id.* at 1.

[10] *Id.*, Exhibit B, at 6-11.

obscuring collision risks and withholding relevant data from the Commission. The Commission should grant Viasat's modification application expeditiously.

DISCUSSION

I. THE MODIFICATION SATISFIES THE *TELEDESIC* STANDARD

Under the well-established *Teledesic* standard, the Commission should process and grant the instant application under Section 25.117(d) as a modification to Viasat's NGSO authorization granted as part of the 2016/2017 processing rounds for Ka-band and V-band systems.[11] As detailed below, parties commenting on or opposing Viasat's application provide no valid basis for reaching a different conclusion. In the following discussion, Viasat first examines in subsection A the mischaracterizations in those pleadings of the relevant legal standards. Then Viasat addresses in subsections B and C the technical issues regarding predicted interference, demonstrating that the modification will not significantly increase interference or make sharing with other NGSO FSS systems authorized in the same processing round significantly more difficult.

A. The *Teledesic* Standard Governs This Modification

1. Parties mischaracterize the standard for reviewing modifications under Section 25.117

The trouble with the arguments of the commenters and the petitioners begins with their mischaracterizations of the standard governing review of modification applications under Section 25.117. All parties recognize that the Commission's *Teledesic* standard provides the relevant

[11] *See Viasat, Inc., Petition for Declaratory Ruling Granting Access for a Non-U.S.-Licensed Non-Geostationary Orbit Satellite Network,* Order and Declaratory Ruling, 35 FCC Rcd 4324 (2020), at ¶ 2 n.7 ("*Viasat NGSO Authorization Order*") (considering Viasat's current NGSO authorization "as part of three processing rounds for NGSO-like applications and petitions" in 2016 and 2017, including rounds for Ka-band and V-band systems).

legal framework,[12] but each party commenting on or opposing the modification adopts its own idiosyncratic and strained reading of that standard. Thus, in addressing these parties' claims, it is important to begin by recalling what the *Teledesic* decision actually said and how the Commission has applied it.

In the *Teledesic* decision, the Commission explained that, under well-established precedent, "[i]f the proposed modification does not present any significant interference problems and is otherwise consistent with the Commission's policies, it is generally granted."[13] The Commission explained that, "[g]iven the fairly lengthy time period required to construct a satellite, licensees often file requests to modify the technical design of their satellites as they are being built."[14] Moreover, "[i]n recognition of the several years required to construct a satellite, or constellation of satellites, the rapidly changing technology, and our goal of encouraging more efficient use of the radio spectrum," the Commission "allow[s] licensees to modify their satellite systems when possible."[15] Indeed, such modifications are routinely granted because they "allow[] the licensee to take advantage of the latest technology in providing service to the public."[16]

In applying this standard, the Commission considers whether a modification would "create any significant interference problems to other systems or make sharing [with] other

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[12] *See SpaceX Petition* at 5 (citing *Teledesic Order*); *Telesat Petition* at 2 (citing *Teledesic Order*); *Kuiper Comments* at 18 (citing *Teledesic Order*); *Boeing Comments* at 5 (citing *Teledesic Order*); *O3b Petition* at 5 (citing decision applying *Teledesic* standard).

[13] *Teledesic Order* at ¶ 5 (citations omitted).

[14] *Id.* (citations omitted).

[15] *Id.*

[16] *Id.* (quoting *American Satellite Company*, 5 FCC Rcd 1186, 1186 (1990)).

NGSO FSS systems significantly more difficult."[17] And, in doing so, the Commission considers not only potential sources of increased interference or spectrum sharing difficulties, but also potential mitigation.[18]

The Commission recently addressed the application of this standard in granting the *First SpaceX Modification Order* last year,[19] which it reaffirmed in the *SpaceX Recon Order* adopted in June of this year.[20] In the *First SpaceX Modification Order*, the Commission relied on the applicant's assessment of aggregate changes in predicted interference with respect to certain other NGSO FSS systems in the same processing round, measured with reference to predicted aggregate interference-to-noise ("I/N") levels.[21] In the *SpaceX Recon Order*, the Commission confirmed that "I/N . . . is the trigger for a potential need to split bandwidth for NGSO networks."[22]

Notably, that assessment considers *aggregate* changes in predicted interference. Moreover, it considers predicted interference above the Commission's interference threshold for "band-splitting" events: a $\Delta T/T$ in excess of 6%, which corresponds to an I/N of -12.2 dB.[23] That assessment also does not consider mere geometric in-line alignments alone—with respect to either number or duration. Rather, it considers the *aggregate* change in predicted interference

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17 *Id*. at ¶ 7.

18 *See, e.g.*, *id*. at ¶ 18 ("Significantly, remedial technical mitigation, such as improvements in the earth station antenna pattern, can be used to mitigate the increased interference potential resulting from an increase in power." (footnote omitted)).

19 *See First SpaceX Modification Order* at ¶ 9 & nn.29-30.

20 *See Space Exploration Holdings, LLC, Request for Modification of the Authorization for the SpaceX NGSO Satellite System*, Memorandum Opinion and Order, 35 FCC Rcd 5649 (IB 2020) ("*SpaceX Recon Order*").

21 *See* Space Exploration Holdings, LLC, IBFS File No. SAT-MOD-20181108-00083 (filed Nov. 8, 2018), Attachment A, at 24-37 ("*SpaceX First Modification Application*").

22 *SpaceX Recon Order* at ¶ 11.

23 *See* 47 C.F.R. § 25.261(c).

over a certain threshold and also above the baseline established by the initial grant. As reflected most recently in the *Viasat NGSO Authorization Order,* the determinative factor in the NGSO FSS context is "the number of times constellations will be required to reduce spectrum" as a result of the change[24]—that is, whether other systems in the same processing round will be required to reduce spectrum during band-splitting events more frequently than they otherwise should have expected. This approach also formed the basis for the showing regarding the potential for increased interference associated with a second SpaceX modification application,[25] which the Commission also granted.[26]

Notably, in the context of responding to petitions to deny its third modification application, SpaceX takes a different view of the *Teledesic* standard than it espouses in its petition in this proceeding. There, SpaceX acknowledges that "a determinative factor in evaluating the interference impact of a proposed modification is 'the number of times constellations will be required to reduce spectrum' under the spectrum sharing rules in Section 25.261."[27] SpaceX goes on to "use[] this metric as a key component in evaluating the concerns raised about its proposed operations at lower altitudes."[28] Curiously, however, in this proceeding SpaceX and the other petitioners and commenters ignore this "determinative factor" in their characterizations of the *Teledesic* standard and its application to Viasat's proposed modification. This omission, along with other inaccurate and incomplete characterizations of the *Teledesic*

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24 *Viasat NGSO Authorization Order* at ¶ 12.

25 *See* Space Exploration Holdings, LLC, IBFS File No. SAT-MOD-20190830-00087 (filed Aug. 30, 2019), Attachment A, at Annex 1 ("*SpaceX Second Modification Application*").

26 *See Second SpaceX Modification Order*.

27 Consolidated Opposition to Petitions and Response to Comments of Space Exploration Holdings, LLC, IBFS File No. SAT-MOD-20200417-00037, at 21 (filed July 27, 2020) ("*SpaceX Third Modification Opposition*") (citation omitted) (quoting *Viasat NGSO Authorization Order* at ¶ 12).

28 *Id.*

standard in the petitions and comments, undermines these parties' erroneous claims about interference in this proceeding.

2. The "magnitude of change" is not determinative under the *Teledesic* standard

As a vivid example of opponents' mischaracterizations of *Teledesic*, the petitions and comments contain various generalized assertions about the degree to which Viasat's modified system differs from its currently authorized system—and urge the Commission to consider the modification in the March 2020 processing round on that basis.[29] These arguments about the "magnitude of change" rest on a blatant misreading of Commission precedent. Neither the *Teledesic* decision nor other rulings applying that standard provide any support for deferring consideration of a modification application on such a basis.

In the *Teledesic* case itself, the applicant proposed to modify nearly *everything* about its system. There, the modification application included the following changes: "1) decreasing the number of satellites from 840 to 288; 2) increasing the altitude from 700 km to 1375 km; 3) decreasing the number of orbital planes from 21 to 12 and the number of satellites in each orbital plane from 40 to 24; 3) decreasing the inclination of the orbital planes from 98.2° to 84°; 4) adding emission designators; and 5) adding optical inter-satellite links in addition to its radio frequency inter-satellite links."[30] And the Commission had no trouble applying the standard described above to approve these far-reaching modifications of both orbital and radiofrequency characteristics.

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[29] *See, e.g.*, *O3b Petition* at 1 (arguing that the modified system is "fundamentally different from what was previously approved, requiring that the system be treated as newly filed"); *Kuiper Comments* at 2, 4 (asserting that Viasat "seeks a new constellation altogether" and that the "sheer magnitude of change involved" warrants consideration in the March 2020 processing round).

[30] *Teledesic Order* at ¶ 3.

The same is true of SpaceX's repeated modifications to Starlink, which have resulted in a system that bears little resemblance to what the Commission initially authorized in 2018. In its first modification application, for instance, SpaceX sought "to: (1) reduce the number of satellites in the constellation from 4,425 to 4,409; (2) operate 1,584 satellites previously authorized to operate at an altitude of 1,150 km at the lower altitude of 550 km; and (3) make related changes to the operations of the satellites in this new lower shell of the constellation."[31] Satisfied that SpaceX's proposal met the *Teledesic* standard, the Commission granted this first modification application.[32] Just four months later, SpaceX again proposed to modify its system. This time, it sought "to further modify the lower shell of its constellation to: (1) increase the number of orbital planes from 24 to 72; (2) decrease the number of satellites per orbital plane from 66 to 22; and (3) make related changes to the deployment and operations of the satellites in these orbital planes."[33] The Commission granted this second modification application as well, concluding that doing so "w[ould] serve the public interest."[34] On their own, each of these two modifications entailed considerable changes to the Starlink constellation. Taken together, they have resulted in a system whose configuration and operating parameters are vastly different from the system that the Commission initially authorized.

Ignoring this precedent, O3b argues that allowing these types of changes to systems authorized in prior processing rounds "would render the Commission's processing round framework meaningless" and would not be "fair" to other operators.[35] That simplistic view is

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[31] *First SpaceX Modification Order* at ¶ 2.

[32] *See id.* at ¶ 11.

[33] *See Second SpaceX Modification Order* at ¶ 3.

[34] *Id.* at ¶ 5.

[35] *O3b Petition* at 5, 11.

completely at odds with the *Teledesic* line of cases. Applying the *Teledesic* standard is *precisely* how the Commission ensures fairness to other operators from an interference standpoint and preserves the integrity of the processing round framework. As explained in the *First SpaceX Modification Order*, that standard's "focus on the public interest in avoiding radiofrequency interference is consistent with the purpose of the Commission's processing round procedure, which is *designed to establish the interference environment in which participants in the processing round could operate their systems*."[36] There is nothing "unfair" about allowing an operator to modify its system and preserve its processing round status where, as here, that modification is within the NGSO FSS technical envelope and operating environment established in that prior processing round. And contrary to claims by Kuiper and Boeing, such modifications still enable other operators to preserve their "reasonable investment expectations"[37] and to rely on "the existing interference environment . . . when designing their systems."[38]

3. An increase in the number of satellites is not determinative under the *Teledesic* standard

By the same token, applying the *Teledesic* standard is not as simple as "counting the satellites" and determining whether the number has increased, as SpaceX and others claim.[39] Again, the *Teledesic* standard looks to whether a modification would "create any significant interference problems to other systems or make sharing [with] other NGSO FSS systems significantly more difficult,"[40] by considering the *aggregate* change *in predicted interference*

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[36] *First SpaceX Modification Order* at ¶ 9 (emphasis supplied).

[37] *Boeing Comments* at 7-8.

[38] *Kuiper Comments* at 4.

[39] *See SpaceX Petition* at 5-8; *O3b Petition* at 4-5; *Boeing Comments* at 6-7.

[40] *Teledesic Order* at ¶ 7.

over the baseline environment established by the initial grant.[41] The Commission has never held that a simple count of the satellites is the determinative factor. If that were the test, then having fewer satellites but causing significantly more interference would always pass muster under Section 25.117—which demonstrably is not the case under the *Teledesic* standard.

It is particularly ironic for SpaceX to be making such an argument. When prosecuting its own V-band application, SpaceX asserted that deploying *more satellites* in its constellation would help *reduce the potential for band-splitting events, and thus reduce interference potential*. SpaceX explained that having more satellites meant "more satellite diversity options,"[42] and that such satellite diversity would allow SpaceX to *greatly reduce the number of in-line events*.[43] Similarly, when prosecuting its Ka-band and Ku-band application, SpaceX asserted that "[s]maller NGSO constellations . . . present more challenges to spectrum sharing, given their far lesser ability to avoid in-line events with other systems," and that "'satellite diversity' gives the fully deployed system enhanced flexibility that can be used in cooperation with multiple NGSO systems to share spectrum efficiently and equitably."[44] SpaceX cannot have it both ways—arguing that *its having* more satellites helps resolve potential interference, while also arguing that

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41 *See supra* at 4-8.

42 *See* Space Exploration Holdings, LLC, IBFS File No. SAT-LOA-20170301-00027 (filed Mar. 1, 2017), at Attachment A, Technical Information to Supplement Schedule S, at 4, n.4 (emphasis supplied) (quoting *Establishment of Policies and Service Rules for the Non-Geostationary Satellite Orbit, Fixed Satellite Service in the Ka-Band*, 18 FCC Rcd 14708 (2003), at ¶ 44 ("With satellite diversity, NGSO FSS systems can avoid an in-line interference event by selecting another visible satellite within their system constellation (performing a hand-over process) whenever the current satellite approaches the in-line event with a satellite operating in another NGSO FSS system constellation.")).

43 *See id.* at 23.

44 *See* Consolidated Opposition and Response of Space Exploration Holdings, LLC, IBFS File No. SAT-LOA-20161115-00118, at 4-5 (filed July 7, 2017).

others' having more satellites results in significant additional interference.[45] The answer depends on the circumstances, including the specifics of the NGSO FSS system design.[46]

Neither SpaceX nor any other party provides any good reason for making an *a priori* determination about how the number of satellites in a constellation affects the procedural status of a modification application. In fact, the *Teledesic* decision provides for an assessment of the change in predicted interference resulting from changes to "orbital configuration," which is broadly defined to include changes to "the number of satellites, number of orbital planes, orbit altitude, and inclination."[47] That decision concluded that Teledesic's proposed changes in orbital configuration and other aspects of its authorized system[48] did not result in significantly more interference, even though some of those changes could potentially affect spectrum sharing with other NGSO FSS systems.[49] In other words, the Commission did not make the type of *a priori* determination that SpaceX and others seek to apply to Viasat's application.

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[45] Indeed, the *SpaceX Petition* is internally inconsistent on this point. SpaceX acknowledges elsewhere that the Commission has permitted an increase in the number of satellites where there is no significant interference impact on other operators in the prior processing round. *See SpaceX Petition* at 8 n.18. And SpaceX specifically contemplates that Viasat's proposed increase in the number of satellites would be permissible under *Teledesic* "if Viasat were to take full responsibility for avoiding" causing significant interference impacts. *Id.* at 10. Viasat has, of course, done just that, expressing that it is "commit[ted] to ensuring that the actual operation of its modified system maintains the same expected operating environment with respect to other systems authorized in the 2016 Round that are implemented." *Viasat Modification Application*, Exhibit A, at 4.

[46] Contrary to SpaceX's assertions, *see SpaceX Petition* at 6-8, Viasat's positions are consistent on this issue. Viasat's amendment to its initial NGSO application highlighted, among other things, a small reduction in the number of satellites as a result of the amendment, and did so in the absence of other changes that would maintain the same operating environment. *See* Viasat, Inc., Application, IBFS File No. SAT-APL-20180927-00076, Exhibit A, at 15-16 (filed Sep. 27, 2018). Viasat has never claimed that an *increase* in the number of satellites *necessarily* results in significant additional interference, and in this case it has employed an approach that employs operational techniques to avoid that very result.

[47] *Teledesic Order* at ¶ 13.

[48] As detailed above, the *Teledesic* case involved indisputably "major" changes to a licensed NGSO FSS system, including changes in orbital configuration (*i.e.*, number of satellites, number of orbital planes, orbital altitude, and inclination), additional carriers on the downlink, and changes in the uplink and downlink power budgets. *Id.* at ¶ 3.

[49] *See id.* at ¶ 13.

Indeed, if changes in orbital configuration—particularly number of orbital planes, orbit altitude, and inclination—alone were a defining factor, then SpaceX's pending third modification application[50] necessarily must be considered as part of the March 2020 processing round. As shown by comparing the green values in Table 2 below with the corresponding values in Table 1,[51] the orbital configuration of SpaceX's proposed modification does not even remotely resemble that of its authorized system.

SpaceX Current Authorization					
Orbital Planes	72	32	8	5	6
Satellites per plane	22	50	50	75	75
Altitude	550 km	1,110 km	1,130 km	1,275 km	1,325 km
Inclination	53°	53.8°	74°	81°	70°

Table 1: Summary of *Currently-Authorized* SpaceX Orbital Configuration

SpaceX Proposed Modification					
Orbital Planes	72	72	36	6	4
Satellites per plane	22	22	20	58	43
Altitude	550 km	540 km	570 km	560 km	560 km
Inclination	53°	53.2°	70°	97.6°	97.6°

Table 2: Summary of *Proposed* SpaceX Orbital Configuration

Nor does SpaceX or any other party explain why the Commission should focus on just one orbital configuration factor (number of satellites), and not the myriad other factors that can

[50] Space Exploration Holdings, LLC, IBFS File No. SAT-MOD-20200417-00037 (filed Apr. 17, 2020) ("*SpaceX Third Modification Application*").

[51] These tables are copied directly from SpaceX's pending modification application. *See id.*, Attachment A, at 3.

significantly affect the interference environment. Take, for example, changes in the minimum elevation angles utilized in an NGSO constellation. As Figure 1 below depicts, lowering the elevation angles employed in an NGSO system has the potential to create more band-splitting events with other NGSO systems, because a given earth station can "see" more satellites (that, of course, is the whole point of lowering elevation angles).

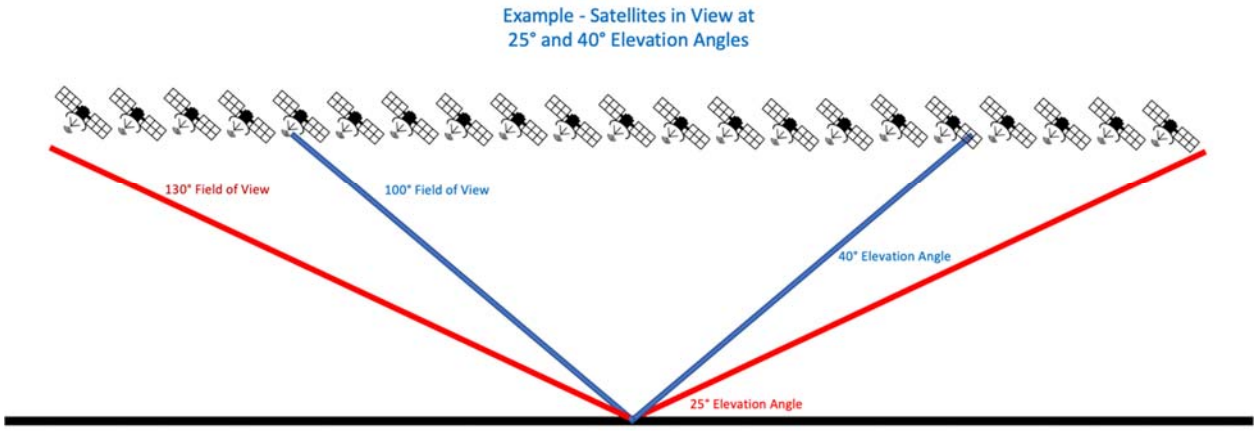

Figure 1: Lower Elevation Angles Bring More Satellites Into View

Yet, SpaceX apparently does not believe that the Commission should require any modification application that would decrease the minimum elevation angle to be deferred to a later processing round. And it should be apparent why. As shown in Table 3 below, doing so would result in SpaceX's pending modification application being considered as part of the March 2020 processing round.

Filing	Elevation Angles	Altitudes
Original License	Minimum of 40 degrees[52]	1,110 km 1,130 km 1,150 km 1,275 km 1,325 km[53]
First and Second Modification	Minimum of 40 degrees, nominally[54]	550 km 1,110 km 1,130 km 1,275 km 1,325 km[55]
Third Modification	User beams: minimum of 25 degrees[56] Gateway beams: general minimum of 25 degrees; minimum of 5 degrees for 560 km and 570 km shells for gateways above 62 degrees latitude[57]	540 km 550 km 560 km 570 km[58]

Table 3: Certain Changes in Critical SpaceX Parameters

As another example, consider changes in power flux density ("PFD") emitted by an NGSO constellation, which can affect the interference situation with respect to other NGSO systems, terrestrial services, and GSO networks alike. Increasing emitted PFD can significantly increase ΔT/T for another NGSO system, and thus create more band-splitting events.

Yet, SpaceX apparently does not believe that the Commission should require deferral to a later processing round of any modification application that would increase PFD levels. And it also should be apparent why this is the case. As shown in Table 4 below, doing so would result

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52 Space Exploration Holdings, LLC, IBFS File No. SAT-LOA-20161115-00118 (filed Nov. 15, 2016), Attachment A, at 5.

53 *Id.* at 1.

54 *SpaceX First Modification Application*, Attachment A, at 5 ("To maintain suitable coverage during the very early stages of initial deployment, SpaceX may periodically use a minimum elevation angle as low as 25 degrees for this initial shell. Then, as further satellites are deployed to populate the remainder of the constellation, SpaceX will revert to a 40 degree minimum elevation angle for all user and gateway beams.").

55 *Id.* at 2, 5.

56 *See SpaceX Third Modification Application*, Attachment A, at 4.

57 *Id.* at 7.

58 *Id.* at 4.

in SpaceX's pending modification application being considered as part of the March 2020 processing round. The specified maximum PFD values for certain beams significantly exceed previously-specified levels—*in one case by more than 20 dB (over a factor of 100 times higher).*[59]

	MOD3 Schedule S	MOD1 Schedule S[60]	Increase
0° - 5°	-170.4 dBW/m^2/4-kHz	-174.7 dBW/m^2/4-kHz	4.3 dB
5° - 10°	-167.0 dBW/m^2/4-kHz	-173.0 dBW/m^2/4-kHz	6.0 dB
10° - 15°	-162.1 dBW/m^2/4-kHz	-171.4 dBW/m^2/4-kHz	9.3 dB
15° - 20°	-154.1 dBW/m^2/4-kHz	-170.0 dBW/m^2/4-kHz	15.9 dB
20° - 25°	-147.5 dBW/m^2/4-kHz	-169.0 dBW/m^2/4-kHz	21.5 dB
25° - 90°	-146.0 dBW/m^2/4-kHz	-146.0 dBW/m^2/4-kHz	0.0 dB

Table 4: Comparison of Proposed Versus Authorized SpaceX Maximum PFD Levels

Notably, when doing so suits its interests at the moment, SpaceX eschews focusing on individual factors that can affect the interference environment, in favor of a holistic approach that balances all of the various considerations. Specifically, in arguing that its two prior modification applications[61] did not create significant additional interference, even though they would result in some increased interference, SpaceX relied on a "dynamic, time-varying radio-frequency interference" I/N analysis for "varying percentages of time"[62] that takes a multitude of factors into account. SpaceX further emphasized the need to balance the probability of increases in *individual I/N values* against probable decreases, in order to assess whether the *overall*

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59 Reply of Viasat, Inc. to Opposition of Space Exploration Holdings, LLC, IBFS File No. SAT-MOD-20200417-00037, at 33 (filed Aug. 7, 2020) ("*Viasat Reply re SpaceX Third Modification*").

60 *See SpaceX First Modification Application,* Schedule S.

61 *See id.*, Attachment A, Technical Information to Supplement Schedule S, at 25; *SpaceX Second Modification Application,* Attachment A, Technical Information to Supplement Schedule S, Annex 1, at A1-1.

62 *See, e.g.*, Consolidated Opposition of Space Exploration Holdings, LLC to Petitions, IBFS File No. SAT-MOD-20190830-00087, at 7 (filed Oct. 30, 2019) ("*SpaceX Second Modification Opposition*").

interference environment would be significantly worse.[63] SpaceX thus lacks any credibility in its effort now to single out the number of satellites as the dispositive factor under the *Teledesic* standard.

Moreover, contrary to O3b's claim, a footnote in the *2017 NGSO Order* did not overturn the Commission's longstanding, holistic approach to modification applications under *Teledesic*.[64] As an initial matter, the Commission does not make major policy decisions in footnotes. As courts have recognized, "administrative agencies . . . , no less than Congress, do not 'hide elephants in mouseholes.'"[65]

Furthermore, read in context, that footnote addressed the fundamentally different situation in which a party seeks a modification to "add back" satellites eliminated from its authorization because it failed after six (or nine) years to fully deploy on time, in accordance with its milestones.[66] The discussion in that order does not speak to a modification request made before the deployment of the system, and well before any milestones are missed. This distinction is critical—and indeed informed the Commission's *Teledesic* decision. There, the Commission emphasized the need for flexibility because of "the several years required to construct a satellite, or constellation of satellites," the importance of incorporating "rapidly changing technology" into system design, and the "goal of encouraging more efficient use of the

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63 *See id.* at 7-8.

64 *See O3b Petition* at 4-5 (citing *Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters*, Report and Order and Further Notice of Proposed Rulemaking, 32 FCC Rcd 7809 (2017) ("*2017 NGSO Order*"), at ¶ 67 n.150).

65 *Ryder v. Union Pac. R.R.*, 945 F.3d 194, 203 (5th Cir. 2019) (quoting *Whitman v. Am. Trucking Ass'ns, Inc.*, 531 U.S. 457, 468 (2001)).

66 *See Viasat Modification Application*, Exhibit A, at 4 n.19; *see also 2017 NGSO Order* ¶ 67 & n.150 (discussing scenario in which the operator of an NGSO system fails to timely deploy all of its authorized satellites, has its authorized constellation reduced to reflect its "diminished operations," and then seeks to increase its authorized constellation size).

radio spectrum."[67] Modifications like Viasat's, made before a system even has been deployed, to incorporate new technology and to facilitate greater spectrum sharing with other NGSO systems in the prior processing round without causing significant additional interference to those systems, are fully consistent with the policies underlying the *Teledesic* decision. In contrast, once an operator fails to implement its system in accordance with its milestones after having six (or nine) years to do so, and its authorized constellation size automatically is reduced to conform to its "diminished operations," compelling reasons exist for a different procedural treatment for a request to modify an authorization to add back the satellites not originally deployed on a timely basis.

In fact, the Commission *has* allowed applicants to increase the number of satellites in a constellation not yet deployed without affecting processing-round status.[68] In one example, the Commission granted an amendment to Orbcomm's then-pending "Little LEO" first round application to significantly increase the number of satellites in its constellation, lower its satellite orbits, and increase satellite transmit power levels.[69] Applying the more stringent standard for amendments, which considers whether they would "increase the *potential* for harmful interference to existing or planned systems,"[70] the Commission found these changes would not increase the potential for intersystem interference *in the aggregate* because other changes would offset the potential effect of the proposed modification.[71] Based on these mitigating measures,

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67 *Teledesic Order* at ¶ 5.

68 *Cf. O3b Petition* at 2.

69 *See Orbital Communications Corporation*, Order and Authorization, 9 FCC Rcd 6476 (1994), at ¶¶ 18-19, *recon. denied*, 10 FCC Rcd 7801 (1995).

70 *See id.* at ¶ 26 (emphasis supplied) (citing 47 C.F.R. § 25.116).

71 *See id.* at ¶ 19. Notably, in the first-round Little LEO context, the Commission considered whether Orbcomm's amendments would "increase the potential for harmful interference to existing or planned systems," *id.* at ¶ 26,

the Commission determined that the system changes in the aggregate, including an increase in the number of satellites, would not worsen the interference environment.[72] This decision is entirely consistent with the *Teledesic* line of cases discussed above—and belies the fixation of certain commenters and petitioners on satellite counts to the exclusion of all relevant factors.

4. An I/N compatibility analysis satisfies the *Teledesic* standard

As noted, the *Teledesic* standard looks to whether a modification would "create any significant interference problems to other systems or make sharing [with] other NGSO FSS systems significantly more difficult,"[73] by considering the *aggregate* change in predicted interference over the baseline environment established by the initial grant.[74] The Commission has granted modifications under the *Teledesic* standard where the applicant relied on dynamic analysis expressed as a cumulative distribution function ("CDF") of the I/N ratio in assessing whether the proposed modification, *in toto,* would result in a significant increase in interference (*i.e.*, more band-splitting events).[75] In the *SpaceX Recon Order*, the Commission confirmed that "I/N . . . is the trigger for a potential need to split bandwidth for NGSO networks."[76] Such an assessment considers *aggregate* changes in potential interference above the Commission's

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and whether deviations from a negotiated sharing agreement among first-round Little LEO systems would adversely affect other first-round applicants, *see id.* at ¶ 17 n.27.

72 *See id*. at ¶ 19.

73 *Teledesic Order* at ¶ 7.

74 *See supra* at 4-8.

75 *See, e.g.*, *SpaceX First Modification Application*, Attachment A, Technical Information to Supplement Schedule S, at 25; *SpaceX Second Modification Application*, Attachment A, Technical Information to Supplement Schedule S, Annex 1, at A1-1.

76 *SpaceX Recon Order* at ¶ 11.

interference threshold for "band-splitting" events: a ΔT/T in excess of 6%, which corresponds to an I/N of -12.2 dB.[77]

Most parties in this proceeding agree that an I/N CDF assessment provides the relevant analysis.[78] SpaceX, on the other hand, questions whether an I/N CDF analysis is relevant in Viasat's case.[79] This is absurd.

As noted above, SpaceX itself has repeatedly relied on an I/N CDF analysis in claiming that its own modification requests satisfy the *Teledesic* standard. Moreover, there is no support for SpaceX's vague assertion that the "assumptions" of the I/N CDF analysis somehow "are no longer valid" when a modification would increase the number of satellites.[80] SpaceX never identifies which assumptions supposedly are affected in that scenario. Nor does SpaceX explain why increasing the number of satellites purportedly alters these assumptions, but other changes to a system's orbital configuration and operations do not. And it is not surprising why: as noted above, SpaceX's repeated modifications to Starlink have made numerous changes to the system's orbital configuration, including lowering altitudes, adding orbital planes, and changing the number of satellites within those orbital planes,[81] and SpaceX has relied on the same I/N CDF analysis in prosecuting its proposed modifications. There is no basis for departing from that approach in this proceeding.

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77 *See* 47 C.F.R. § 25.261(c).

78 *See, e.g.*, *Telesat Petition* at 3 ("Telesat agrees that any impact on the interference environment of another first-round NGSO system should be evaluated based on an analysis of I/N CDF curves."); *O3b Petition* at 6-7, 9-10; *Kuiper Comments* at 8.

79 *See SpaceX Petition* at 4.

80 *Id*.

81 *See supra* at 9.

5. An NGSO FSS applicant approved in the 2016/17 processing rounds is not required to protect later-round applicants

Finally, contrary to Kuiper's claims,[82] the *Teledesic* standard does not require Viasat to show that its modified system will protect Kuiper's newly-authorized system, which the Commission considered as part of a subsequent processing round. Kuiper has it backward: because Kuiper's system was granted as part of a later processing round, Kuiper must protect Viasat's system from interference, not vice versa.

As the Commission has explained, in the NGSO FSS context, the *Teledesic* standard considers whether the modification would cause a significant increase in interference to "other NGSO FSS system[s] in the *same* processing round," not systems in subsequent rounds.[83] And the recent *Kuiper Authorization Order* makes clear that the Commission considered and granted Kuiper's system "in the March 2020 Processing Round,"[84] and specifically rejected Kuiper's request to be treated on par with earlier processing round applicants.[85] The Commission found "an insufficient basis to treat Kuiper on an equal basis with earlier authorized systems under section 25.261 of the Commission rules," and determined that "Kuiper must coordinate to prevent harmful interference to operational systems licensed or granted U.S. market access in the previous NGSO FSS processing rounds."[86]

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82 *See, e.g.*, *Kuiper Petition* at 7 (claiming that the modification "increases the interference between the Viasat system and the Kuiper System, which significantly impacts the operation of the Kuiper System," and arguing that the modification should be considered as part of the March 2020 processing round); *see also id.* at 9 (asserting that "Viasat does not accept the burden of resolving the additional in-line interference" with Kuiper's system).

83 *First SpaceX Modification Order* at ¶ 11 (emphasis supplied).

84 *Kuiper Systems, LLC Application for Authority to Deploy and Operate a Ka-band Non-Geostationary Satellite Orbit System*, IBFS File No. SAT-LOA-20190704-00057, Order and Authorization, FCC 20-102 (rel. July 30, 2020), at ¶ 2 ("*Kuiper Authorization Order*").

85 *Id.* at ¶ 34.

86 *Id.*

The Commission also emphasized that, in establishing processing rounds for considering NGSO applications, it had *not* "adopt[ed] an open-ended requirement to accommodate all future applicants."[87] Such a requirement, the Commission explained, would "create an open-ended processing round in which new entrants would be placed on par with previously authorized systems and therefore fail to provide certainty to these systems as intended when establishing a processing round."[88] That result would be "contrary to the public interest goals of [the Commission's] processing round rules."[89]

The Commission thus specifically determined that, absent "a coordination agreement with operators authorized in previous processing rounds, . . . Kuiper must demonstrate that its operations will not cause harmful interference to any operational system licensed or granted U.S. market access in the July 2016 Processing Round and the May 2017 Processing Round."[90] Moreover, "[t]o commence operations in these bands, the Commission must approve Kuiper's demonstration as sufficient to show that Kuiper's NGSO system can operate without causing harmful interference to any operational systems in these processing rounds."[91] As Viasat's NGSO authorization was granted as part of the 2016 and 2017 processing rounds,[92] it is Kuiper's obligation to protect Viasat's NGSO system from interference, not the other way around. Moreover, based on the results of Viasat's analysis of the I/N impact of its proposed

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87 *Id.* at ¶ 36 (quoting *2017 NGSO Order* at ¶ 61).

88 *Id.* at ¶ 42.

89 *Id.*

90 *Id.* at ¶ 50.

91 *Id.*

92 *See Viasat NGSO Authorization Order* at ¶¶ 2 & n.7 (noting that Viasat's application was filed as part of the 2016 and 2017 processing rounds); *id.* ¶ 12 (rejecting a party's "request to remove the ViaSat Petition from the existing Ku-/Ka-band and V-band processing rounds").

modification, Viasat is skeptical as to the validity of Kuiper's analysis claiming a significant impact on Kuiper's system.

Boeing separately claims that Viasat's interference analysis should account for the V-band system Boeing proposed in an application filed as part of the 2017 V-band processing round.[93] As an initial matter, Boeing remains merely an *applicant* for a Commission authorization. And because the Commission has not acted on Boeing's application, the Commission has not defined the parameters of any system that Boeing someday may be authorized to operate, and thus has not established a clear baseline for evaluating any predicted interference impact. Nevertheless, for illustrative purposes, Viasat is providing a supplemental I/N CDF analysis with respect to Boeing's *proposed* system in connection with this consolidated response.[94]

The corresponding table and figures for Boeing's V-band system follow. As with the results included in Viasat's modification application, the modification reduces the probability of exceeding the -12.2 dB I/N trigger, significantly for the uplinks and slightly for the downlinks.

	Uplink		Downlink	
	Current	Modified	Current	Modified
Boeing V	0.486971	0.026995	0.030620	0.025887

Table 5: Probability of Exceeding 6% ΔT/T Threshold

[93] *See Boeing Comments* at 6-7.

[94] As discussed further below, *see infra* at 42-43, the Commission should reject calls by Boeing and others to initiate a new V-band processing round as part of its consideration of the instant modification application.

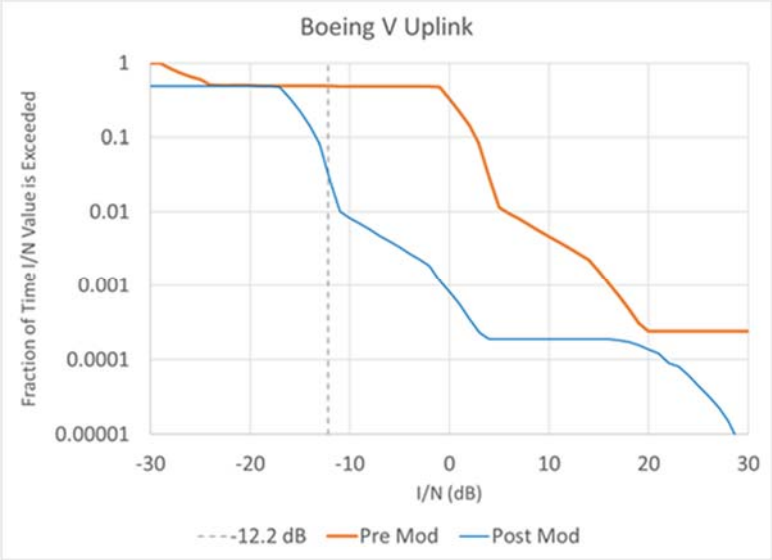

Figure 2: Boeing V-Band Uplink Comparison for Typical Earth Station Antennas

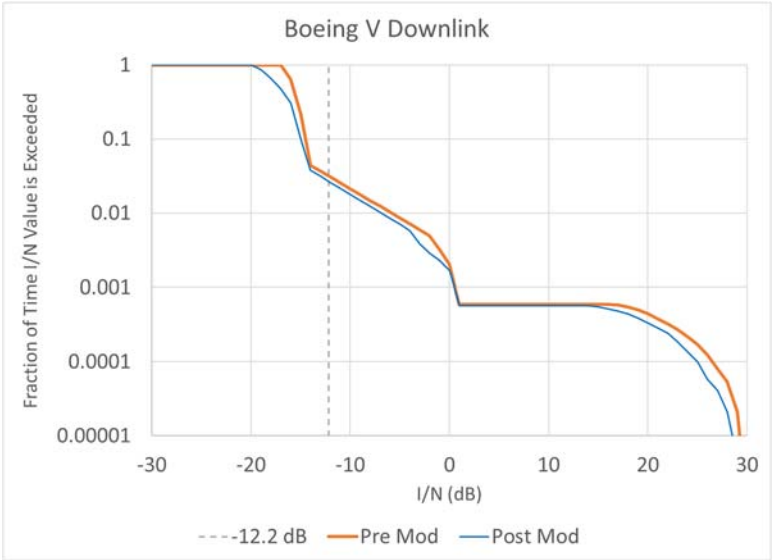

Figure 3: Boeing V-Band Downlink Comparison for Typical Earth Station Antennas

Boeing also claims that "Viasat's analysis involving other NGSO systems inappropriately treats all inline events as fungible regardless of their location over the Earth."[95] That is incorrect. Viasat's analysis does not treat inline events as fungible regardless of location over

[95] *Boeing Comments* at 7.

the Earth. In fact, as described in the modification application, while Viasat has analyzed various locations, the results presented are for a representative earth station located at N39°50' latitude, W98°35' longitude.[96] This location is approximately the center of the CONUS and the latitude at which the number of visible satellites in the modified constellation peaks. In other words, while this latitude is slightly outside of Boeing's 22° to 37° latitude range, these are actually worst case results.

B. Applying the *Teledesic* Standard Shows That the Modification Will Not Significantly Increase Interference

A faithful application of the *Teledesic* standard to this modification application demonstrates that it will not "create any significant interference problems" with respect to other same-round systems or make sharing with such systems "significantly more difficult."[97] Viasat's application demonstrated that the modified system has been designed and will be operated such that the probability of exceeding the 6% ΔT/T threshold, above which parties are required to either coordinate or split the spectrum (*i.e.*, engage in band-splitting), is not increased.[98] To demonstrate this compatibility, Viasat performed an analysis of the effect of the proposed modification on uplink and downlink interference using the characteristics of four NGSO systems authorized through the Commission's most recent Ka-band processing round (SpaceX, OneWeb, Telesat, and O3b) and one NGSO system authorized through the Commission's most recent V-band processing round (SpaceX).[99]

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[96] *Viasat Modification Application*, Exhibit B, at 13 & n.12 ("Viasat has run the simulation with multiple locations in the CONUS and achieved similar results for both the uplink and downlink analyses and chose 39°50' North and 98°35' West as a representative location.").

[97] *Teledesic Order* at ¶ 7.

[98] *See Viasat Modification Application*, Exhibit B, at 12-18.

[99] *See id.*

Consistent with the precedent and practice discussed above, Viasat provided I/N CDF analyses of uplink and downlink interference for each of these systems, and in all cases, the post-modification curve is below the pre-modification curve on the I/N = -12.2 dB line.[100] With respect to Telesat's comments,[101] the post-modification curve is in fact below the pre-modification curve for all I/N values, as shown in Viasat's modification application.[102] Notably, Viasat's simulation was conservative, as it did not consider the effects of atmospheric attenuation and thus, if anything, overestimates I/N.[103] This analysis demonstrates that the modification "reduces the probability of exceeding" the -12.2 dB I/N trigger, "significantly for the uplinks and slightly for the downlinks."[104]

The alternative analyses submitted by the parties challenging Viasat's application are fundamentally flawed in various respects. As discussed below, these analyses dramatically overstate the interference impact on downlinks and uplinks of other NGSO systems authorized in the 2016 and 2017 processing rounds. Moreover, Viasat demonstrates below that the modification will not result in significant additional interference for downlinks and uplinks into Viasat's own system.

As Viasat previously explained: "The modified VIASAT-NGSO system has been designed and *will be operated* such that the probability of exceeding the 6% ΔT/T threshold,

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100 *See id.*

101 *See Telesat Petition* at 3-4, 11-13.

102 *See Viasat Modification Application*, Exhibit B, at 17 (Figures E1-7 and E1-8). Thus, Viasat already has included in its application the information that Telesat suggests is relevant. *See Telesat Petition* at 3-4, 11-13.

103 *Viasat Modification Application*, Exhibit B, at 13. Moreover, consistent with SpaceX's approach in its pending modification application, "[t]o present a worst-case assessment of the interference environment, the analysis also assumes that the two systems do not implement any interference mitigation strategies" through cooperative efforts. *Id.* at 12; *see also SpaceX Third Modification Application*, Attachment A, Annex 1, at A1-1.

104 *Viasat Modification Application*, Exhibit B, at 13.

above which parties are required to either coordinate or split the spectrum ('band splitting'), is not increased."[105] More specifically, Viasat will operate its modified system such that it does not exceed PFD limits, does not exceed EPFD limits, and does not exceed the interference profile of its pre-modified system with respect to other same-round NGSO FSS systems. The tools available to Viasat in operating its modified system include dynamic power limits, avoidance angles, and the number of co-frequency satellites serving a given location on the Earth at a given time.

Viasat also explained: "[T]he modification provides Viasat with the flexibility needed to more efficiently share spectrum with other NGSO satellite systems. It better enables Viasat to mitigate the disproportionate impact of the default band-splitting rules on certain NGSO constellation designs, by providing Viasat with increased flexibility to employ satellite diversity as a mitigation technique more often than otherwise would have been possible with its previous design. Figure 1 shows the average number of VIASAT-NGSO satellites visible as a function of latitude for the authorized (pre-mod) and proposed (post-mod) designs. It can be seen that the modification significantly increases the number of diversity options over the CONUS."[106]

[105] *Id.* at 12 (emphasis supplied).

[106] *Id.*, Exhibit A, at 4-5.

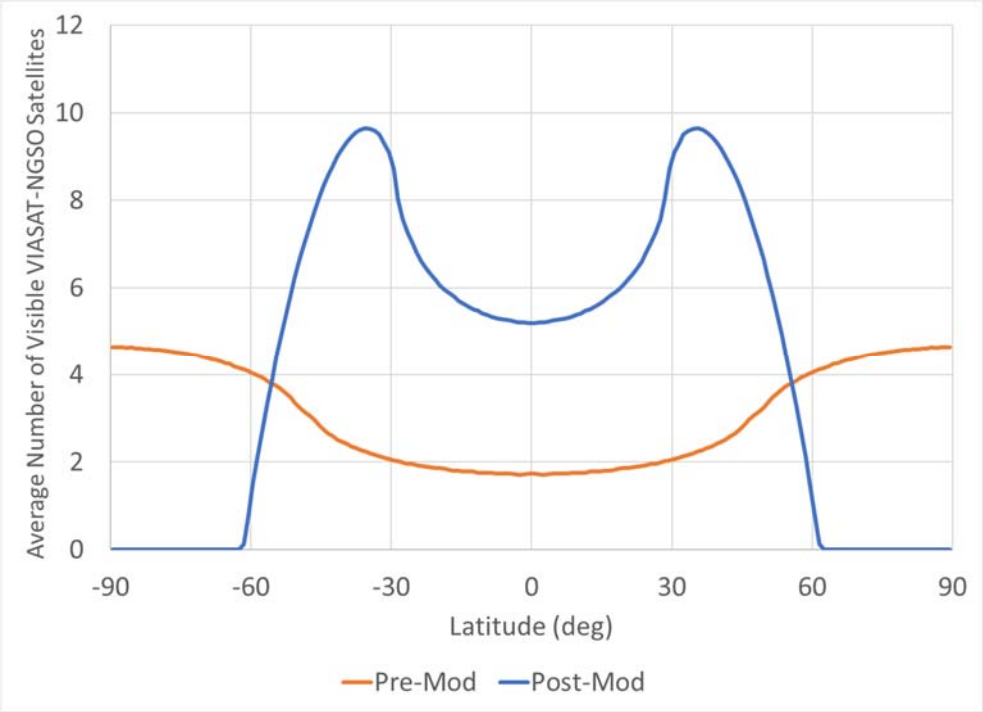

Figure 1, *Viasat Modification Application*, Exhibit B

O3b presents a very simplistic assessment of the total duration of projected "in line" events with the O3b system before and after the proposed modification, "defined for this purpose as a separation angle between an O3b satellite and a Viasat satellite of less than 5 degrees."[107] O3b does not even differentiate between (i) a mere geometric alignment and (ii) a circumstance that potentially could cause Viasat to exceed the -12.2 dB I/N trigger for band splitting.[108] As O3b should know well, the Commission has abandoned its prior rules that were based on mere geometric alignments between NGSO FSS systems in favor of a metric that

[107] *O3b Petition* at 7.

[108] *See id.* at 7-8 & Fig. 2.

focuses on changes in system noise temperature, and that is expressed as a ΔT/T equal to 6 percent, or an I/N of -12.2 dB.[109]

SpaceX, for its part, makes a similar error in simplistically asserting with no analysis that the "addition of eligible satellites by Viasat would pose a significant increase in the number and duration of geometric in-line events with other NGSO systems."[110] Again, mere potential geometric alignments are not relevant.

In sum, Viasat has provided detailed analyses of the potential effect of its proposed modification on other NGSO FSS systems authorized in the 2016/2017 processing rounds, using dynamic, time-varying radio-frequency interference expressed as a cumulative distribution function of the I/N ratio, for varying percentages of time. This was derived from a time-domain simulation of the relevant NGSO FSS systems over a long enough time to produce meaningful statistics. And this analysis considers band-splitting events that are manifested by exceeding the -12.2 dB I/N trigger, but not mere geometric alignments that do not trigger "band splitting."

As explained above, Viasat has a number of tools available to *manage the operation* of its modified NGSO FSS system *and ensure* that it does not exceed the interference profile of its pre-modified system with respect to other same-round NGSO FSS systems. Moreover, Viasat expressly has committed to do so. Furthermore, with this modification, Viasat is able to employ satellite diversity as a mitigation technique more often than otherwise would have been possible to avoid actual band-splitting events, meaning that having more satellites available is another useful tool (as SpaceX itself recognizes when it wants to deploy more satellites).[111]

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[109] *See 2017 NGSO Order* at ¶¶ 45-49.

[110] *SpaceX Petition* at 11; *see also id.* at 4.

[111] *See supra* at 11-12.

1. Uplink interference into other NGSO systems

The modification will not significantly increase uplink interference into other NGSO systems authorized in the 2016/2017 processing rounds. Indeed, Viasat's modification application demonstrates that the modification significantly *reduces* the probability of exceeding the -12.2 dB I/N band-splitting trigger beyond the baseline established in its current authorization.[112] SpaceX thus is compelled to concede in its petition that, based on Viasat's filings with the International Telecommunication Union ("ITU"), "the uplink transmissions to its modified NGSO system should not impose significant additional interference onto SpaceX's NGSO system."[113] As Viasat has shown, the same is true for other NGSO systems authorized in the 2016/2017 processing rounds.[114]

In any event, Telesat's claims about increased uplink interference into other NGSO FSS systems[115] rest on flawed attempts to show that Viasat's modified system would exceed the limits reflected in the I/N curves that define the NGSO FSS operating environment established in the 2016/2017 processing rounds.[116] There are two fundamental problems with this showing.

First, the showing fails to account for Viasat's ability to ensure that its operations will stay within those I/N limits by using operational tools such as dynamic power limits, avoidance

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112 *See id.* at 12-18.

113 *SpaceX Petition* at 14.

114 *See Viasat Modification Application*, Exhibit B, at 12-18.

115 *See Telesat Petition* at 13-15, 19-20. Kuiper's claims on this issue incorrectly assume that Viasat's modification must account for Kuiper's system authorized as part of the March 2020 processing round. *See supra* at 21-23.

116 Telesat asserts that, "with respect to the victim system, all possible valid cases should be considered in evaluating the I/N CDF, so that a full assessment can be carried out on the impact of the interference on all possible links of the victim system." *Telesat Petition* at 9. That is exactly what Viasat did. *See Viasat Modification Application*, Exhibit B, at 13 & n.12. Moreover, Telesat is correct that a reference to "operational EPFD spectral densities" in the application instead should read "operational EIRP spectral densities." *See Telesat Petition* at 9-10; *Viasat Modification Application*, Exhibit B, at 13.

angles, and the number of co-frequency satellites serving a given location on the Earth at a given time. Instead, those analyses wrongly assume that eight, or more, Viasat satellites[117] would be active at a given frequency, at any given moment, and at any given location, and that the Viasat LEO network always would use the maximum power authorized.

Second, the showing ignores Viasat's commitment to ensure that its operations will stay within the NGSO FSS operating environment established in the 2016/2017 processing rounds. As noted above: "The modified VIASAT-NGSO system has been designed and will be operated such that the probability of exceeding the 6% ΔT/T threshold, above which parties are required to either coordinate or split the spectrum ('band splitting'), is not increased."[118] As also stated above, (i) Viasat will operate its modified system such that it does not exceed PFD limits, does not exceed EPFD limits, and does not exceed the I/N interference profile of its pre-modified system with respect to other same-round NGSO FSS systems, and (ii) Viasat has a variety of tools available to enable it to do so in operating its modified system.[119] Again, to this end, Viasat will use appropriate combinations of these types of operational tools to ensure that the I/N of the modified system does not exceed the interference profile of its pre-modified system with respect to other same-round NGSO FSS systems.

Finally, Telesat fails to identify "discrepancies" between Viasat's "PFD and EIRP masks data" and its "I/N CDF plots."[120] Viasat agrees with Telesat that "a static analysis modeling the

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[117] The "N_co parameter" value of "eight" referred to by some commenters is the maximum number, for all times and locations, of possible co-frequency satellites serving a given location on the Earth, as specified in Viasat's ITU filing for its LEO system.

[118] *Viasat Modification Application*, Exhibit B, at 12.

[119] *See supra* at 26-27.

[120] *Telesat Petition* at 10; *see also id.*, Annex 2.

worst case scenario" is a reasonable approach for *bounding* a dynamic interference analysis.[121] However, the static analysis Telesat provides is flawed. In fact, Telesat is not even modeling Viasat's NGSO system. For example, in Tables A2-1a and A2-1b, Telesat assumes a "min slant range" of 1,000 km.[122] But Viasat's currently licensed system, which Telesat says it is modeling, has an altitude of 8,200 km; hence the minimum slant range is 8,200 km, not 1,000 km (and, for that matter, the altitude and minimum slant range for Viasat's modified system is 1,300 km). Clearly the 1,000 km value used by Telesat has no bearing on Viasat's currently authorized system or proposed modification.

2. Downlink interference into other NGSO systems

The modification also will not significantly increase downlink interference into other NGSO systems authorized in the 2016 and 2017 processing rounds. In fact, as Viasat demonstrated in its application, the modification will slightly reduce the probability of exceeding the -12.2 dB I/N trigger beyond the baseline established in its current authorization.[123] Moreover, in making this showing, Viasat generally provided the same level of information as SpaceX provided in connection with its own first, second, and third modification requests. Thus, SpaceX's claim that "Viasat did not provide complete information on the assumptions that went into its analysis"[124] is undermined by SpaceX's approach when it comes to its own applications.

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121 *Id.* at 25.

122 *See id.* at 27.

123 *See Viasat Modification Application*, Exhibit B, at 12-18.

124 *SpaceX Petition* at 11.

In any event, claims by SpaceX, O3b, and Telesat[125] about increased downlink interference into other NGSO FSS systems rest on flawed attempts to show that Viasat's modified system would exceed the limits reflected in the I/N curves that define the NGSO FSS operating environment established in the 2016/2017 processing rounds.[126] As with similar claims in the uplink direction discussed above,[127] there are two fundamental problems with these showings.

First, the showings fail to account for Viasat's ability to ensure that its operations will stay within those I/N limits by using available operational tools such as dynamic power limits, avoidance angles, and the number of co-frequency satellites serving a given location on the Earth at a given time. Instead, those analyses wrongly assume that eight, or more, Viasat satellites would be active in a given frequency band segment, at any given moment, and at any given location, and that the Viasat LEO network always would use the maximum power authorized.

Second, the showings ignore Viasat's commitment to ensure that its operations will stay within the NGSO FSS operating environment established in the 2016/2017 processing rounds. Again, to this end, Viasat will use appropriate combinations of these types of operational tools to ensure that the I/N of the modified system does not exceed the interference profile of its pre-modified system with respect to other same-round NGSO FSS systems.

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[125] *See id.* at 15-16; *O3b Petition* at 2-3, 6-8; *Telesat Petition* at 15-17, 20-22. Again, Kuiper's claims on this issue incorrectly assume that Viasat's modification must account for Kuiper's system authorized as part of the March 2020 processing round. *See supra* at 21-23.

[126] Viasat analyzed gateways for SpaceX and OneWeb, and inadvertently replaced the word "gateway" with "user" in the I/N charts appearing in Figures E1-1, E1-2, E1-5, and E1-6. *See Viasat Modification Application*, Exhibit B, at 14, 16.

[127] *See supra* at 30-32.

3. Downlink interference into Viasat's NGSO system

The modification also will not cause increased downlink interference into Viasat's system, for the same reasons the Commission recognized in the *First SpaceX Modification Order* and the *SpaceX Recon Order*. In the *First SpaceX Modification Order*, the Commission found that "[t]here should be no change to the interference environment for earth stations communicating with SpaceX satellites as a result of lowering the operational altitude."[128] The Commission explained that "[t]he level of the desired signal received by a user terminal will be the same, as the level of the signal transmitted from a SpaceX satellite at lower altitude will be reduced only to the amount that compensates for the shorter transmit path."[129] In the *SpaceX Recon Order*, the Commission noted SpaceX's acknowledgment that "the higher gain of its gateway antennas could result in additional interference as compared to its user terminals," but also found that "interference events will be shorter due to the narrower antenna beam" used for transmitting at lower altitudes.[130]

Viasat's modified system likewise will operate within the same PFD levels as the currently authorized NGSO system.[131] Viasat's modification application includes discussion and analysis of the authorized PFD limits within which its system will operate, as applied to the modified constellation.[132] SpaceX expressly recognizes this fact, noting that "Viasat states in its application that its proposed LEO system will operate with the same PFD levels as its currently authorized MEO system," and that in light of such operation, "there would be no reason to

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128 *First SpaceX Modification Order* at ¶ 14.

129 *Id.*

130 *SpaceX Recon Order* at ¶ 15.

131 *See Viasat Modification Application*, Exhibit A, at 1.

132 *See id.,* Exhibit B, at 3-4.

anticipate that its modified downlinks would be more susceptible to interference from other NGSO systems."[133] The record accordingly supports a finding that the modification will not cause increased downlink interference into Viasat's system.[134]

4. Uplink interference into Viasat's NGSO system

Finally, opponents fail to show that the modification would result in increased uplink interference into Viasat's NGSO system.[135] These claims are foreclosed by precedent and are unfounded in any event.

In the *First SpaceX Modification Order*, the Commission considered similar claims by parties that the modified system's lower altitude and different orbital configuration would make the system more susceptible to interference from other same-round systems in the uplink direction.[136] The Commission observed that, "[i]f SpaceX lowered the transmission power of its own earth stations to take advantage of the closer operational altitude of its modified satellites, then its satellites would be more susceptible to interference from the transmissions of earth stations communicating with other NGSO FSS systems in the same frequency band."[137] But the Commission went on to find that SpaceX could "offset this additional interference by keeping the transmit power of its own earth stations at the same level that they are currently authorized to

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133 *SpaceX Petition* at 14.

134 Indeed, the only party that raises any specific opposition on this issue is Kuiper, who, as noted above, incorrectly assumes that Viasat's modification must account for Kuiper's system authorized as part of the March 2020 processing round. *See supra* at 21-23.

135 *Cf. SpaceX Petition* at 12-13; *O3b Petition* at 8-11; *Telesat Petition* at 6-8. Again, Kuiper's claims on this issue incorrectly assume that Viasat's modification must account for Kuiper's system authorized as part of the March 2020 processing round. *See supra* at 21-23.

136 *See First SpaceX Modification Order* at ¶ 15.

137 *Id.*

transmit, which would allow the SpaceX transmissions to be received in the presence of stronger signals of other NGSO FSS systems."[138]

Here, too, Viasat's modified system will be able to offset any additional interference from the transmissions of earth stations communicating with other NGSO FSS systems. As noted in Viasat's modification application, "the modified system will operate within the power density levels already authorized"[139]—thus enabling Viasat to follow the same approach noted above in the *First SpaceX Modification Order* for mitigating uplink interference into its own system, while managing its system operations to stay within the NGSO FSS operating environment defined in the 2016/2017 processing rounds. Opponents fail to account for this ability to offset such interference in their analyses—in some cases quoting selectively from the *First SpaceX Modification Order* to avoid acknowledging the Commission's ruling on this issue.[140]

C. Other Interference-Related Issues Raised by Opponents Are Unavailing

1. Viasat has committed to using operational measures to preserve the existing NGSO FSS operating environment

As discussed in Section I.B, above, Viasat has affirmatively committed to undertake operational measures "ensuring that the actual operation of its modified system maintains the same expected operating environment" with respect to other NGSO FSS systems authorized in the 2016/2017 processing rounds that are implemented.[141] As a result of these operational

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[138] *Id.* The *SpaceX Recon Order* did not overturn the Commission's determination in the *First SpaceX Modification Order* on this issue. *See SpaceX Recon Order* at ¶ 11.

[139] *Viasat Modification Application*, Exhibit A, at 4.

[140] *See, e.g.*, *O3b Petition* at 10 n.20 (quoting a portion of paragraph 15 of the *First SpaceX Modification Order*, without acknowledging the Commission's ruling in that paragraph that the applicant could offset additional uplink interference as noted above).

[141] *Viasat Modification Application*, Exhibit A, at 4.

measures, "band-splitting events under the NGSO sharing framework in Section 25.261" for such systems will "not exceed the probabilities that would have been experienced with respect to Viasat's original system design."[142] This commitment ensures that Viasat's modified system will not "create any significant interference problems to other systems or make sharing [with] other NGSO FSS systems significantly more difficult" under *Teledesic*.[143]

SpaceX's efforts to discount Viasat's commitment fall flat. The plain text of Viasat's application belies SpaceX's groundless claim that Viasat has "made no commitment" to ensure that its operations stay within the I/N curves that define the existing environment established in the 2016/2017 processing rounds.[144] This is not a case where an applicant is relying exclusively on coordination and the operational techniques *of other o*perators. Rather, in making the commitment quoted above, Viasat accepts the burden of ensuring that its modified system does not significantly and adversely change the NGSO FSS operating environment established in the 2016/2017 processing rounds.

SpaceX and Kuiper also make irrelevant assertions about beam-pointing information.[145] Both discuss Viasat's prior-stated concerns with SpaceX and Kuiper proposals to initiate a rulemaking that would require NGSO FSS operators to provide detailed and proprietary real-time beam-pointing information. Viasat's concerns with new, impractical, and burdensome rules that would require sharing competitively-sensitive business information in no way calls into question Viasat's commitment to bear the burden of maintaining the same operating environment for other NGSO FSS systems in the 2016/2017 processing rounds with respect to Viasat's system.

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142 *Id.*

143 *Teledesic Order* at ¶ 7.

144 *SpaceX Petition* at 8.

145 *See id.* at 8-10; *Kuiper Comments* at 9-10.

Viasat's commitment does not depend on other operators taking any new steps with their systems to maintain the interference environment—and certainly does not require other providers to use Viasat's beam-pointing information to alter their own operations. Moreover, contrary to SpaceX's suggestion,[146] Viasat does not require access to SpaceX's beam-pointing information to ensure that Viasat's modified system remains within the operating envelope established by Viasat's existing authorization. Requiring the provision of such information is particularly unnecessary given that the Commission already provides that sharing ephemeris data, not beam-pointing information, is what is "essential for the compatible operation of NGSO FSS constellations."[147]

Viasat's provision of beam-pointing information to its competitors not only is unnecessary for the purposes of this modification application, but also would be counterproductive. Mandating the provision of real-time beam-pointing information would result in reduced spectral efficiency and unduly constrain the provision of service to customers. NGSO FSS systems providing broadband services operate in a dynamic environment—satellites move quickly across the sky, and traffic demand fluctuates with time, and often moment by moment. Maximizing spectrum efficiency requires an operator to very rapidly reassign beams and channels. Having to slow down this process to provide beam-pointing information to other systems would result in delays in the provisioning of service and wasted capacity and would impair service offerings to consumers. Such an approach would add significant round-trip latency to both systems because each operator would require real-time advance notification of the beam-pointing data from other operators *before* it could schedule to use a particular beam to

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146 *See SpaceX Petition* at 10.

147 *2017 NGSO Order* at ¶ 57; *see also* 47 C.F.R. § 25.146(e).

serve a particular location with a particular satellite. In fact, the time required to process the data and adjust network operations may be longer than the actual near in-line event itself.[148] For these reasons, and in light of other real-world considerations such as latency in the communications link between the operators, rain fade, or other atmospheric conditions occurring for some users while the system updates are being sent out, it is highly unlikely that such an approach could be accomplished in a sufficiently timely fashion to avoid significantly impairing service.

There currently is no requirement to provide such information to either same-round or subsequent-round systems, and none should be adopted. Indeed, in response to a prior SpaceX proposal to mandate that NGSO systems provide beam-pointing information to facilitate interference avoidance, other operators expressed strong opposition,[149] explaining that doing so is "infeasible" and "unnecessary" and "would constrain service to customers and reduce spectral efficiency,[150] and that "state-of-the-art NGSO systems assign beams and channels rapidly in real

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[148] Sharing of beam-pointing and channel assignment information between operators would require that operators first process and format the real-time beam-pointing and channel frequency assignment information into an agreed format for transmission, which would take some time. It also requires that some form of communications link be established between the operators involved, with the associated delays. Once received, the beam-pointing and channel frequency assignment information for each satellite from operator A would need to be *unpacked and processed against the current operational state* of the beam-pointing and channel frequency assignments of each of operator B's satellites *in order to calculate and transmit a new set* of beam-pointing and channel frequency assignments with respect to each of operator B's satellites and all if its associated user terminals.

[149] *See* Comments of O3b Limited, RM-11855, at 17-18 (filed June 15, 2020) ("*O3b June 15 Comments*"); Reply Comments of O3b Limited, RM-11855, at 11-13 (filed June 30, 2020) ("*O3b June 30 Reply Comments*"); Reply Comments of Telesat Canada, RM-11855, at 7 (filed June 30, 2020) ("*Telesat June 30 Reply Comments*"). SES and O3b have expressed this same view in the context of Kuiper's NGSO application, challenging Kuiper's statements regarding the ability to eliminate in-line events based on real-time sharing of active link information from other operators, because in general "operational details on matters such as moment-by-moment beam positioning, channel usage, and transmit earth station usage are commercially sensitive and will not be shared." *See* SES Americom, Inc. and O3b Limited, Notice of Ex Parte Presentation, IBFS File No. SAT-LOA-20190704-00057, Call Sign S3051, Att. at 4 (filed Mar. 17, 2020) (responding to Kuiper ex parte filed on Jan. 27, 2020).

[150] *O3b June 30 Reply Comments* at 11-12.

time, rendering it impossible to share this information in advance."[151] Commenters also expressed concerns that such data contains confidential and proprietary traffic trends that otherwise would not be shared with competitors, and that revealing it would present network security implications with respect to how government customers are utilizing a given system.[152] Calls in the record for Viasat to provide such data to SpaceX and Kuiper in this licensing proceeding are a red herring and should be rejected accordingly.

Finally, claims that Viasat has not provided sufficient detail about the operational practices it will employ to ensure that its operations stay within the I/N curves that define the NGSO FSS operating environment established in the 2016/2017 processing rounds[153] ignore the fact that allowing NGSO FSS operators to employ tools of their choosing to stay within I/N limits is no different than the wide flexibility the Commission provides them to comply with EPFD limits to protect GSO FSS systems. No NGSO operator yet has been required to detail specifically how it will stay within those EPFD limits, and there is no valid reason for a different approach with respect to the I/N limits that protect NGSO FSS systems. Nor has any NGSO operator been required to detail in advance the precise operational techniques that it intends to employ to stay within I/N limits, including SpaceX in the context of its own three modification applications. For example, in connection with an increase in SpaceX's Ku-band gateway earth stations' susceptibility to interference resulting from its first modification, SpaceX simply "indicate[d] willingness to 'forgo a greater level of protection' for its gateway stations in the event of a space station transmitting to commercially-licensed earth stations operating in the

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151 *Telesat June 30 Reply Comments* at 7.

152 *See, e.g.*, *O3b June 15 Comments* at 6; *O3b June 30 Reply Comments* at 12-13.

153 *See SpaceX Petition* at 8-9.

United States," and no further showings were required.[154] In any event, the discussion above provides illustrations of the types of operational techniques that Viasat plans to employ.

2. There is no need for additional conditions regarding satellite-to-satellite links

The Commission also should reject SpaceX's claim that Viasat's "proposed relocation into the heart of previously licensed LEO systems" requires the imposition of a new condition governing satellite-to-satellite links between Viasat's LEO network and Viasat's GSO network.[155] Beyond simply pointing out the altitudes of adjacent systems, SpaceX has provided no analysis showing that an additional condition is needed. SpaceX even recognizes that its concerns would be mooted if the Commission were to grant SpaceX's proposed reduction in altitude of its satellites that are currently authorized for altitudes of 1,275 km and 1,325 km.[156]

In any event, Viasat's existing conditions and commitments are more than sufficient to ensure that its operation of satellite-to-satellite links does not cause significantly increased interference. As SpaceX acknowledges,[157] Viasat's NGSO system is already subject to the following condition with respect to GSO operators:

> If satellite-to-satellite transmissions in the 27.5-28.6 GHz and 29.5-30.0 GHz bands are authorized by another administration, this market access grant is subject to ViaSat submitting a modification to its Petition showing that off-axis power flux density levels at the GSO are no greater than those that would be produced by an earth-based antenna operating in compliance with the off-axis EIRP density limits contained in section 25.218(i)(1)-(4).[158]

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[154] *See SpaceX Recon Order* at ¶ 15; *see also* Opposition of Space Exploration Holdings, LLC and SpaceX Services, Inc, IBFS File Nos. SAT-MOD-20181108-00083, SES-LIC-20190402-00425, SES-AMD-20190410-00520, *et al.*, at 10 (filed June 10, 2019).

[155] *SpaceX Petition* at 3, 16-17.

[156] *Id.* at 17 n.28.

[157] *See id.* at 17.

[158] *Viasat NGSO Authorization Order* at ¶ 52(f).

Viasat's modification application also specifically states that "Viasat will seek in the future the Commission's approval of a suitable showing regarding off-axis PFD levels from a VIASAT-NGSO satellite at the GSO arc with respect to satellite-to-satellite communications."[159] Moreover, as to same-round NGSO systems, Viasat has specifically committed to "ensur[e] that the actual operation of its modified system maintains the same expected operating environment" with respect to other NGSO FSS systems authorized in the 2016/2017 processing rounds that are implemented.[160] Together, these conditions and commitments will ensure that Viasat's satellite-to-satellite links will not materially affect the operating environment with respect to other NGSO FSS systems that must be protected from significant increases in interference.

3. The modification application does not trigger a new V-band processing round

In a further effort to delay consideration of Viasat's modification, some parties argue that the modification should trigger an entirely new V-band processing round.[161] These arguments are specious. They fail for the same reason as calls to consider Viasat's modification as part of the March 2020 Ka-band processing round: Viasat's modified system will not cause significantly increased interference, either to same-round V-band systems or to same-round Ka-band systems. Viasat has made a robust showing demonstrating that this is the case, both in its modification application and in the supplemental analysis provided above.[162] The *Teledesic* standard accordingly requires consideration of Viasat's application as a modification of an NGSO system authorized in the 2016/2017 processing rounds, and preservation of Viasat's processing round status for the V-band as well as the Ka-band.

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159 *Viasat Modification Application*, Exhibit A, at 2.

160 *Id.* at 4.

161 *See SpaceX Petition* at 16; *Boeing Comments* at 2-4; *Kuiper Comments* at 2, 19-20.

162 *See Viasat Modification Application*, Exhibit B; *supra* at 23-24.

Boeing unpersuasively attempts to lump Viasat's modification in with brand new V-band applications filed by AST&Science LLC and Mangata Networks LLC, arguing that those other applications "materially alter the established sharing environment among NGSO systems that was bounded by the March 2017 cut-off deadline."[163] Neither of those other parties was an applicant in the 2017 V-band processing round, so neither is on the same procedural footing as Viasat, and their applications are irrelevant to this proceeding. And Viasat has committed to *maintaining* the sharing environment among NGSO systems authorized in the 2017 V-band processing round.[164] Thus, even if the Commission were to create a new V-band processing round to consider the applications filed by AST&Science LLC and Mangata Networks LLC, there would be no basis for deferring Viasat's modification to that new processing round.

II. THE MODIFICATION WILL SAFEGUARD SPACE SAFETY BY REDUCING COLLISION RISKS

As to the SpaceX comments on orbital debris,[165] Viasat explained that it designed its modified LEO constellation to be able to meet the highest standards of space safety for the constellation as a whole, and Viasat provided a detailed showing in support.[166] Consistent with this commitment to space safety, Viasat has supported the Commission's proposal to adopt a suitable collision metric for an entire LEO constellation over a 15-year license term, and Viasat did so when SpaceX and others opposed the Commission's adoption of such a safe space standard.[167] Viasat's modification application thus shows that its planned LEO system is capable

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163 *Boeing Comments* at 3-4 (internal quotation marks, alterations, and citations omitted).

164 *See Viasat Modification Application*, Exhibit A, at 4.

165 *See SpaceX Petition* at 18-27.

166 *See Viasat Modification Application*, Exhibit B, at 6-11.

167 *See, e.g.*, Letter of Patricia Cooper, SpaceX, to Marlene Dortch, FCC, IB Docket No. 18-313, at 1-2 (filed Apr. 16, 2020) ("*SpaceX Apr. 16 Ex Parte*"); Letter of John P. Janka, Viasat, to Marlene Dortch, FCC, IB Docket No. 18-313, at 1-2 (filed Apr. 17, 2020) ("*Viasat Apr. 17 Ex Parte*").

of meeting the very same requirements that Viasat is asking that SpaceX meet in connection with SpaceX's pending third modification application.[168]

Viasat's orbital debris showing is consistent with the Commission's proposal to apply a 0.001 large object collision risk metric to an entire constellation, and to measure compliance over a 15-year license term.[169] This is reflected in the 15-year value contained in Viasat's Schedule S.[170] The mission life of each individual satellite will be 7.5 years, such that Viasat expects to replenish its constellation during the license term. Viasat's statements in its modification application, and its underlying DAS analysis, are based on these considerations.[171]

Adopting an aggregate collision risk metric implies a certain level of reliability regarding the maneuverability capabilities of the individual satellites that make up the constellation. To state the obvious, satellites that cannot effectively maneuver cannot avoid collisions. Thus, Viasat also factored into its design requirements a requisite level of satellite reliability, with the expectation that the Commission will adopt policies regarding reliability when it resolves certain proceedings currently pending before it.[172] As Viasat has explained, the Commission is at a crossroads. It can either:

- Allow companies like SpaceX to continue their current course of deploying unreliable and disposable satellites, thereby signaling to the entire industry (and

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168 *See Viasat Reply re SpaceX Third Modification* at 26-28, 39-40. SpaceX's tired refrain that Viasat is "apply[ing] one standard to its own proposed operations while trying to hold [SpaceX] to a much more stringent one" is therefore demonstrably false. *SpaceX Petition* at 19.

169 *Viasat Modification Application*, Exhibit B, at 6; *see also Mitigation of Orbital Debris in the New Space Age*, Report and Order and Further Notice of Proposed Rulemaking, 35 FCC Rcd 4156 (2020), at ¶ 159 ("*2020 Orbital Debris Order and FNPRM*") (proposing a 0.001 aggregate collision risk standard measured over the "licensing period").

170 *See Viasat Modification Application*, Schedule S, Satellite Information, Estimated Lifetime of Satellite(s) From Date of Launch.

171 *See id.*, Exhibit B, at 8 n.9.

172 *See, e.g., Viasat Reply re SpaceX Third Modification* at iv; *see also 2020 Orbital Debris Order and FNPRM* at ¶ 160.

the world) that operators may launch large LEO constellations without ensuring that their satellites can be maneuvered reliably or avoid collisions; or

- Provide clear guidance about the importance of satellite reliability and space safety, in which case the market will positively respond by fostering the mass-production of innovative, low-cost, and reliable satellites and satellite components.[173]

Viasat supports the Commission's providing clear guidance on the importance of satellite reliability and space safety and will design its LEO system accordingly. However, satellite operators will not likely expend the resources needed to satisfy safe space standards if competitors, like SpaceX, are not being held to the same standards, let alone their prior commitments to the Commission.[174] SpaceX's assertions to the contrary about Viasat's commitments are specious.[175]

In fact, SpaceX's entire petition is based on misrepresentations and contradictions, and the Commission should not miss the irony that SpaceX—the only party to raise any objections to Viasat's showing on orbital debris—is now apparently deeply concerned about the orbital debris risks posed by any future failed satellites in Viasat's modified 288-satellite constellation while SpaceX is concurrently proposing to deploy approximately 10,000 spacecraft into NGSO orbit over its 15-year license term, despite the catastrophic number of those Starlink satellites already launched that have met a (very) untimely demise.[176]

SpaceX's petition stammers right out of the gate by trying to malign Viasat for "back[ing] into" its 99.5% satellite reliability expectation "only to . . . comply with safety

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[173] *See Viasat Reply re SpaceX Third Modification* at 21.

[174] *See* Petition to Deny or Defer of Viasat, Inc., IBFS File No. SAT-MOD-20200417-00037, at 26-37 (filed July 13, 2020) ("*Viasat Petition re SpaceX Third Modification*"); *Viasat Reply re SpaceX Third Modification* at 40-42.

[175] *See SpaceX Petition* at 18-19.

[176] *See Viasat Reply re SpaceX Third Modification* at 18-21.

requirements for collision risk and probability of successful deorbit."[177] But as SpaceX must know, this is exactly how the systems engineering process works: Top level requirements (in this case for collision risk and probability of successful deorbit) are used to generate lower level requirements (*i.e.*, the necessary reliability of the satellite maneuver capability).

In any event, the Commission's practice is to rely on the technical statements made by applicants in the absence of evidence to the contrary. Viasat has stated in its modification application that the "expected maneuver capability reliability over the satellite lifetime will be designed to be greater than 99.5%."[178] If the constellation's experiential failure rate ever significantly exceeded this value, Viasat would expect the Commission's inquiry. Given SpaceX's asserted "unparalleled commitment to safe space,"[179] the Commission should ask why SpaceX does not welcome the same oversight. Perhaps it is because SpaceX's in-orbit failure rates are so staggeringly high *by design*.[180]

SpaceX next resorts to inventing entirely new standards and metrics by which to judge the safety of Viasat's modified constellation. Indeed, SpaceX went to the trouble of engineering its own Frankenstein version of the NASA DAS software[181] in a flawed attempt to demonstrate that "Viasat's proposed system would have a significantly higher collision risk than claimed in Viasat's application."[182] But SpaceX's "analysis" depends on running the DAS software

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177 *SpaceX Petition* at 18-19.

178 *Viasat Modification Application*, Exhibit B, at 8.

179 Letter from William M. Wiltshire, Counsel to SpaceX, to Jose P. Albuquerque, Chief, Satellite Division, FCC, IBFS File No. SAT-LOA-20161115-00118, at 3 (filed April 20, 2017) ("*SpaceX April 20 Letter*").

180 *See Viasat Petition re SpaceX Third Modification* at 31.

181 This is not the first time SpaceX has improperly used the NASA DAS software in connection with an FCC filing. *See Viasat Petition re SpaceX Third Modification* at 11-12; *Viasat Reply re SpaceX Third Modification* at 4-8.

182 *SpaceX Petition* at 25.

"recursively" so that DAS's actual predictions for collisions during 100 years of decay time are simply repeated again and again for subsequent centuries not actually modeled by NASA.[183] SpaceX then purports to sum up all of the hypothetical collisions that its bespoke software extrapolates will occur over at least the next *760 years* in order to demonstrate that Viasat's system is "unsafe."[184]

SpaceX identifies no basis for using such an analysis, and there is none. Indeed, SpaceX's novel approach to assessing deorbit time and collision risk is not just wholly inconsistent with NASA's standards and software; it is also blatantly hypocritical and anti-competitive. For instance, in the context of making the orbital debris showing mandated by its original 2018 authorization from the Commission,[185] SpaceX focused its DAS analysis and its discussion of satellite failures on *an injection orbit of 350 km*, from which its satellites would naturally decay in a matter of months, to claim that "SpaceX satellites satisfy the NASA safety standard by several orders of magnitude."[186] SpaceX did so even though its *authorized operating orbits* included dozens of orbital shells and thousands of satellites at 1,110 km, 1,130

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183 *Id.* at 24.

184 *Id.* SpaceX's invented DAS argument isn't simply wrong, but purposefully misleading. Most egregiously, in Table 1, SpaceX goes so far as to pejoratively compare the actual DAS to its made-up "recursive" version of the DAS by referring to the actual DAS as "Limited DAS." *Id.* This would be like describing a 100-yard-long football field as being of "limited" length.

185 *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), at ¶ 15 ("*SpaceX Initial Authorization Order*") ("[W]e agree with NASA that the unprecedented number of satellites proposed by SpaceX and the other NGSO FSS systems in this processing round will necessitate a further assessment of the appropriate reliability standards of these spacecraft, as well as the reliability of these systems' methods for deorbiting the spacecraft. Pending further study, it would be premature to grant SpaceX's application based on its current orbital debris mitigation plan. Accordingly, we believe it is appropriate to condition grant of SpaceX's application on the Commission's approval of an updated description of the orbital debris mitigation plans for its system." (footnotes omitted)).

186 Letter from William M. Wiltshire, Counsel to SpaceX, to Jose P. Albuquerque, Chief, Satellite Division, FCC, IBFS File No. SAT-MOD-20181108-00083, at 1-2 (filed Mar. 13, 2019).

km, 1,275 km, and 1,325 km.[187] Thus, it should be apparent that if the approach SpaceX advocates here were applied to SpaceX, its system never would have been authorized to operate at altitudes of approximately 1,110 to 1,325 kilometers.[188] Nor should it be any surprise that once SpaceX abandons its currently authorized plans (via its pending third modification application),[189] it pivots its advocacy in an effort to prevent its competitors from utilizing the orbital resources SpaceX seeks to abandon. And one can only guess how quickly SpaceX would repudiate this approach once the Commission denies its latest modification application.

In the alternative, SpaceX uses a 100-year assumption, even though (i) under this alternative test, its authorized constellation still would fail spectacularly, (ii) SpaceX itself argued against such an approach earlier this year, claiming that it would "replac[e] actual performance with a series of worst-case assumptions" and "***would effectively prevent any operator planning a system that would operate above approximately 900 km from being licensed in the United States***,"[190] and (iii) the Commission has adopted such an assumption for

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[187] Many of these orbital parameters are currently authorized. *See* summary at Table 1, *supra.*

[188] *See SpaceX Initial Authorization Order* at ¶ 2.

[189] *See* summary at Table 2, *supra*.

[190] *SpaceX Apr. 16 Ex Parte* at 2 (emphasis in original) ("For example, while SpaceX has chosen to deploy at very low altitude for numerous reasons, including the benefit that any debris at those low altitudes will demise in the atmosphere in a matter of months, most other NGSO systems operate at much higher altitudes, where debris will remain in orbit for decades or centuries. Determining the precise effects of the rule is extremely complex in a multi-constellation environment, but assuming an NGSO system with fairly representative characteristics and using NASA's Debris Assessment Software, SpaceX calculates that ***the Commission's draft rule would effectively prevent any operator planning a system that would operate above approximately 900 km from being licensed in the United States.***").

MEO satellites[191] (*i.e.*, those satellites operating above 2,000 km and below GEO orbit),[192] *but not for LEOs designed to be disposed of through atmospheric reentry*.

This is why, consistent with its advocacy for assessing aggregate LEO collision risk over a 15-year license term,[193] Viasat provided the demonstration it did in its modification application, explaining that the design of the proposed modification results in the probability of a large-object collision involving the VIASAT-NGSO constellation, taken as a whole, being less than 0.001 over 15 years.[194] Notably, even SpaceX's "Recursive DAS" analysis purports to show the Commission the aggregate collision risk posed by Viasat's entire NGSO constellation.[195] Yet SpaceX states explicitly in the very same petition that it "does ***not*** support . . . an aggregate collision risk limit of 0.001 for NGSO constellations."[196] And in connection with its own pending modification, SpaceX denied that the Commission even proposed an aggregate

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[191] *See 2020 Orbital Debris Order and FNPRM* at ¶ 37 n.110 ("NGSO space stations not disposed of through atmosphere re-entry, i.e. space stations in medium-Earth orbit (MEO) may refer to this 100-year outer limit in implementing the collision risk assessment."); *id.* ¶ 158 n.540 ("We note that the ODMSP does not provide a separate metric for spacecraft operating in MEO for assessment of per-satellite probability of collision with large objects. *See* ODMSP, 3-1. The ODMSP does provide for a 100-year maximum orbital lifetime for use in the assessment, however, and as the *Order* specifies above, applicants planning to operate spacecraft in the MEO region can refer to this 100-year value in calculating probability of collision on a per-satellite basis.").

[192] *See id.* at ¶ 108.

[193] *See, e.g.*, Letter of John P. Janka, Viasat, to Marlene Dortch, FCC, IB Docket No. 18-313, at 2 (filed Apr. 17, 2020) ("Viasat's analysis indicates that one could have 4,000 satellites, deployed at 1,100 km, over 15 years, and still satisfy the Commission's total system collision probability metric as long as those satellites have a level of reliability consistent with what NASA recommended to the Commission."); *Viasat Apr. 17 Ex Parte* at 1-2 (reiterating Viasat's support for "a 0.001 total-system collision probability metric for an NGSO constellation as a whole, measured over a 15-year license term," and explaining that this "approach of achieving a low probability of collision for an entire NGSO constellation is very much achievable as long as one designs and builds satellites with reliability commensurate with the scale of the constellation").

[194] *Viasat Modification Application*, Exhibit B, at 6-7.

[195] *See SpaceX Petition* at 25.

[196] *Id.* at 26 (emphasis added).

collision risk limit,[197] and conspicuously failed to offer its own estimate of the aggregate collision risk posed by its Starlink system.[198] SpaceX lost credibility on these issues long ago.

SpaceX's remaining criticisms are equally off-base and easily dispatched. For instance, while SpaceX correctly notes that "Viasat states its intention to reserve 256 m/s of ΔV to perform an active disposal maneuver,"[199] it then incorrectly concludes that "Viasat's fuel reserve figure is just sufficient for a single impulse burn to move perigee from 1,300 to 300 km, but leaves no additional fuel for other orbital parameter changes (to say nothing of collision avoidance or other maneuvers)."[200] SpaceX surely knows that Viasat's stated "intention to ***reserve*** 256 m/s of ΔV to perform an active disposal maneuver" does not imply that this is the total ΔV budget for Viasat's satellites. Obviously, other ΔV allocations exist for orbit parameter changes and avoidance maneuvers during the rest of mission life since Viasat has explained that at least 256 m/s will ***remain*** at end of life, such that the satellite can successfully deorbit. SpaceX's argument to the contrary is purposefully misleading.

SpaceX also makes several specious calculations regarding the required showings for post-mission disposal in Section 25.114(d)(14)(vii)(D)(i).[201] Looking at the requirements one by one, the first is "the probability of success of the chosen disposal method will be 0.9 or greater for any individual space station."[202] As stated in Viasat's modification application: "The expected maneuver capability reliability over the satellite lifetime will be designed to be greater

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197 *See SpaceX Third Modification Opposition* at 19 n.58.

198 *See Viasat Reply re SpaceX Third Modification* at 27 n.79.

199 *SpaceX Petition* at 20 (citing *Viasat Modification Application*, Exhibit B, at 10).

200 *Id.*

201 *See id.* at 20-25.

202 47 C.F.R. § 25.114(d)(14)(vii)(D)(1).

than 99.5%."[203] The second part of the requirement specifies "a goal, for large systems, of a probability of success for any individual space station of 0.99 or better."[204] Again, as stated in Viasat's modification application: "Such a 99.5% maneuver capability reliability over satellite lifetime also would ensure that VIASAT-NGSO satellites will be able to successfully deorbit with a probability of success greater than the Commission's 99% goal for large NGSO systems."[205] The third part of the requirement indicates that "successful disposal is defined as atmospheric re-entry of the spacecraft within 25 years or less following completion of the mission."[206] As before, Viasat's modification application addresses this requirement with Figure 3, which shows that the worst-case passive deorbit time "is less than one year, significantly less than the 25-year standard."[207] Viasat's modified system therefore is fully compliant with the Commission's post-mission disposal requirements.[208]

SpaceX's claims about small object collision risk are similarly baseless. SpaceX provides no analysis or evidence whatsoever in support of its assertion that the modification will result in an "increased risk of collision with . . . small objects."[209] And its claim that this purportedly "increased risk . . . calls into question the legitimacy of Viasat's asserted 99.5%

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[203] *Viasat Modification Application*, Exhibit B, at 8.

[204] 47 C.F.R. § 25.114(d)(14)(vii)(D)(1).

[205] *Viasat Modification Application*, Exhibit B, at 9.

[206] 47 C.F.R. § 25.114(d)(14)(vii)(D)(1).

[207] *Viasat Modification Application*, Exhibit B, at 11, Fig. 3.

[208] SpaceX also cannot complain that Viasat analyzed demise time from disposal orbit, *SpaceX Petition* at 19, when SpaceX itself has never provided demise times from operational orbits for its currently licensed system. Viasat is not required to provide such an analysis. OneWeb notably also did not provide such an analysis in connection with its recent authorization. *See WorldVu Satellites Limited, Debtor-in-Possession, Petition for Declaratory Ruling Granting Access to the U.S. Market for the OneWeb Non-Geostationary Satellite Orbit Fixed-Satellite Service V-Band System*, IBFS File No. SAT-LOI-20170301-00031, Order and Declaratory Ruling, FCC 20-117 (rel. Aug. 26, 2020), at ¶ 16 ("*OneWeb Authorization Order*").

[209] *SpaceX Petition* at 26.

reliability rate" is nonsense.[210] The 99.5% figure represents "[t]he expected maneuver capability reliability over the satellite lifetime"[211]—*i.e.*, the probability that the satellite will still be maneuverable at end of mission life—and accounts for electronic and mechanical failure mechanisms of the satellite, not the probability of a small object collision rendering the satellite non-maneuverable. NASA's ODMSP addresses small object collision risk by ensuring that "the probability of accidental collision with orbital debris and meteoroids sufficient to prevent compliance with the applicable post-mission disposal maneuver requirements does not exceed 0.01 (1 in 100)."[212] Viasat will design its satellite with sufficient shielding and redundancy to meet that requirement and will provide the appropriate analysis to the Commission when the design matures.

Nor has Viasat "sought to impose" failure rates "on other NGSO systems."[213] Rather, Viasat is simply pointing out that SpaceX has now experienced a failure rate of nearly 7%[214]—14 times greater than what Viasat is designing its satellites to achieve, and 7 times greater than the failure rate that SpaceX previously assured the Commission it would design and manufacture the Starlink system to be "nowhere near."[215] Further, Viasat observes that an actual failure rate this high, manifesting after such a small fraction of a Starlink satellite's design life has passed,

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210 *Id.*

211 *Viasat Modification Application*, Exhibit B, at 8.

212 *2020 Orbital Debris Order and FNPRM* at ¶ 38 (citation omitted).

213 *SpaceX Petition* at 19.

214 *See* Jonathan McDowell, "Reentered and Bad Starlinks," https://planet4589.org/space/stats/megacon/starbad.html (providing data as of Sep. 6, 2020) (last visited Sep. 13, 2020). Dr. McDowell is an astrophysicist at the Harvard-Smithsonian Center for Astrophysics.

215 *See SpaceX April 20 Letter* at 4. In response to a request from the Commission that SpaceX "provide an analysis of collision risk, assuming rates of satellite failure resulting in the inability to perform collision avoidance procedures of 10, 5 and 1 percent," SpaceX represented: "SpaceX will construct its spacecraft to specifications and tolerances to ensure that failure rates are nowhere near the [1, 5 or 10 percent] levels postulated in this question." *Id.*

optimistically implies a staggering 22% failure rate over the duration of the Starlink mission. In SpaceX's case, the wisdom should be apparent of the need to assess the aggregate collision risk of the Starlink system "taking into consideration an assumed 10% failure rate of the maneuver capability."[216] In its own modification application proceeding, SpaceX has not made any attempt to repudiate Viasat's analysis, and frankly, with numerous SpaceX satellites falling out of the sky, there is not much SpaceX could say.

Indeed, given SpaceX's dismal experiential failure rate, SpaceX may want to spend more time studying Viasat's modified system design and less time throwing boulders (like a made-up version of DAS) through its own glass house. It is hard to believe that the same company chosen by NASA to transport astronauts to the ISS has engineered the Starlink satellites—unless, of course, SpaceX's business plan is in fact to provide service reliability through constellation redundancy, *i.e.*, to launch very large numbers of low-cost, low-reliability satellites, and still be able to provide commercial service even as large numbers of its satellites fail.[217] While this may be optimal for SpaceX's bottom line, it is decidedly not in the public interest or good for humanity as a whole. Unless stopped, SpaceX's behavior could well result in a cascade of Starlink collisions that would bring an inglorious end to the New Space Age.[218]

At bottom, Viasat is strongly committed to space safety. Its modified system is capable of complying with both the current NASA debris standards for single satellites and the

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[216] *Cf. SpaceX Petition* at 25 & n.48. SpaceX projects a similar failure rate onto Viasat's LEO system, *see id.*, even though SpaceX opposed the Commission's March 2020 "white copy" proposal that applicants conduct a collision risk assessment assuming a 10% failure rate of maneuver capability, claiming that such "pessimistic assumptions" did not accurately reflect real risk and "would decrease the accuracy of the collision probability metric by replacing actual performance with a series of worst-case assumptions." *SpaceX Apr. 16 Ex Parte* at 2. The Commission did not adopt that proposal. Particularly having itself far exceeded that 10% rate just months after opposing adoption of the proposal, SpaceX's duplicity should be apparent.

[217] *See Viasat Petition re SpaceX Third Modification* at 31.

[218] *See Viasat Reply re SpaceX Third Modification* at 4.

Commission's recently proposed requirements for large constellations as a whole, should those requirements be adopted.[219] In fact, the modification would allow Viasat to reduce the constellation aggregate probability of a large object collision from less than 0.04 to less than 0.001 over 15 years.[220]

To the extent the Commission seeks further information about Viasat's orbital debris mitigation plans, it should take the same approach as it did in granting other recent NGSO applications. For instance, in its *Kuiper Authorization Order*, the Commission noted that, "[b]ecause the design of Kuiper's satellites is not completed, . . . Kuiper consequently did not present specific information concerning some required elements of a debris mitigation plan."[221] The Commission accordingly "condition[ed] [its] grant of the Kuiper application on Kuiper presenting, and the Commission granting, a modification of this authorization to provide for review of the final orbital debris mitigation plan."[222] Similarly, in its recent order granting OneWeb's market access application for an NGSO system, the Commission included a condition requiring OneWeb to submit, within six months of the grant, additional information about its orbital debris mitigation plans.[223] If the Commission desires additional information from Viasat, it can readily grant Viasat's modification application with a similar condition.

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219 Viasat's reservation of rights to "modify [its] orbital debris mitigation plan to incorporate any less-stringent requirements" adopted by the Commission, *see Viasat Modification Application*, Exhibit B, at 6, merely reflects that Viasat should not be required to operate under more restrictive rules that do not equally apply to its competitors.

220 *Id.*

221 *Kuiper Authorization Order* at ¶ 32.

222 *Id.*

223 *See OneWeb Authorization Order* at ¶ 16.

III. THE MODIFICATION SERVES THE PUBLIC INTEREST IN OTHER RESPECTS

In its modification application, Viasat explained that, while not necessary to demonstrate under a Section 25.117(d) analysis because of the presumption recognized in *Teledesic*, grant of the modification request would affirmatively serve the public interest in other respects. Among other things, "the modified system has been optimized to deliver sub-100 ms broadband service to homes and small businesses throughout CONUS."[224] This feature of the modified system dovetails with Chairman Pai's recognition that "[n]ext-generation satellites are bringing new competition to the broadband marketplace and new opportunities for rural Americans who have had no access to high-speed Internet access for far too long."[225] And "each of the extremely-high-capacity satellites in the modified constellation is expected to have up to 4 to 5 times the capacity of any LEO satellite proposed to date."[226] Moreover, as noted above, the modified constellation will "meet the highest standards of space safety for a LEO constellation as a whole," by "satisfying the Commission's proposed collision-risk standard of less than 0.001 on an entire constellation basis, and over a 15-year license term."[227] These and other public interest benefits noted in the modification application underscore the importance of granting Viasat's modification promptly.

SpaceX's efforts to attack these public interest benefits of Viasat's proposed modification are unavailing. As an initial matter, SpaceX's claim that "Viasat made no mention of any public

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224 *Viasat Modification Application*, Exhibit A, at 4.

225 *Id.* at 4-5 (quoting Chairman Ajit Pai, Remarks at the Satellite Industry Association's 21st Annual Leadership Dinner at 2 (Mar. 12, 2018), *available at* https://www.fcc.gov/document/chairman-pai-remarks-satellite-industry-association-dinner).

226 *Id.* at 5.

227 *Id.*

interest benefit of the application such as improved space safety or providing enhanced service to customers"[228] is belied by the prior showing described above. For the same reason, SpaceX's claim that any reliance on these benefits amounts to a "post hoc rationalization[]" is absurd on its face,[229] as they were specifically articulated in Viasat's modification application. SpaceX also overlooks that these include the very same public interest benefits that SpaceX contends should compel the Commission's grant of its own third modification application.[230]

Kuiper likewise misses the mark in arguing that the "ability to provide broadband service does not . . . justify including Viasat's [modification application] in the 2016 Processing Round, given that Viasat will be able to provide that service as part of the 2020 Processing Round."[231] As explained at length above, the *Teledesic* standard governs the processing round status of a modification application,[232] and Viasat has amply demonstrated that its modification application satisfies the *Teledesic* standard.[233] Having been authorized as part of the 2016/2017 processing rounds, Viasat is appropriately seeking to retain the same procedural rights as other operators who were authorized in those rounds and have modified their systems.[234] Moreover, Kuiper's

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228 *SpaceX Petition* at i.

229 *Id.* at 3.

230 *See, e.g.*, *SpaceX Third Modification Application*, Legal Narrative, at i ("With this application, SpaceX seeks to . . . fully deploy a satellite constellation that will deliver high-speed, low-latency competitively-priced broadband service to the underserved and unserved throughout the United States . . . .").

231 *See Kuiper Comments* at 5.

232 *See supra* at 4-25.

233 *See supra* at 25-36.

234 For similar reasons, Kuiper's attempt to tie Viasat's modification to a pending rulemaking proceeding on amendments to Section 25.261 is unavailing. *See Kuiper Petition* at 5-6. There is no rational connection between Viasat's decision to modify its system and *future* changes to Section 25.261 that Kuiper seeks for its own benefit, *see* Comments of Kuiper Systems LLC, RM-11855, at 3 (filed June 15, 2020)—changes that were opposed by many in the industry, *see, e.g.*, *O3b June 30 Reply Comments* at 5-12; Reply Comments of Space Exploration Holdings, RM-11855, at 5-6, 10 (filed June 30, 2020). As explained at length above, the *Teledesic* standard allows Viasat to modify its system in a manner that ensures it will not significantly increase

assertion that Viasat would "be able to provide [broadband] service as part of the 2020 Processing Round" with its proposed LEO system is far from certain. To the contrary, particularly in light of the spectrum-preclusive effects of SpaceX's system, there is no reason to believe that any system authorized in the 2020 Processing Round that does not consist of many thousands of satellites successfully will be able to deploy.[235]

CONCLUSION

Viasat's modified NGSO FSS system will yield an array of public interest benefits by utilizing extremely-high-capacity satellites (up to 4 to 5 times the capacity of any LEO satellite proposed to date) to provide sub-100 ms latency broadband service to American homes and small businesses. The design of the constellation also allows the highest standards of space safety to be met for this constellation as a whole.

Significantly, the modified system does so without creating any significant additional interference with respect to other NGSO FSS systems authorized in the same processing round, consistent with Commission precedent.

More specifically, Viasat will ensure that the actual operation of its modified system will not result in additional "band-splitting" events with respect to those NGSO FSS systems that could reduce their spectrum. The operational tools available to achieve this requirement are no different than those that the Commission allows other NGSO FSS operators to use to stay within

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interference for other NGSO FSS systems authorized in the same processing round or make sharing with such systems significantly more difficult, just as other operators have been permitted to do.

[235] *See* Reply Comments of Viasat, Inc., RM-11861, at 4 (filed Sep. 1, 2020) (warning that "the deployment of many tens of thousands of NGSO FSS satellites would provide effectively ZERO remaining 'look angles' for any other NGSO FSS system, blocking access to critical spectrum by . . . other systems, but barely affecting that 'mega-constellation'"); Comments of Viasat, Inc., RM-11861, at 3 (filed Aug. 17, 2020) ("It is not an overstatement to conclude that the potential for spectrum sharing occasioned by antenna directivity in NGSO FSS systems is being overtaken by the spectrum-preclusive effects of 'mega' NGSO FSS constellations.").

the I/N limits that protect other NGSO FSS systems and within the EPFD limits that protect geostationary FSS systems.

Commenters and petitioners provide no credible basis for denying this modification application or deferring it to a later processing round. They wrongly assume that Viasat will ignore its commitment to stay within the relevant technical operating environment, and that Viasat will not use suitable operational tools to do so. They also wrongly assume that one particular change in Viasat's orbital parameters (number of satellites) is determinative.

Promptly granting this modification, and also allowing Viasat to maintain its spectrum-sharing status vis-à-vis other same-round NGSO FSS systems, (i) is consistent with Commission precedent, and (ii) will enable Viasat to take the next important step in providing ubiquitous high-speed, low-latency broadband connectivity to American homes and small businesses.

Respectfully submitted,

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September 15, 2020

DECLARATION OF MARK A. STURZA

I, Mark A. Sturza, hereby make the following declarations under penalty of perjury:

1. I am President of 3C Systems Company, which has acted as consultant to Viasat, Inc. ("Viasat") regarding the matters addressed in the foregoing Consolidated Opposition to Petitions and Response to Comments of Viasat, Inc. ("Opposition").

2. I have reviewed the Opposition and certify that, to the best of my knowledge, information and belief, the factual assertions in the Opposition are truthful and accurate.

3. I hereby declare that I am the technically qualified person responsible for preparation of the engineering information contained in the Opposition, that I am familiar with Part 25 of the Commission's rules, that I have either prepared or reviewed the engineering information submitted with the Opposition, and that it is complete and accurate to the best of my knowledge, information and belief.

/s/
Mark A. Sturza
President
3C Systems Company

September 15, 2020

CERTIFICATE OF SERVICE

I, Kayla Ernst, hereby certify that on this 15th day of September 2020, I caused to be served a true copy of the foregoing Consolidated Opposition and Response to Comments of Viasat, Inc. via first-class mail upon the following:

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