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

In the Matter of	)	
	)	
WorldVu Satellites Limited	)	IBFS File Nos. SAT-LOI-20170301-00031
	)	& SAT-AMD-20180104-00004
Amendment to Petition for Declaratory Ruling Granting Access to the U.S. Market for the OneWeb V-Band System	)	Call Sign: S2994

CONSOLIDATED OPPOSITION AND REPLY COMMENTS OF ONEWEB

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WorldVu Satellites Limited ("OneWeb") hereby submits this Consolidated Opposition and Reply to the separate pleadings filed by The Boeing Company ("Boeing"), Iridium Constellation LLC ("Iridium"), Elefante Group, Inc. ("Elefante"), Space Exploration Holdings, LLC ("SpaceX"), and SES Americom, Inc. and O3b Limited (together, "SES"), in response to OneWeb's amendment of its pending Petition for Declaratory Ruling Granting Access to the U.S. Market for the OneWeb V-Band System.[1] In the Amendment Application, OneWeb seeks to increase the number of proposed medium-earth orbit ("MEO") satellites from 1,280 to 2,560 and add certain Ku-, Ka-, and E-band frequencies to OneWeb's non-geostationary satellite orbit ("NGSO"), fixed-satellite service ("FSS"), MEO component of its satellite system (the "MEO Component").

INTRODUCTION AND SUMMARY

More than two years ago, OneWeb applied for U.S. market access for 720 low-earth orbit ("LEO") satellites (the "LEO Component").[2] The OneWeb Ku-/Ka-band Petition ushered in a new wave of NGSO system proponents in the Ku-band, the Ka-band, and the V-band. Seeking to build upon the vision of its LEO Component, OneWeb timely filed an application for the

[1] *See WorldVu Satellites Limited, Petition for Declaratory Ruling Granting Access to the U.S. Market for the OneWeb V-Band System*, IBFS File No. SAT-LOI-20170301-00031 (filed Mar. 1, 2017) ("OneWeb V-band Petition"); *Amendment to Petition for Declaratory Ruling Granting Access to the U.S. Market for the OneWeb V-Band System*, IBFS File No. SAT-AMD-20180104-00004 (filed Jan. 4, 2018) ("Amendment Application").

[2] *See WorldVu Satellites Limited, Petition for Declaratory Ruling Granting Access to the U.S. Market for the OneWeb System*, IBFS File No. SAT-LOI-20160428-00041 (filed Apr. 28, 2016) ("OneWeb Ku/Ka-band Petition").

MEO Component in March of 2017 in response to the Commission's call for additional V-band NGSO system applications and petitions.[3]

As the pathfinder in this latest generation of proposed NGSO constellations, OneWeb expended significant capital and effort designing an NGSO system that was consistent both with the Commission's rules as they existed when OneWeb applied for the LEO Component and the MEO Component *and* that was capable of expeditiously delivering service to unserved and underserved areas, including rural areas. Importantly, where other applicants proposed satellite networks in knowing violation of the Commission's milestone rules, OneWeb went to great lengths to design an NGSO system to ensure *compliance* with the Commission's milestone rules.

After OneWeb filed the OneWeb V-band Petition, however, the Commission concluded a rulemaking proceeding in which it substantially changed the milestone rules. Under the newly relaxed milestone regime, NGSO system proponents suddenly were required to construct just half the authorized constellation in six years and the full constellation in nine years. This substantial relaxation of the satellite milestone rules in the midst of multiple pending NGSO processing rounds was unprecedented in the Commission's history and represented a quantum shift in what was possible for companies like OneWeb to responsibly build under the same application or petition.[4] Naturally, OneWeb revisited the kind of NGSO system it expected to

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[3] *See Boeing Application Accepted for Filing in Part; Cut-Off Established for Additional NGSO-Like Satellite Applications or Petitions for Operations in the 37.5-40.0 GHz, 40.0-42.0 GHz, 47.2-50.2 GHz, and 50.4-51.4 GHz Bands, Public Notice*, DA 16-1244 (IB 2016) ("V-band Processing Round"); *see also* OneWeb V-band Petition.

[4] It is rare for the Commission to make such a fundamental change to its application processing rules. And this makes sense. Milestone rules force NGSO system proponents to design, build, and deploy systems within a reasonable time frame. *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, ¶¶ 62 & 66-67 (2017) ("*NGSO*

implement in light of this unprecedented Commission rule change, and promptly responded with a timely-filed application to expand the number of satellites and frequencies of the MEO Component of its NGSO system.[5]

In response to the Amendment Application, SpaceX, SES, Boeing, Iridium, and Elefante Group submitted responsive pleadings. SpaceX, SES, and Iridium argue that the Amendment Application should be dismissed or addressed in a subsequent processing round. These commenters, however, ignore the fact that the Amendment Application was an entirely rational and appropriate response to the Commission's unforeseen and unprecedented changes to the milestone rules in the midst of multiple NGSO processing rounds. These commenters also fail to acknowledge that OneWeb's MEO Component will be modified in such a way that OneWeb will have improved ability to avoid in-line interference events and, thus, the Amendment Application will serve to facilitate frequency conflict resolution rather than exacerbate the spectrum sharing

Order"). This allows the Commission to prevent warehousing of spectrum or orbital resources so that only serious, well-designed satellite networks are proposed and built. *Id.* at ¶¶ 62 & 66 (establishing milestone requirements to "prevent harmful 'warehousing' of spectrum and orbital resources" and discourage applicants "from seeking authorizations for oversized, unrealistic constellations").

[5] OneWeb also revisited its system design in light of the milestone rule changes in the LEO Component of its NGSO system, filing a modification application to its market access grant on March 19, 2018. *See WorldVu Satellites Limited, Modification to OneWeb U.S. Market Access Grant for the OneWeb Ku- and Ka-Band System*, IBFS File No. SAT-MOD-20180319-00022 (filed Mar. 19, 2018) ("Modification Application"). OneWeb has likewise provided compelling reasons for the Commission to grant the Modification Application consistent with Commission precedent and the public interest. *See Modification to OneWeb U.S. Market Access Grant for the OneWeb Ku- and Ka-Band System*, *Consolidated Opposition and Reply Comments of OneWeb*, IBFS File No. SAT-MOD-20180319-00022 (filed Aug. 27, 2018) ("Modification Opposition and Reply Comments").

environment. OneWeb's Amendment Application should therefore not be considered a newly filed application subject to a second processing round.[6]

While SpaceX and SES suggest that granting OneWeb's application would undermine the processing round framework and increase the amount of interference experienced by other NGSO constellations, both criticisms are off the mark. OneWeb demonstrates herein that these concerns regarding increased interference in the NGSO sharing environment are inaccurate and misleading. Similarly, Iridium errs when it argues that OneWeb's planned FSS or MSS operations are inconsistent with applicable Commission band plans or regulations. The Commission has explicitly recognized that NGSO feeder links can support both FSS and MSS systems.

Equally unavailing are suggestions that the Amendment Application requires additional scrutiny of its potential to create orbital debris or that OneWeb's expanded MEO Component will create orbital spacing issues. OneWeb remains subject to the direct and effective regulation of the United Kingdom Space Agency, and its expanded MEO Component design will ensure

[6] *See* 47 C.F.R. § 25.116(c)(1) & (4). Additionally, OneWeb observes that the current dynamic of the V-band processing round has shifted materially since applications and petitions were due in March 2017. The lead applicant in the processing round, Boeing, has withdrawn its first V-band application that proposed an NGSO constellation of 2,956 satellites. *See* Letter from Bruce A. Olcott, Counsel to The Boeing Company, to Jose Albuquerque, Chief, Satellite Division, International Bureau, IBFS File Nos. SAT-LOA-20161115-00109 *et al.*, (filed July 31, 2018). The Commission has also granted two other applications. *See Request for Modification of U.S. Market Access for O3b Limited's Non-Geostationary Satellite Orbit System in the Fixed-Satellite Service and in the Mobile-Satellite Service,* Order and Declaratory Ruling, FCC 18-70 at ¶¶ 21-23 (rel. June 6, 2018) ("*O3b Grant*"); Audacy Corporation, *Application for Authority to Launch and Operate a Non-Geostationary Medium Earth Orbit Satellite System in the Fixed- and Inter-Satellite Services,* Order and Authorization, FCC 18-72 (rel. June 6, 2018). In short, OneWeb anticipates being able to successfully coordinate with other V-band operators.

sufficient orbital spacing such that other NGSO operators are subjected to no greater risk than under OneWeb's initial MEO Component design.

Accordingly, OneWeb reiterates its position that grant of the Amendment Application serves the public interest, convenience, and necessity. The Amendment Application should be promptly granted by the Commission.

I. ONEWEB'S MEO COMPONENT IS NOT A SEPARATE NGSO-LIKE SYSTEM

SES and SpaceX rely upon a mixture of largely administrative and procedural minutiae to concoct an argument that OneWeb's LEO and MEO Components each form different satellite systems. Neither SpaceX's nor SES's arguments withstand close scrutiny. OneWeb's LEO and MEO satellites, which are part of the same NGSO-like system, do not violate the Commission's rules against ownership of multiple unbuilt NGSO systems in the same frequency band.[7] Indeed, a close reading of the OneWeb V-band Petition clearly demonstrates that from the outset OneWeb intended to *include a V-band payload on the LEO Component* as well as deploy the MEO Component.[8] In short, SES's and SpaceX's claims conveniently ignore the reality of how the satellites in the OneWeb NGSO system will function together.

As an initial matter, and contrary to SpaceX's assertions otherwise, it is entirely inconsequential that OneWeb filed separate market access petitions in the Ku-, Ka-, and V-bands, and that the two petitions have different file numbers and call signs.[9] The fact that

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[7] *See* Petition to Dismiss or Defer of SES Americom, Inc. and O3b Limited, IBFS File No. SAT-AMD-20180104-00004, at 5-7 (filed Aug. 6, 2018) ("SES Petition"); Petition to Deny or Defer of Space Exploration Holdings, LLC, IBFS File No. SAT-AMD-20180104-00004, at 9-11 (filed Aug. 6, 2018) ("SpaceX Petition"); *see also* 47 C.F.R. §§ 25.159(b) & 25.137(d)(5).

[8] *See* OneWeb V-band Petition, Attachment A (Technical Narrative) at 27 ("V-band Technical Narrative").

[9] SpaceX Petition at 9-10.

OneWeb filed separate petitions in response to the Commission's processing rounds, rather than amending its initial market access application, is not demonstrative of any intent to independently operate separate NGSO systems.[10]

SpaceX's other arguments purporting to demonstrate that the OneWeb NGSO system runs afoul of the Commission's unbuilt systems rule are similarly unpersuasive. For example, SpaceX argues that OneWeb's omission of the LEO Component from its PFD compliance demonstration evidences OneWeb's intent to operate separate satellite systems.[11] As an initial matter, the Commission has noted its agreement with SpaceX that the ITU's PFD limits "were derived for constellations up to 840 satellites and under worst case assumptions."[12] OneWeb agrees with this assessment of the ITU's PFD limits and used the value of 2,560 MEO satellites to calculate the applicable PFD mask. When OneWeb submitted the Amendment Application, the FCC had not yet authorized a large NGSO constellation—like SpaceX's—that did not fit within the ITU's intended framework for demonstrating PFD compliance. In addition, OneWeb was then still in the process of modifying the L5 ITU filing to increase the number of satellites in the LEO Component from 720 to 1,980. At that time, it would have been premature for OneWeb to demonstrate PFD compliance with both the LEO and MEO Components, so it demonstrated compliance for the MEO Component alone. As described in Section II below, the OneWeb NGSO system—composed of both LEO and MEO satellites—will operate as a single NGSO

[10] *See* OneWeb V-band Petition; SpaceX Petition at 9.
[11] *See* SpaceX Petition at 10.
[12] *See Space Exploration Holdings, LLC Application for Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System, Memorandum Opinion, Order and Authorization*, IBFS File No. SAT-LOA-20161115-00118, at ¶ 35 (2018).

system. The way in which OneWeb has calculated the relevant PFD limit mask does not alter that operational reality.

Similarly, SES's inaccurate observation that "[t]here is simply nothing in the Amendment or any of OneWeb's previous filings, much less the design of the two satellite constellations, to suggest that OneWeb's authorized Ku-/Ka-band LEO constellation and the system proposed in the Amendment are one and the same" entirely ignores the substantial evidence to the contrary.[13] *First*, OneWeb's initial V-band application repeatedly refers to the V-band *component* of OneWeb's *system*, which consists of "a 720-satellite LEO constellation as well as a larger 1,280-satellite MEO constellation."[14] *Second*, end user customers will not necessarily even be aware of whether they are accessing a LEO or a MEO satellite at any instant in time. The frequency ranges will be used simultaneously in both the LEO Component and the MEO Component of the OneWeb NGSO system. A collection of NGSO satellites that functions cooperatively under the control of a single entity to provide service using common earth stations constitutes a *single* NGSO system.

OneWeb notes this interpretation is entirely consistent with both the Commission's and the ITU's definition of a "satellite system." The Commission's rules and the ITU Radio Regulations both define a "satellite system" as "[a] space system using one or more artificial earth satellites."[15] Similarly, both the ITU and the Commission define a "space system" as

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[13] *See* SES Petition at 7; *see also* OneWeb Market Access Application, Attachment A (Technical Narrative), at 1 (referring to OneWeb's V-band satellites as a "component of OneWeb's non-geostationary satellite orbit ('NGSO') system").
[14] *See, e.g.*, OneWeb V-band Petition, Legal Analysis, at 8; OneWeb V-band Petition, Technical Narrative, at 1.
[15] ITU RADIO REGULATIONS § 1.111 (2016 ed.); 47 C.F.R. § 25.103.

"[a]ny group of *cooperating* earth stations and/or space stations employing space radiocommunication for specific purposes."[16] Thus, an NGSO satellite system consists of a group of *cooperating* earth stations and/or space stations employing space radiocommunication for a specific purpose. The LEO and MEO Components together exhibit the hallmarks of a "satellite system" as contemplated by both the Commission and the ITU.

Additionally, SpaceX offers no support for its assertion that OneWeb will not comply with equivalent power flux-density ("EPFD") requirements.[17] OneWeb is committed to meeting EPFD limits while operating all satellites in the LEO and MEO Components simultaneously. Section 22.5C of the ITU Radio Regulations states that EPFD limits apply to "emissions from all the space stations of a non-geostationary-satellite system in the fixed-satellite service."[18] Both the LEO and MEO Components of the OneWeb NGSO system will comply with any applicable EPFD limits.[19] Contrary to the implication of SpaceX, OneWeb does not intend to double-dip into critical spectrum sharing resources by treating EPFD compliance of each of the LEO and MEO Components separately and independently.

Even if the Commission concludes—which it should not—that OneWeb's LEO and MEO Components are not part of the same satellite system, the requirements of Section 25.137(d)(5) of the Commission's rules should be waived. The Commission may waive a rule if "special circumstances warrant a deviation from the general rule" and such deviation will "better

[16] ITU RADIO REGULATIONS § 1.110 (emphasis added); 47 C.F.R. § 25.103.
[17] *See* SpaceX Petition at 10.
[18] *See* ITU Radio Regulations No. 22.5C.
[19] OneWeb notes the Commission's rules require an NGSO operator to certify its compliance and receive a "favorable" or "qualified favorable" finding from the ITU regarding its EPFD compliance prior to initiating service. *See* 47 C.F.R. §§ 25.146(a), (c).

serve[ ] the public interest" than strict application of the rule.[20] Here, special circumstances make deviation from Section 25.137(d)(5) in the public interest. The Commission changed the milestone requirements for satellite systems after OneWeb had initially designed and applied for its LEO and MEO Components—components that complied with the Commission rules existing at the time each petition was filed. Contrary to SpaceX's suggestion, OneWeb should not be forced to amend its application in a subsequent processing round just because OneWeb chose to follow the rules as written. OneWeb's Amendment Application should be considered as part of the current processing round.[21] Any other result would be "irrational," "legally unsustainable," and would "effectively handicap[ ] those applicants that responsibly designed and proposed networks that compl[ied] with the Commission's existing rules" when the applications were filed.[22] OneWeb should not be disadvantaged because it complied with fundamental NGSO milestone rules in effect at the time and did not seek waivers of milestone rules that the Commission subsequently altered in material ways to benefit other applicants, including SpaceX.[23]

SES and SpaceX make unsupported allegations that OneWeb intends to warehouse spectrum.[24] Far from speculative filings, the Modification Application and the Amendment

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[20] *See Northeast Cellular Telephone Co., L.P. v. F.C.C.*, 897 F.2d 1164, 1166 (D.C. Cir. 1990).
[21] *See* SpaceX Petition at 14.
[22] *See Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters,* Reply Comments of Viasat, Inc., IB Dkt No. 16-408 at 30 (filed Apr. 10, 2017) ("Viasat Reply").
[23] Any other treatment of the OneWeb Amendment Application would be arbitrary and capricious in violation of the Administrative Procedures Act. See 5. U.S.C. § 706(2) (a reviewing court shall "hold unlawful and set aside agency action, findings, and conclusions found to be – (A) arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law").
[24] SES Petition at 7; *see* SpaceX Petition at 12.

Application demonstrate OneWeb's intention to build and deploy each of its LEO and MEO Components. These satellites will support OneWeb's mission to bridge the digital divide by bringing transformative broadband connectivity to the nearly 50% of the world that is currently underserved.[25] Grant of the Amendment Application would position OneWeb to be the first NGSO FSS system to achieve the compelling vision of connectivity it shares with Commission leadership.[26] Thus, authorizing OneWeb to build its MEO Component as quickly as possible will serve the public interest, convenience, and necessity.

II. ONEWEB'S AMENDMENT APPLICATION FACILITATES FREQUENCY CONFLICT RESOLUTION AND THEREFORE SHOULD NOT BE TREATED AS A NEWLY FILED APPLICATION

Under Part 25 of the Commission's rules, a major amendment of a pending application is one that "increases the potential for interference, or changes the proposed frequencies or orbital locations to be used."[27] A major amendment is not considered a newly filed application if it "resolves frequency conflicts with authorized stations or other pending applications but does not create new or increased frequency conflicts."[28] A major amendment is also not considered a newly filed application if it "does not create new or increased frequency conflicts, and is demonstrably necessitated by events which the applicant could not have reasonably foreseen at

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[25] ONEWEB, *We All Need Access*, *available at* http://www.oneweb.world/#home (last accessed Aug. 26, 2018).

[26] As the Commission has repeatedly stated, closing the digital divide is its most important mission. *See, e.g.,* Remarks of FCC Chairman Ajit Pai at "Broadband for All Seminar," (June 26, 2017) ("Since my first day as Chairman of the FCC, I've said repeatedly that my number one priority is closing the digital divide and bringing the benefits of the Internet age to all Americans. . .Communications for all – which in 2017 means Broadband for All – is the main reason my agency exists.").

[27] 47 C.F.R. § 25.116(b)(1).

[28] *Id.* at (c)(1).

the time of filing."[29] Although adding certain Ku-, Ka-, and E-band frequencies may be a major amendment under certain circumstances, this should not result in the Amendment Application being treated as a new application because it serves to help resolve, rather than create, frequency conflicts.[30] Moreover, the Commission's revision of fundamental milestone rules while multiple processing rounds remained pending caused OneWeb to amend its V-band Petition when it did. As Viasat noted, considering OneWeb's Amendment Application a new application is the sort of "inequitable result" that "Viasat does not believe that the Commission intended . . . when it made significant changes to its NGSO regulatory framework (*e.g.*, with respect to required geographic coverage and milestones) in the *NGSO Order*."[31]

A. Adding More Satellites to the MEO Component Will Help Resolve Frequency Conflicts and Will Not Increase the Risk of Interference to Other NGSO Systems

The attempts of multiple commenters to characterize the Amendment Application as increasing the potential NGSO interference environment are unsubstantiated.[32] As discussed herein, the Amendment Application will in fact improve the ability of the OneWeb system to share spectrum with other NGSO operators. Therefore, the OneWeb Amendment Application should not be considered a newly filed application—it should instead be addressed within the current processing round.

Contrary to the claims of SpaceX and SES, an increase in the number of satellites and frequencies available to the MEO Component will help enable OneWeb to further reduce the

[29] *Id.* at (c)(4).
[30] *See id*. at (c)(1).
[31] *See* Viasat Reply, at 30.
[32] *See, e.g.,* SpaceX Petition at 23-26; SES Petition at 14-16.

necessity of harmful in-line interference events occurring and the power level at any victim receiver during an in-line interference event. This will augment OneWeb's ability to utilize satellite diversity, which in turn will facilitate greater coordination with other NGSO operators. SpaceX and SES present a fundamentally flawed analysis of the potential interference environment between OneWeb and other NGSO operators because they simplistically assume interference increases in direct correlation with the number of satellites in a constellation—something both companies have previously acknowledged is not accurate.[33] As SES has explained in the past, adding more satellites to an NGSO system "will enhance [its] its ability to use satellite diversity to share spectrum with NGSO satellite networks, in addition to expanding the network's capacity and resiliency.[34] SpaceX, in defending its own satellite system, stated it can "successfully coordinate" with other NGSO systems in part because the number of satellites "will provide multiple NGSO satellites in the field of view of any given earth station," enabling SpaceX to "select the specific satellite that would avoid a potential in-line interference event with GSO and other NGSO operations."[35]

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[33] *See* SpaceX Petition at 24; SES Petition at 14-16. Additionally, OneWeb notes that it has been involved in detailed coordination discussions with SES for over two years, using real parameters and actual data, rather than the generic hypotheticals described in the SES Petition. *See* SES Petition at 13-16.

[34] *See O3b Limited Petition for a Declaratory Ruling Granting Access to the U.S. Market for the O3b MEO Satellite System,* Petition for Declaratory Ruling, IBFS File No. SAT-LOI-20141029-00118, Attachment A, Technical Information to Supplement Schedule S at 29 (filed Oct. 29, 2014).

[35] *Application of Space Exploration Holdings, LLC for Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System*, IBFS File No. SAT-LOA-2016115-00118, Attachment A, Technical Information to Supplement Schedule S at 36 (filed Nov. 15, 2016).

SpaceX also makes unwarranted claims that grant of the Amendment Application would create more NGSO sharing issues than OneWeb's proposed modification to its authorized LEO satellites.[36] Specifically, SpaceX advances the meritless contention that the disparity in effective isotropic radiated power (EIRP) levels between the respective uplink transmissions of OneWeb's LEO and MEO Components means that OneWeb's Amendment Application would have a negative impact on other applicants.[37] In particular, SpaceX asserts that "very large separation angles are required to reduce ΔT/T below the 6% threshold at which band splitting may be required."[38] SpaceX's assertion in this regard is incorrect as initially demonstrated in the chart below where the path loss difference between the LEO Component and MEO Component alone is taken into account. Assuming (i) a hypothetical coordination agreement entails orbit avoidance of 3 degrees with a 0.3m Ku-band earth station, (ii) worst case relative path losses between LEO and MEO Components (the ratio improves with non-zenith elevations), and (iii) no satellite G/T benefit at the MEO satellite, the avoidance angle necessary to compensate for the increased EIRP is an additional 3.6 degrees (6.6 minus 3.0).

Altitude	1200.0	8500.0	*km*
Worst Case Relative Pathloss	0.0	17.0	*dB*
Relative Satellite Receive G/T	0.0	0.0	*dBK*
EIRP increase	0.0	17.0	*dB*
Avoidance angle to maintain equal power at victim	**3.0**	**6.6**	***deg***

[36] SpaceX Petition at 24.
[37] *Id.* 24-25.
[38] *Id.* at 24.

Thus, SpaceX is simply wrong to assert that "very large separation angles are required" when comparing LEO to MEO coexistence.[39] Furthermore, the suggestion that "in extreme cases, there is simply no separation angle that can achieve the ΔT/T of 6% for uplink" is equally unfounded.

SpaceX's overly generic assessment also ignores numerous possible differences between the respective MEO and LEO link architectures, including minimum elevation angle, power compensation strategy, and most importantly, space station receive antenna beam width (which impacts the satellite receive G/T levels), all of which further reduce the apparent disparity in EIRP between the MEO and LEO uplink EIRP levels. For example, in V-band, OneWeb MEO satellites utilize a receive beam gain (and hence satellite receive G/T level) that is 11.5 dB higher gain than the OneWeb LEO satellites. This 11.5 dB increase in MEO satellite receiver sensitivity partly compensates for the 17 dB range difference between LEO and MEO satellites, and so would further reduce the separation angles that were calculated for the MEO satellites in the table above.

Finally, SpaceX fails to consider the difference in the size of the geographic coverage areas between LEO and MEO satellites, which can be a factor of more than 10 when assuming similar elevation angle constraints. The availability of this larger area to each MEO satellite results in considerably more available link geometries that can be utilized during coordination between NGSO systems. Therefore, SpaceX's concern regarding separation angles is misguided,

[39] *Id.*

and OneWeb does not expect that its MEO Component architecture will unduly impact SpaceX's—or any other NGSO operator's—planned constellations.[40]

Furthermore, no commenter has asserted that OneWeb's proposed operations in the E-band will result in harmful interference to future satellite operations. Both SpaceX and SES acknowledge that there are currently no authorized satellite systems in the E-band.[41] The Commission itself has acknowledged the E-band spectrum is "the functional equivalent of a green field" over most of the U.S.[42] Moreover, the independent analysis of the Elefante Group—the only commenter on the Amendment Application who currently proposes E-band operations—explicitly supports OneWeb's conclusion that an increase in the number of satellites will not increase interference to other NGSO operators.[43] Simply put, OneWeb's Amendment Application will not increase the risk of interference to any operator in the E-band, nor will OneWeb's MEO Component foreclose future uses of the E-Band. Given OneWeb's ability to share E-band frequencies with future E-band operators, there is no need for the Commission to foreclose OneWeb access to the E-band.

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[40] And as demonstrated in OneWeb's Opposition to the pleadings filed against Modification Application, grant of the Modification Application also will not cause any harmful interference to other NGSO operators. *See* Modification Opposition and Reply Comments.
[41] *See* SES Petition at 24; SpaceX Petition at 27.
[42] *Allocation of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz for Government Operations,* Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014, at ¶ 432 (2016).
[43] *See generally* Comments of the Elefante Group, Inc., IBFS File No. SAT-AMD-20180104-00004 (filed Aug. 6, 2018).

B. OneWeb's Amendment Application Was Necessitated By Events OneWeb Could Not Have Reasonably Foreseen at the Time of Filing

OneWeb's Amendment Application was necessitated by the Commission's decision to change the milestone rules in the middle of multiple processing rounds. OneWeb filed a petition for U.S. market access in the V-band on March 1, 2017.[44] Three months prior, the Commission had released a Notice of Proposed Rulemaking, which proposed for the first time—and at SpaceX's prompting[45]—a milestone regime requiring launch of 75% of an authorized constellation in six years.[46] When OneWeb filed the V-band Petition, it had no way of knowing whether the Commission would adopt a 75% milestone or something much more stringent or much more lenient. It was not until after OneWeb filed its V-band Petition that the Commission adopted the *NGSO Order*, adopting a 50% launch and operation requirement by year six.[47] OneWeb's Amendment Application reflects the MEO Component for which it would have filed had it known what the Commission's final milestone requirement was going to be.

Unsurprisingly, OneWeb is not alone in pointing out that applicants should be allowed to amend their applications and petitions in light of rule changes adopted in the *NGSO Order*.[48] As Viasat observed in the NGSO rulemaking proceeding, refusing to allow changes would "effectively handicap[ ] those applicants that responsibly designed and proposed networks that compl[ied] with the Commission's existing rules in the first instance . . . plac[ing] the risk and

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[44] *See* OneWeb V-band Petition.
[45] *See Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed Satellite Service Systems and Related Matters,* Notice of Proposed Rulemaking, 31 FCC Rcd 13651, ¶ 32, n.81 (2016) ("*NGSO NPRM*"); Reply Comments of SpaceX, IB Dkt No. 12-267, at 8-9 (filed Mar. 2, 2015).
[46] *See id.* at ¶ 32.
[47] *NGSO Order*, 32 FCC Rcd 7809 at ¶ 67.
[48] *See* Viasat Reply, at 8-10.

burden associated with the proposed NGSO co-existence rules on applicants that filed compliant applications well before this proceeding ever started."[49] Instead, basic principles of equity dictate that when the Commission alters fundamental rules in the midst of three processing rounds, applicants should be allowed to make changes to their pending applications without being penalized and deferred to a subsequent processing round.[50] The Commission should not encourage applicants to file for unrealistic constellations based on a gamble about what the Commission's final rules might be six months later. Such a situation would lead to inequitable results that are not what the Commission intended when it originally adopted Section 25.116 of the Commission's rules.

C. OneWeb's Amendment Application Should Be Addressed in the Current Processing Round

SpaceX and SES argue that the Amendment Application should be dismissed or deferred to a subsequent processing round.[51] To the contrary, applicable Commission precedent demonstrates that the Commission should waive Sections 25.116, 25.155, and 25.157 of the Commission's rules to address the OneWeb Amendment Application in the current processing round. Even if OneWeb's Amendment Application did not fall into one of the exceptions articulated in Section 25.116(c)—it does—the Commission should waive those rules and process OneWeb's Amendment Application in the current processing round for equitable reasons.

The Commission has long acknowledged that waivers are appropriate when, because of special circumstances, deviation from a rule would better serve the public interest than would

[49] *See id.* at 30.
[50] *See id.*
[51] *See* SpaceX Petition at 16-27; SES Petition at 12-24.

strict adherence to it, and granting the waiver would not undermine the rationale for the rule.[52] For example, the Commission has previously waived the processing round requirement for other NGSO constellations where the applicant's use of the proposed spectrum would not create a risk of interference to other present or future users of the spectrum.[53] The addition of satellites in the Ku-, Ka-, and V-bands will enhance OneWeb's ability to utilize satellite and frequency diversity, as well as other interference mitigation approaches to be agreed upon during coordination discussions, across the OneWeb NGSO system. And, since the E-band has no current operators, OneWeb's proposed use of the E-band and ability to share E-band frequencies do not create a risk of interference to future satellite operators.

SpaceX's reliance on the *Echostar* and *Starsys* precedent to suggest that OneWeb's Amendment Application should be deferred to a subsequent processing round is fundamentally flawed. *Echostar* involved a grossly untimely filing by Echostar, submitted over *four years* after the relevant filing deadline had passed.[54] In addition, *Echostar* involved a GSO processing round with a different set of regulatory and policy considerations than the current NGSO FSS processing round.[55] This is not remotely similar to the circumstances surrounding the

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[52] *See Northeast Cellular*, 897 F.2d at 1166.
[53] *Northrop Grumman Space & Mission Systems Corporation; Applications for Authority to Operate a Global Satellite System Employing Geostationary Satellite Orbit and Non-Geostationary Satellite Orbit Satellites in the Fixed-Satellite Service in the Ka-band and V-band,* Order and Authorization, 24 FCC Rcd 2330, at ¶ 34 (IB 2009); *see also Application of O3b Limited to Operate a Gateway Earth Station with a Non-U.S. Licensed, Non-Geostationary Orbit Ka-band Space Station System*, IBFS File No. SES-LIC-20100723-00952, Radio Station Authorization, at 6, Condition 90043 (granted Sept. 25, 2012).
[54] *Echostar Satellite Corporation*, 16 FCC Rcd 14300, at ¶ 3 (2001) ("*Echostar*").
[55] *Id.*

Amendment Application, which was filed shortly after the *NGSO Order* was released. *Echostar* simply is not applicable to the Amendment Application.

Likewise, SpaceX relies on *Starsys* to argue that the Commission should only waive Commission rules where the Commission explicitly states that major amendments are required.[56] But *Starsys* involved an amendment filed *four years* after the initial application was submitted to the Commission and that was at odds with a spectrum sharing regime that had been agreed to by all processing round applicants.[57] Here, no such sharing agreement has been mutually agreed upon by all the processing round applicants. Therefore, the spectrum sharing environment would not be impacted by the processing of the Amendment Application, and OneWeb would remain subject to the Commission's spectrum sharing rules for NGSO systems when operating in the United States.[58] In other words, *Starsys* involved processing round dynamics far different than OneWeb currently faces. *Echostar* and *Starsys* provide no basis for the Commission to reject OneWeb's Amendment Application.

In short, contrary to the assertions of SpaceX and SES, it will serve the public interest for the Commission to waive Sections 25.116, 25.155 and 25.157(c) for the Ka-, Ku-, E-, and V-bands and grant OneWeb's Amendment Application within the context of the current NGSO processing round. As SpaceX pointed out in its comments to OneWeb's Amendment Application, flexibility is important to NGSO FSS operators.[59] Equally important to NGSO FSS

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[56] *See* SpaceX Petition at 20.
[57] *Application of Starsys Global Positioning, Inc.*, Order and Authorization, 11 FCC Rcd 1237, at ¶ 20 (1995) ("*Starsys*").
[58] *See* 47 C.F.R. § 25.261.
[59] Comments of Space Exploration Holdings, LLC, IBFS File No. SAT-MOD-20180319-00022, at ii (filed July 30, 2018).

operators is accurately forecasting the regulatory environment. Here, the Commission relaxed several rules fundamental to the NGSO operating environment, including the milestone regime, EPFD compliance demonstrations, and geographic coverage requirement. Where the Commission alters fundamental rules *after* initiating three processing rounds, it should allow applicants to amend their pending applications without being penalized and deferred to a subsequent processing round.

III. NGSO FEEDER LINKS CAN SUPPORT MSS AND FSS SYSTEMS

Iridium seeks to prevent OneWeb from accessing the 19.4-19.6 GHz, 29.1-29.25 GHz, and 29.25-29.5 GHz bands ("MSS Feeder Links Bands") based upon assertions that OneWeb's planned operations are inconsistent with the Ka-band Plan and the Commission's regulations.[60] Similar to its treatment of Iridium's past attempts to prevent NGSO operators from accessing the MSS Feeder Link Bands, the Commission should allow OneWeb to proceed with its proposed use of the MSS Feeder Link Bands.[61]

As an initial matter, OneWeb recognizes Iridium's rights and operations in the MSS Feeder Link Bands. OneWeb remains willing to coordinate with Iridium to ensure effective sharing of this spectrum.[62] Notwithstanding OneWeb's willingness to coordinate with Iridium,

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[60] Petition to Deny of Iridium Constellation LLC, IBFS File No. SAT-AMD-20180104-00004 (filed Aug. 6, 2018) ("Iridium Petition").

[61] *See, e.g., O3b Grant* at ¶¶ 21-23 (dismissing Iridium's Petition to Deny O3b access to the MSS and MSS Feeder Link Bands); *NGSO Order* at ¶ 19 (granting access to the 19.3-19.4 GHz and 19.6-19.7 GHz bands over Iridium's objections).

[62] *See* Amendment Application, Technical Annex at 34 ("OneWeb is confident that it can efficiently share the spectrum used by Iridium without causing any interference or operational disruption to the Iridium system. This will be achieved through coordination with Iridium, and placement of the OneWeb gateway earth stations in the United States such that there is sufficient geographic separation between the gateway stations of Iridium and those of OneWeb"); *see also* 47 C.F.R. § 25.250 (outlining coordination requirements between NGSO feeder links).

OneWeb's planned operations in the MSS Feeder Link Bands are consistent with the U.S. Table of Frequency Allocations and the Commission's Ka-band Plan and applicable regulations, including those of the ITU.[63]

As Iridium notes, OneWeb does not currently plan to offer MSS in the United States.[64] Instead, OneWeb plans to offer MSS outside the United States. It is possible that OneWeb will support such MSS operations via gateway earth stations that will be located in the United States. Consequently, OneWeb has sought authority for access to the MSS Feeder Link Bands, from within the United States, to support these MSS operations.

Iridium's arguments in support of its attempt to foreclose access to these bands are easily refuted for three reasons. *First*, Iridium cites the *DISCO II* framework for the proposition that the Commission grants market access "only to the extent that 'the non-U.S.-licensed NGSO-like satellite system' is 'seeking to serve the United States.'"[65] But the Commission has already properly concluded that OneWeb satisfied the *DISCO II* framework for U.S. market access.[66] The addition of the MSS Feeder Link Bands does nothing to undermine the Commission's determination. OneWeb—like Iridium—is inherently global and the global connectivity created by its NGSO system will further the public interest in the United States even though many of its services may in fact be provided overseas.

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[63] *See NGSO Order*, App. A.
[64] *See* Amendment Application, Legal Narrative at n. 3.
[65] Iridium Petition at 3.
[66] *See WorldVu Satellites Limited Petition for Declaratory Ruling Granting Access to the U.S. Market for the OneWeb NGSO FSS System,* Order and Declaratory Ruling, 32 FCC Rcd 5366, Statement of Chairman Ajit Pai (2017) (stating "today, the FCC harnesses that inspiration as we seek to make the promise of high-speed Internet access a reality for more Americans, partly through the skies").

Second, Iridium claims that OneWeb's planned operations are inconsistent with the Ka-band Plan. Iridium notes that OneWeb "proposes to operate mobile terminals in frequencies where the FCC's band plan does not even permit MSS operations, specifically the 19.7-20.2 GHz and 29.5-30.0 GHz bands."[67] Yet Iridium fails to acknowledge that footnote 6 of the Amendment Application's Technical Annex states that any MSS user terminals would "operate *in internationally recognized MSS frequency allocations* such as 19.7-20.2 GHz, 29.5-30.0 GHz, 40.0-40.5 GHz, and 50.4-51.4 GHz,"[68] and that such operations would take place outside of the United States. OneWeb only intends to use the MSS Feeder Link Bands as just that: feeder link bands for MSS operations, which is entirely consistent with the Commission's Ka-band Plan.

In the *O3b Grant*, the Commission, on its own motion, waived the Ka-band Plan to allow O3b access to the 19.7-20.2 and 29.5-30.0 GHz frequencies for MSS operations.[69] While OneWeb does not seek authorization for such access at this time, the Commission's reason for granting such access to O3b are instructive. In particular, the Commission noted that traditional distinctions between FSS and MSS services are losing relevance, and that the Commission has recently "allowed mobile applications within FSS."[70] The Commission also noted that O3b's mobile operations will use directional antennas capable of sharing spectrum.[71] These

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[67] Iridium Petition at 4.
[68] Amendment Application, Technical Annex at 3, n. 6. Similarly, footnote 37 notes that the 19.7-20.2 GHz band "is allocated for MSS downlinks on a primary basis according to the U.S. Table of Frequency Allocations and the ITU Table of Frequency Allocations, but MSS is not included in the Commission's Ka-band Plan. *At this time, OneWeb is not seeking authority to operate MSS earth stations in the United States*. However, such feeder link usage in the United States to serve MSS terminals in oceanic areas outside U.S. territory would be entirely consistent with the ITU Radio Regulations and the Commission's rules."
[69] *O3b Grant* at ¶ 22.
[70] *Id*. at n. 59.
[71] *Id*.

considerations are equally relevant for OneWeb. Far from an attempt to "evade" the Ka-band Plan, OneWeb's proposal is in fact squarely in line with applicable precedent and the Commission's explicit recognition that granting access to these bands for innovative NGSO-based services is necessary as traditional FSS and MSS platforms continue to converge.

Third, as multiple satellite operators have pointed out to the Commission, the MSS Feeder Link Bands are currently underutilized.[72] Because Iridium's NGSO MSS feeder links are limited in number, OneWeb anticipates it will not be difficult to coordinate shared use of the MSS Feeder Link Bands. To deny OneWeb access to this spectrum would be to allow this spectrum to otherwise remain underutilized, which is directly at odds with the Commission's goal of "promot[ing] more flexible use" of the MSS Feeder Link Bands.[73]

Accordingly, Iridium's criticisms of OneWeb's planned operations are unsupported, and the Commission should grant OneWeb access to the MSS Feeder Link Bands.

IV. THE ONEWEB APPLICATION IS CONSISTENT WITH COMMISSION ORBITAL DEBRIS REGULATIONS

OneWeb's debris mitigation plan remains subject to direct and effective regulatory oversight by the United Kingdom Space Agency (UKSA). Under Section 25.114(d)(14) of the Commission's rules, "[f]or non-U.S.-licensed space stations, the requirement to describe the design and operation strategies to minimize orbital debris risk can be satisfied by demonstrating that debris mitigation plans for the space station(s) for which U.S. market access is requested are subject to direct and effective regulatory oversight by the national licensing authority."[74] NGSO

[72] *See, e.g.,* Comments of Viasat, Inc., IB Dkt. No. 16-408 at 9 (filed Feb. 27, 2017); Comments of O3b Networks; Comments of O3B Limited, IB Dkt. No. 16-408 at i (filed Feb. 27, 2017).
[73] *NGSO NPRM* at ¶ 32.
[74] 47 C.F.R. § 25.114(d)(14).

systems that are subject to direct and effective regulation by the United Kingdom concerning orbital debris mitigation are not required to provide an orbital debris mitigation showing.[75] In keeping with this principle of comity, the Commission has granted amendments of applications to companies like O3b without requiring supplemental debris mitigation plans because that company was subject to the United Kingdom's debris mitigation requirements.[76]

OneWeb will continue to work directly with the UKSA. To the extent that the Commission has questions regarding the UKSA's oversight of the MEO Component, OneWeb will promptly provide such information as requested.

[75] *See Petition for Declaratory Ruling of 03b Limited Granting Access to the U.S. Market for the O3b MEO Satellite System*, IBFS File No. SAT-AMD-20150115-00004, Radio Station Authorization, at 4, Condition 15 (granted Jan. 22, 2015) (stating "[t]his grant is based upon the finding that SES Limited is and will be subject to direct and effective regulation by the United Kingdom concerning orbital debris mitigation" and granting a minor amendment without a new debris management plan).

[76] *Id.*

CONCLUSION

The OneWeb Amendment Application establishes that OneWeb's proposed expansion of the MEO Component would serve the public interest and help resolve frequency conflicts. No party has demonstrated that the OneWeb Amendment Application is inconsistent with the Commission's Part 25 standards for amendments, or that the Amendment Application is not subject to an exception to the Commission's rules regarding newly filed applications. Accordingly, OneWeb respectfully requests that the Commission expeditiously grant the OneWeb Amendment Application.

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August 27, 2018

CERTIFICATION OF PERSON RESPONSIBLE FOR PREPARING ENGINEERING INFORMATION

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

Dated: August 27, 2018

By *<u>/s/ Richard J. Barnett</u>*

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CERTIFICATE OF SERVICE

I, Hannah Wigger, hereby certify that on this 27th day of August, 2018, I caused a true and correct copy of the foregoing "Consolidated Opposition and Reply Comments of OneWeb" to be sent by first class mail, postage prepaid, to the following:

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