Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Allocation and Authorization of Additional	)	RM-_____
Spectrum for the Fixed-Satellite Service in the	)	
50.4-51.4 GHz and 51.4-52.4 GHz Bands	)	

PETITION FOR RULEMAKING

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SUMMARY

With this petition, The Boeing Company ("Boeing") proposes the allocation and authorization of additional uplink (Earth-to-space) spectrum for the Fixed-Satellite Service ("FSS"), in the bands 50.4-51.4 GHz and 51.4-52.4 GHz. This new uplink spectrum will help create a five gigahertz block of uplink spectrum that, paired with FSS downlink spectrum in the 37.5-42.5 GHz band, will enable very high data-rate V-band satellite broadband services in the near future.

The 50.4-51.4 GHz and 51.4-52.4 GHz bands are well-suited for FSS operations. There are no active non-Federal terrestrial or satellite users of these bands and little or no Federal use. The authorization of FSS operations in these bands is consistent with the existing international allocation in the 50.4-51.4 GHz band, and the emerging international consensus regarding FSS use of the 51.4-52.4 GHz band. By combining this otherwise largely fallow spectrum with the existing V-band FSS allocations, the Commission can create a powerful new option for the delivery of satellite broadband services.

The authorization of additional FSS uplink spectrum will strongly serve the public interest and the Commission's policy goals. Demand for broadband service has grown exponentially in recent years. One of the Commission's most pressing initiatives is to foster greater availability of affordable, high-quality broadband Internet service, particularly in rural, remote and impoverished areas where terrestrial providers cannot or will not build out. Next-generation broadband satellite systems – such as the V-band NGSO system Boeing is applying for concurrent with this petition – could bridge the broadband gap by delivering high-speed, low-latency communications service to all users at the same cost regardless of location. By bringing comparable Internet speeds, performance and prices to Americans

regardless of where they live, satellite broadband systems also have the potential to create new national broadband competitors and re-invigorate the United States telecommunications marketplace. These next-generation systems can also extend U.S. leadership in advanced aerospace, satellite and earth station technologies.

FSS systems operating in the 50.4-52.4 GHz range will be able to provide valuable new services throughout the entire United States without increasing the risk of interference to existing co-frequency or adjacent-band users. There is no risk of interference to terrestrial fixed or wireless operations because there are currently no non-Federal terrestrial users in this band. Although the 2015 World Radiocommunication Conference ("WRC-15") has initiated studies examining the potential for International Mobile Telecommunications ("IMT") in this band, it is likely that the constraints of protecting passive services will make this band ultimately unsuitable for IMT, leaving this band otherwise unused for the foreseeable future. To the extent IMT systems may be deployed in the 50.4-52.4 GHz band, they may employ opportunistic spectrum access techniques to avoid potential interference from FSS earth station transmissions.

FSS in the 50.4-52.4 GHz band will also not present a risk of interference to passive services such as Earth Exploration Satellite Service ("EESS") or radio astronomy. V-band FSS will adopt the same out of band emissions limits that currently protect EESS and radio astronomy operations in adjacent bands, and can employ exclusion zones around radio astronomy observatories as necessary.

To the extent that Federal users are operating in this band, interference with these operations can also be avoided through the use of exclusion zones, which are already commonly employed.

Given the constantly increasing need for broadband connectivity nationwide, it is strongly in the public interest for the Commission to facilitate investment in very high data-rate V-band satellite services. Authorizing FSS operation in the otherwise fallow spectrum throughout the 50.4-52.4 GHz band is a critical step to unlocking the full power of high-frequency FSS to provide nationwide satellite broadband.

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To: FCC Secretary

PETITION FOR RULEMAKING

Pursuant to Section 1.401 of the Commission's Rules,[1] The Boeing Company ("Boeing") urges the Commission to allocate and authorize additional uplink (Earth-to-space) spectrum for the Fixed-Satellite Service ("FSS") in the spectrum bands 50.4-51.4 GHz and 51.4-52.4 GHz.

Specifically, Boeing requests that the 50.4-51.4 GHz band – which already includes an allocation for FSS – be added to the list of frequencies authorized for Earth-to-space FSS transmissions in Section 25.202 of the Commission's rules.[2] With respect to the 51.4-52.4 GHz band, which does not yet include an FSS allocation, Boeing requests that the Commission add FSS Earth-to-space as a co-primary allocation in the U.S. Table of Frequency Allocations and add this band to the list of authorized FSS Earth-to-space frequencies.[3] These changes will help create a five gigahertz block of uplink spectrum that, paired with FSS downlink spectrum in the 37.5-42.5 GHz band, will enable satellite broadband service by very high data-rate broadband satellite systems that will be deployed in the near future.

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[1] 47 C.F.R. § 1.401.

[2] 47 C.F.R. § 25.202(a)(1).

[3] 47 C.F.R. § 2.106; 47 C.F.R. § 25.202(a)(1).

I. SUMMARY

The Commission has repeatedly recognized the near-constant growth in demand for ubiquitously available, high-speed broadband service. Among the services being developed to meet this demand is a new generation of very high data-rate satellites designed to leverage the unique characteristics of high-band spectrum, including the V-band. The services enabled through the use of this spectrum would provide a dramatic improvement in the speed and latency of satellite broadband available to United States consumers, promoting the Commission's goals of universal service and competition in the broadband market.

Currently, FSS V-band allocations exist for four and a half gigahertz of downlink spectrum (37.5-42.0 GHz, space-to-Earth).[4] To this existing allocation, the Commission has appropriately proposed adding an additional one half gigahertz of downlink spectrum at 42.0-42.5 GHz in order to make more intensive use of this underused block while maintaining adequate protection for radio astronomy in the adjacent 42.5-43.5 GHz band.[5] This action will create five gigahertz of FSS V-band downlink spectrum.

There are currently four gigahertz of allocated FSS uplink spectrum (47.2-50.2 GHz and 50.4-51.4 GHz, Earth-to-space) in the United States, although the upper most one gigahertz has not been designated for FSS use in Part 25 of the Commission's rules.[6] To realize the full

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[4] 47 C.F.R. § 2.106.

[5] *See* Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band et al., IB Docket No. 97-95, FCC 10-186 ¶¶ 12-19 (2010) ("*V-Band Third FNPRM*").

[6] Boeing acknowledges that a Federal-only FSS uplink allocation exists at 42.5-43.5 GHz, adjacent to the V-band downlink range and co-frequency with radio astronomy operations. Because additional FSS uplink spectrum near the existing FSS Earth-to-space allocation is vastly superior than this lower-band uplink, Boeing does not seek reallocation or access to the 42.5-43.5 GHz band.

benefits of nationwide broadband via high data-rate V-band FSS, the Commission should authorize FSS Earth-to-space operations in the 50.4-51.4 GHz band and allocate the 51.4-52.4 GHz band for FSS uplinks to create a full five gigahertz of paired spectrum for V-band FSS operations.

II. BACKGROUND

The 50.4-51.4 GHz band is a shared band between Federal and non-Federal users, with co-primary allocations for Fixed, FSS, Mobile, and MSS.[7] There are no non-Federal terrestrial or satellite networks licensed in this band. The only reported Federal users are NASA and military agencies, which have previously reported using portions of the 50.0-55.0 GHz band for radar research and development.[8]

The 51.4-52.4 GHz band is a shared Federal/non-Federal band currently allocated for terrestrial fixed and mobile wireless services. There are no active licenses for non-Federal fixed or mobile services in this band.[9] Likewise, there appears to be little or no Federal use of this band, with the only reported users being the radar research that NASA and the military agencies have reported conducting in portions of the 50-55 GHz range.[10]

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[7] 47 C.F.R. § 2.106.

[8] Federal Spectrum Use Summary, 30 MHz – 3000 GHz, National Telecommunications and Information Administration, Office of Spectrum Management, at 78 (Jun. 21, 2010) (available at https://www.ntia.doc.gov/files/ntia/Spectrum_Use_Summary_Master-06212010.pdf) ("*Federal Spectrum Use Summary 2010*").

[9] ULS License Search for licenses in this range, last reviewed May 11, 2016.

[10] *Federal Spectrum Use Summary 2010* at 78.

Boeing proposes that these otherwise largely fallow spectrum bands be combined with the existing V-band FSS uplink spectrum to create a full five gigahertz of paired spectrum suitable for use by high data-rate satellites providing nationwide broadband services. This proposal is consistent with the existing international allocation in the 50.4-51.4 GHz band, and the emerging international consensus regarding FSS use of the 51.4-52.4 GHz band.

ITU-R Resolution 162, adopted at WRC-15, notes that satellite service plays an important role in achieving universal broadband access and that technological developments such as spot-beam technologies and frequency re-use achieve very efficient use of spectrum.[11] Accordingly, Resolution 162 initiated a series of studies intended to pave the way for a new primary allocation to the FSS in the 51.4-52.4 GHz band. Although these studies are focused in part on creating an FSS allocation to support feeder links for GSO satellites, Resolves 1 of Resolution 162 calls for studies on "the additional spectrum needs for development of the fixed-satellite service, taking into account the frequency bands currently allocated to the fixed-satellite service, the technical conditions of their use, and the possibility of optimizing the use of these frequency bands with a view to increasing spectrum efficiency."[12] Any such comprehensive review of the additional spectrum needs for FSS necessarily must include consideration of the spectrum needs for other types of FSS systems, such as those operating with non-geostationary satellite orbit ("NGSO") constellations. Further, individual Administrations would remain free to shape this allocation based on their national spectrum environment and needs.

[11] RESOLUTION 162 (WRC-15) Studies relating to spectrum needs and possible allocation of the frequency band 51.4-52.4 GHz to the fixed-satellite service (Earth-to-space) (available at http://www.itu.int/dms_pub/itu-r/oth/0c/0a/R0C0A00000C0025PDFE.pdf).

[12] *Id.*

In the United States, the 50.4-51.4 GHz and 51.4-52.4 GHz bands are well-suited for satellite use because they are unused by terrestrial wireless, nearly adjacent to substantial existing FSS allocations and subject to interference protection requirements with which FSS operators can comply. In 2010, the Commission noted that the use of "spot beams" made possible by higher frequency FSS allows satellite operators to shape their service areas with high accuracy, a capability not available to some other communications technologies.[13] FSS spot beams permit the creation of accurate and reliable exclusion zones, which provide greater protection for other users such as radio astronomy, enhancing the possibility of sharing between FSS and incumbent services.[14] Based on this conclusion, the Commission proposed to eliminate the Broadband Satellite Service allocation in the 42.0-42.5 GHz band in favor of an FSS allocation in order to promote greater use of the spectrum while protecting adjacent frequency radioastronomy operations.[15] The high degree of protection for adjacent services – and the correspondingly greater sharing capabilities – afforded by FSS operations are equally relevant in the 50.4-51.4 GHz and 51.4-52.4 GHz bands.

III. THE PUBLIC INTEREST BENEFITS OF THE PROPOSED ADDITIONAL FSS EARTH-TO-SPACE SPECTRUM ALLOCATION

The authorization of additional FSS uplink spectrum will strongly serve the public interest and the Commission's policy goals. One of the Commission's most pressing goals is to foster greater availability of affordable, high-quality broadband Internet service. As Chairman Wheeler observed, "access to broadband is a powerful motor for lifting people from poverty and

[13] *V-Band Third FNPRM*, ¶ 18.

[14] *Id*.

[15] *Id*.

reducing economic inequalities."[16] The 2010 *National Broadband Plan* recognized the paradox of broadband service, noting that while broadband "is a modern necessity of life, not a luxury,"[17] the project of deploying ubiquitous broadband is "the great infrastructure challenge of the early 21st century."[18] The Chairman has confirmed that "satellites will be crucial to the success" of universal broadband access, both in the United States and abroad.[19] Next-generation broadband satellite systems can bridge the broadband gap because they are able to deliver advanced communications service to all users at the same cost regardless of location.

Concurrent with this petition, Boeing is submitting an application to launch and operate such a system. Boeing is proposing an NGSO low earth orbit ("LEO") satellite system that would operate in the V-band to provide low-latency, very high data-rate broadband coverage throughout the United States and internationally.[20] Boeing's NGSO FSS system could introduce new capabilities into the broadband marketplace, furthering the Commission's goals of achieving ubiquitous, high-quality, competitive broadband in the United States. The proposed addition of two gigahertz of V-band FSS uplink spectrum would therefore serve the public interest by permitting satellite operations to make use of this largely fallow spectrum to serve a

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[16] Remarks of Chairman Tom Wheeler, 19th Annual Satellite Leadership Dinner (March 7, 2016) (available at https://apps.fcc.gov/edocs_public/attachmatch/DOC-338135A1.pdf) ("*Chairman Wheeler Speech*").

[17] Federal Communications Commission, Omnibus Broadband Initiative, *Connecting America: The National Broadband Plan* (2010) ("*National Broadband Plan*"), at 338 (*available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-296935A1.pdf).

[18] *Id.* at xi.

[19] *Chairman Wheeler Speech*.

[20] The Boeing Company Application for Authority to Launch and Operate a Non-Geostationary Low Earth Orbit Satellite System in the Fixed Satellite Service (S2966), SAT-LOA-20160622-00058 (Filed June 22, 2016).

constantly growing national need, without increasing the risk of interference to other spectrum users.

A. The Proposed New FSS Allocation Will Help Facilitate National Broadband Access

Nearly one hundred million Americans, many in rural and remote areas, still do not have access to broadband, in part because the cost of deploying terrestrial broadband networks is extremely high.[21] Although 96 percent of those living in urban areas of the United States have access to broadband Internet with speeds at least 25 MB down/3 MB up,[22] 39 percent of those in rural areas – more than 23 million people – do not.[23] On Tribal Lands, the disparity is even more stark: 41 percent of those living on Tribal Lands – more than 1.5 million people – lack access, including 68 percent of those living on Tribal Lands in rural areas.[24] Indeed, a recent report from the Government Accountability Office found that, "[t]he high costs of infrastructure buildout on tribal lands, which tend to be remote and rugged terrain, work in tandem with tribal

[21] *National Broadband Plan* at 3; *Connect America Fund*, WC Docket No. 10-90, Report and Order and Further Notice of Proposed Rulemaking, FCC 11-161, 26 FCC Rcd 17663 ¶ 30 (2011) (allocating "at least $100 million per year to ensure that Americans living in the most remote areas in the nation, where the cost of deploying traditional terrestrial broadband networks is extremely high, can obtain affordable access through alternative technology platforms, including satellite and unlicensed wireless services") ("*USF/ICC Transformation Order*") (subsequent history omitted).

[22] *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 15-191, 2016 Broadband Progress Report, FCC 16-6, 31 FCC Rcd 699 (2016), at Appendix D ("*2016 Broadband Progress Report*").

[23] *Id*.

[24] *Id.,* ¶ 88.

member poverty to create a barrier to high-speed Internet expansion on tribal lands."[25] The Commission has recognized that alternatives to terrestrial service, such as satellite, are likely to be the most viable option for bringing broadband to these areas that remain underserved.[26] Very high data-rate FSS systems operating in the V-band can help fulfill the promise of satellite broadband throughout the United States, including to Americans living in unserved and underserved areas.

B. The Proposed New FSS Allocation Will Help Foster Broadband Competition

Next-generation satellite services using large LEO constellations and operating in the V-band will be able to provide very high data-rate services with low latency, making them optimally positioned to address the persisting inequity of broadband access by bringing comparable Internet speeds, performance, and prices to Americans regardless of where they live. Satellite broadband has the potential to re-invigorate the United States broadband marketplace by bringing new national competitors to a market that has stagnated over the last decade, leaving customers with fewer choices and higher prices. The market for high-speed fixed broadband is relatively stagnant: when it comes to the 25 Mbps downstream service that is increasingly recognized as a baseline,[27] three out of four Americans homes are served by a single provider or

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[25] U.S. Gov't Accountability Office, *Additional Coordination and Performance Measurement Needed for High-Speed Internet Access Programs on Tribal Lands*, GAO-16-222, 29 (Jan. 2016).

[26] *USF/ICC Transformation Order*, ¶ 30.

[27] Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act, GN Docket Not. 14-126, *2015 Broadband Progress Report and Notice of Inquiry on Immediate Action to Accelerate Deployment*, FCC 15-10, 30 FCC Rcd 1375, ¶ 26 (2015) ("*2015 Broadband Progress Report*"); *see also id.*, Statement of Chairman Tom Wheeler.

none at all.[28] The launch and operation of next-generation broadband satellite systems using the V-band could help significantly to remedy this disparity.

C. The Proposed New FSS Allocation Will Further the Goal of Spectrum Efficiency

Through the use of millimeter wave technology and phased arrays forming numerous small transmission and receive beams, high-frequency FSS systems can re-use individual frequencies many times within the beams of a given satellite transponder. Thus, V-band FSS will not only make intensive use of the largely fallow 50.4-51.4 GHz and 51.4-52.4 GHz bands, it will maximize the public interest value of limited spectrum.

Granting this petition to allocate and authorize FSS Earth-to-space transmissions in the 50.4-51.4 GHz and 51.4-52.4 GHz bands would also increase spectrum efficiency by creating full five gigahertz blocks of paired downlink/uplink spectrum. As the Commission has noted, paired uplink/downlink bands tend to increase the efficiency of spectrum use and are "most useful for facilitating rapid deployment of new networks."[29]

IV. FSS SYSTEM OPERATING IN THE 50.4-52.4 GHZ BAND WILL BE ABLE TO PROTECT EXISTING SPECTRUM USERS

FSS operators have significant experience in preventing interference to co-frequency and adjacent frequency users including radioastronomy and the Earth exploration satellite service

[28] Community-Based Broadband Solution: The Benefits of Competition and Choice for Community Development and High-speed Internet access at 12 (*available at* https://www.whitehouse.gov/sites/default/files/docs/community-based_broadband_report_by_executive_office_of_the_president.pdf) (Jan. 2015).

[29] Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, GN Docket No. 12-268, *Report and Order*, FCC 14-50, ¶ 17 (2014).

("EESS"). This will allow FSS operators to make intensive use of this spectrum without increasing the risk of interference to existing co-frequency or adjacent frequency users.

A. Protection of Terrestrial Fixed and Mobile Users

As noted above, there are no currently active non-Federal terrestrial wireless users in this band. WRC-15, however, adopted a U.S.-supported resolution initiating sharing and compatibility studies on the use of certain higher frequencies between 24.25 GHz and 86 GHz for International Mobile Telecommunications ("IMT") service.[30] The studies conducted pursuant to Resolution 238 include the 50.4-52.6 GHz range, which contains the 50.4-51.4 GHz and 51.4-52.4 GHz bands that are the subject of this petition.[31] To the extent IMT systems may be deployed in the 50.4-52.4 GHz band, it may be possible to employ opportunistic spectrum access techniques to avoid potential interference from FSS earth station transmissions.

Boeing also expects that the potential for out of band interference into adjacent EESS (passive) and space research operations both above and below this spectrum will likely make IMT a poor fit for the 50.4-51.4 GHz and 51.4-52.4 GHz bands. In contrast, as discussed below, NGSO FSS would be compatible with passive services.

[30] Resolution 238 (WRC-15), Studies on frequency-related matters for International Mobile Telecommunications identification including possible additional allocations to the mobile services on a primary basis in portion(s) of the frequency range between 24.25 and 86 GHz for the future development of International Mobile Telecommunications for 2020 and beyond (*available at* https://www.itu.int/dms_pub/itu-r/oth/0a/06/R0A0600006C0001PDFE.pdf).

[31] *Id*. at 3.

B. Protection of the Earth Exploration Satellite Service

ITU-R Resolution 750 addresses protection of EESS (passive) operations in the 50.2-50.4 GHz and 52.6-54.25 GHz from active services in adjacent bands.[32] One provision of Resolution 750, codified as footnote US156, requires FSS earth stations in the 50.4-50.9 GHz band to limit out-of-band emissions to -20 dBW/200 MHz as measured at the input of the antenna (Earth stations having an antenna gain greater than or equal to 57 dBi may increase power to -10 dBW/200 MHz).[33] Satellite systems operating in the adjacent bands can comply with these power limits.

Another provision of Resolution 750, codified as footnote US157, limits Fixed operations in the 51.4-52.6 GHz band to -33 dBW in any 100 MHz of the EESS (passive) band.[34] Applying these same limits to operations under the proposed FSS allocation in this band would ensure that the addition of FSS service would not create a source of interference to EESS (passive) operations. Boeing acknowledges that proposed V-band FSS operations in this band would need to comply with the same limits.

In addition to adherence to the power limitations for protection of adjacent band operations, NGSO FSS would be compatible with these passive services through coordination

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[32] Resolution 750 (WRC-07) Compatibility between the Earth exploration-satellite service (passive) and relevant active services, at 480 (*available at* http://www.itu.int/dms_pub/itu-s/oth/02/01/S020100002C4006PDFE.PDF) ("*Resolution 750*").

[33] 47 C.F.R. § 2.106, US156; *see also* Amendment of Parts 2, 15, 80, 90, 97, and 101 of the Commission's Rules Regarding Implementation of the Final Acts of the World Radiocommunication Conference (Geneva, 2012) (WRC-12), Other Allocation Issues, and Related Rule Updates, et al., ET Docket No. 15-99, *Order*, FCC 15-50, ¶¶ 2, 137 (2015) ("*WRC-12 Implementing Order*") (codifying ITU Resolution 750 by adopting allocation table footnote US156).

[34] 47 C.F.R. § 2.106, US156; *WRC-12 Implementing Order,* ¶ 138.

with the limited number of users and the ability to selectively reduce FSS system power or direct uplink beams away from passive receivers, as necessary.

C. Protection of Radio Astronomy

The power level limits established in Resolution 750 for the protection of EESS (passive) in the 50.2-50.4 GHz and 52.6-54.25 GHz bands will also provide substantial protection for radio astronomy operations in these bands. In addition to complying with these power level limits, FSS operators can further protect radio astronomy observations by establishing exclusion zones around radio astronomy observatories as necessary.[35]

D. Protection of other Federal Users

NASA and military agencies have reportedly conducted radar research in portions of the 50-55 GHz band.[36] Interference with any such operations can be avoided through the use of exclusion zones, which are already widely used to avoid interference to radio astronomy stations.

V. CONCLUSION

Given the increasing need for ubiquitous broadband connectivity, it is strongly in the public interest for the Commission to facilitate investment in very high data-rate V-band satellite services. Allocating spectrum and authorizing FSS operations in the otherwise fallow 50.4-51.4 GHz and 51.4-52.4 GHz bands are critical steps to unlocking the full power of high-frequency FSS to provide nationwide satellite broadband. Boeing therefore urges the Commission to

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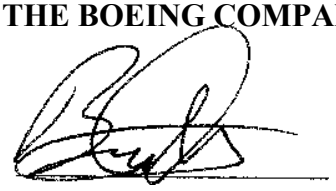
[35] *V-Band Third FNPRM*, ¶ 18.

[36] *Federal Spectrum Use Summary 2010* at 78.

modify Part 2 of its rules to allocate additional V-band FSS Earth-to-space spectrum and to modify Part 25 of its rules to authorize its use for FSS systems at the earliest possible time.

Respectfully submitted,

THE BOEING COMPANY

By: 

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