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ATTORNEYS AT LAW

April 20, 2017

BY ELECTRONIC FILING

Jose P. Albuquerque
Chief, Satellite Division
International Bureau
Federal Communications Commission
445 Twelfth Street, S.W.
Washington, DC 20554

Re: *Space Exploration Holdings, LLC, IBFS File No. SAT-LOA-20161115-00118*

Dear Mr. Albuquerque:

On behalf of Space Exploration Holdings, LLC ("SpaceX"), we hereby respond to your letter dated March 21, 2017, in which you have requested additional information with respect to the above referenced application for authority to deploy and operate a non-geostationary satellite orbit ("NGSO") system.[1]

1. ***A statement from SpaceX disclosing the accuracy with which the parameters of satellite orbits will be maintained, including apogee, perigee, inclination, and the right ascension of the ascending node(s). Although SpaceX indicates that it will maintain the accuracy of its orbital parameters at a level that will allow operations with sufficient spacing to minimize the risk of conjunction with adjacent satellites in the constellation and other constellations, SpaceX must still disclose the information specified above concerning the accuracy of the orbital parameters of its satellite system.***

Apogee and perigee will be maintained to within 30 km, and inclination will be maintained to less than 0.5 degree of the respective target values. The right ascension of the ascending nodes ("RAANs") will precess and span the full range of 0-360 degrees. As the design matures and approaches flight, these values will be refined further.

In addition, SpaceX has designed orbits that feature large self-conjunction miss distances, meaning that, in order to ensure that two SpaceX satellites will never collide, SpaceX satellites

[1] Letter from Jose P. Albuquerque to William M. Wiltshire and Paul Caritj, IBFS File No. SAT-LOA-20161115-00118 (Mar. 21, 2017).

need only maintain a position with a tolerance no larger than 60 km along-track in the worst case, or even greater distances at earlier stages of the roll-out. It is unlikely this full along-track margin will ever be used, but these highly conservative tolerances further improve the robustness of the SpaceX system. Despite these large system tolerances, however, SpaceX will maintain extremely accurate information about the location of each satellite, and make this information available to other operators through its shared ephemeris data.

2. ***Please provide an analysis of collision risk for satellites during the passive disposal phase, i.e., after all propellant is consumed, for a 4,425 satellite deployment, assuming 100% reliability, and using representative scenarios for altitude at the end of the active phase. As part of that analysis, please provide an assessment of how many conjunctions and/or collision avoidance maneuvers might be required of the International Space Station (ISS), assuming it is in operation throughout the period in which SpaceX satellites would transit the ISS orbit.***

As described in the application, after its mission is complete, each spacecraft (regardless of operational altitude) will be moved to a lower altitude circular orbit in its operational inclination. SpaceX will maintain active control of its satellites as they are gradually lowered to orbits with a perigee of at most 300 km, and allocate propellant budgets so that it can perform any collision avoidance maneuvers that might be required during this process. Thus, the passive disposal phase (*i.e.*, after all propellant is consumed or vented) will not even begin until perigee is well below the altitude of the ISS. In addition, because this de-orbiting phase will be relatively brief, SpaceX can choose specific values of RAAN (relative to the ISS RAAN) to ensure that de-orbiting satellites will not intersect the ISS orbit for the vast majority of cases. Even when orbital intersections

occur, the need for collision avoidance will be extremely unlikely. Thus, under nominal operations, no collision avoidance maneuvers should be required of the ISS.[2]

As also discussed in the application, the passive deorbit phase will last no more than one year, well below the international standard of 25 years. The first significant "deorbit phase" of the constellation will occur around 2025, at solar maximum, further decreasing the amount of time required for atmospheric demise down to months or even weeks. During this short window of time, SpaceX anticipates no significant risk of collision with any active satellites or debris. Even so, SpaceX will ensure accurate tracking of all deorbiting satellites in their passive disposal phase, such that other operators would need to engage in conjunction avoidance maneuvers only on extremely rare occasions.

SpaceX will continue to monitor the orbital environment, spacecraft design, and orbital characteristics of its disposal orbits to ensure that these are performed responsibly, and incorporate any improvements should the need become apparent. If future analysis demonstrates the need, the passive deorbit phase could be significantly shortened with only modest propellant impacts.

3. Please 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. This analysis should include a study performed assuming all failures occur at the mission altitude, but may also include additional studies specifying alternative assumptions concerning the orbital locations (such as injection altitude) at which failures might occur.

SpaceX's current and planned space-based activities underscore its unparalleled commitment to safe space. SpaceX has had extensive experience in safe-flight design and

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[2] As NASA has recognized, "[t]he vast majority of space objects decaying down through the lower portions of LEO never pose an actual threat to human space flight operations." *Process for Limiting Orbital Debris*, NASA Technical Standard, NASA-STD-8719.14A, § 4.6.3(c) ("NASA Standard 8719.14A"), *available at* http://everyspec.com/NASA/NASA-NASA-STD/NASA-STD-8719--14A_CHG-1_46754/.

operation through many missions of both the Falcon 9 launch vehicle and the Dragon spacecraft carrying out missions to the ISS. The company is highly experienced with cutting-edge debris mitigation practices and has deep ties with the domestic and international institutions tasked with ensuring the continued safety of space operations.

Accordingly, SpaceX is committed to maintaining a debris-free environment in space. For example, SpaceX has designed a rigorous maneuver response procedure to react to Joint Space Operations Center ("JSpOC") conjunction warning messages, including future enhancements afforded by the Space Fence, in order to tightly control overall constellation risk to a safe value. Its satellites are designed with propulsion systems capable of performing frequent maneuvers to avoid any trackable orbital debris. The constellation itself is designed to avoid any instance in which one satellite would pose a danger to another, without requiring any additional avoidance maneuvers. Each satellite will include redundancy for critical components, as well as other attributes that enhance reliability and survivability. SpaceX will also aggressively monitor the health of each satellite (including specialized on-board instrumentation) so that it can quickly detect any potential problems, and will have recovery protocols in place should such a problem arise.

Having taken such steps to reduce the risk of collision or malfunction, SpaceX views satellite failure to deorbit rates of 10 or 5 percent as unacceptable, and even a rate of 1 percent is unlikely. Not surprisingly, there are several other aspects of the company's operations and business practices that combine to effectively eliminate the chance that such rates will ever occur. First, SpaceX will construct its spacecraft to specifications and tolerances designed to ensure that failure rates are nowhere near the levels postulated in this question. Specifically, SpaceX is

designing the constellation to exceed NASA's debris mitigation guidelines, which require a post-mission disposal success rate of 90 percent,[3] by targeting a less than 1 percent rate of failure to deorbit from all causes. This is not only a sound practice to secure safety of space generally, but also a business imperative for a company like SpaceX that depends upon regular access to and use of space.

In addition, unlike operators with a small number of large satellites, SpaceX's incentives to maintain the overall health of its constellation align well with SpaceX's and the Commission's goals of ensuring the continued safety of space. Because each satellite will constitute only a small portion of the overall system investment, SpaceX will have little incentive to keep an unhealthy satellite in orbit and a far stronger incentive to maintain overall constellation health and an operating environment free of debris. Therefore, SpaceX intends to use information from its aggressive monitoring program to quickly detect any potential problems and deorbit affected satellites at a more conservative threshold of spacecraft health.

Second, SpaceX will deploy its spacecraft incrementally over a long period of time. Launching thousands of satellites will take years to complete, enabling SpaceX to monitor and react to developments with its constellation along the way. Thus, even in the unlikely event that an unforeseen circumstance arises, SpaceX would be able to defer further deployment until the problem has been identified and corrected before resuming launch of subsequent spacecraft.

Third, SpaceX does not intend to freeze the design process for its spacecraft at the first launch. Rather, it will continue to explore new technologies and implement upgrades in an iterative process to ensure that its satellites are highly reliable – a necessity not only for maintaining

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[3] *Id.* § 4.6.2.4(a).

the continued safety of space, but also for delivering a high-quality service. SpaceX already has substantial experience engaging in such a process of continued improvement with its Dragon capsule, and this ongoing review would likely expose and correct any latent defect in system design. This would enable SpaceX not only to avoid launching any more problematic spacecraft, but also to de-orbit any spacecraft already in orbit identified as at risk for similar issues.

SpaceX will work to ensure that the odds of satellite failure to deorbit are driven as far towards zero as possible – both to ensure the continued safety of space and to ensure the continued health of its constellation. To the extent any spacecraft become incapacitated on-station without the ability to maneuver, they would not materially increase the risk of collision with other SpaceX spacecraft; in the unlikely event of a failed satellite, that satellite would merely become another piece of debris and be treated no differently for collision-avoidance screening and risk assessment than any other piece of trackable debris.

The probability of a collision between a failed SpaceX satellite and another piece of debris is also extremely remote. SpaceX has an ongoing simulation corroborating probabilities between JSpOC information and the predictions of NASA's Orbital Debris Engineering Model, which is used to analyze collision risks under different maneuver protocols. Assuming a satellite failure rate of 1 percent at mission altitude and no maneuver events for these incapacitated vehicles, there is approximately a 1 percent chance *per decade* that *any* failed SpaceX satellite would collide with a piece of tracked debris. While the question suggests consideration of higher failure rates, these scenarios would be highly unlikely for the reasons discussed above. In case of such an extreme failure rate, however, the consequences can be approximately linearly extrapolated.

SpaceX commends the Commission for raising this issue, as the elimination of orbital debris is critical for all users of space. This would be an appropriate topic for inquiry of all NGSO applicants to ensure that *all* systems that serve the U.S. meet the same high standard. While the Commission applies its own orbital debris mitigation analysis to those seeking a U.S. license, it cannot simply assume that non-U.S. licensed systems that seek access to the U.S. market have been held to the same standard. The Commission may choose to defer to other licensing administrations on general oversight of debris mitigation efforts. But with respect to this crucial issue in particular, it must collect sufficient evidence to determine whether those administrations have imposed the requisite level of oversight. Unless the Commission receives such evidence, it should require non-U.S. licensees seeking access to the U.S. market to submit a response to this same question. Only in this way can the Commission have confidence that all those NGSO systems serving the United States have adequately considered and planned for mitigation of orbital debris that would pose a serious danger to all other users of space.

4. ***Please state whether, during all stages of satellite operations prior to the passive disposal phase, SpaceX will perform collision avoidance procedures, including conjunction assessment, execution of avoidance maneuvers, trajectory planning and conjunction assessment for any planned alteration of satellite trajectory, and notification to other potentially affected operators of any planned alteration of a satellite's trajectory.***

SpaceX confirms that it intends to perform collision avoidance procedures, including conjunction assessment, execution of avoidance maneuvers, trajectory planning and conjunction assessment for any planned alteration of satellite trajectory, and notification to other potentially affected operators of any planned alteration of a satellite's trajectory. SpaceX will perform conjunction screening and avoidance maneuvers for all phases of operations, including any

planned alteration of satellite trajectory, prior to passive disposal. All satellites will have sufficient propellant and capability to perform any avoidance maneuvers required for all phases of the satellites' mission. SpaceX is already practicing this activity with JSpOC through a simulation of 100 satellites to ensure both parties (SpaceX and JSpOC) are prepared to implement conjunction avoidance strategies with a large constellation. SpaceX intends to share information on planned maneuvers with the satellite community, though it has not yet settled on the exact means through which it will do so. Potential options include JSpOC, the Federal Aviation Administration, and the Space Data Association, among others.

5. Any additional information you may wish to provide concerning human casualty risk resulting from satellite disposal, such as outcomes based on higher fidelity analysis, or any risk or loss mitigation strategies under development.

SpaceX has assigned a high priority to minimizing the risk of damage or injury that may be caused by the planned demise of constellation satellites. Accordingly, SpaceX has applied a design philosophy of using materials that will completely demise during atmospheric re-entry, unless an exception is absolutely necessary to the mission. Its design teams coordinate with all relevant subsystems to ensure design for demisability. For the majority of the satellite, this involves designing components to facilitate rapid break-up upon re-entry. For a select few components made with materials that have extremely high melting points, however, the goal is instead to design structures that resist break-up into multiple pieces so as to minimize the total quantity of high-risk objects that could reach the ground. While an overwhelming majority of each satellite can be expected to demise completely, a preliminary analysis using NASA's Debris Assessment Software ("DAS") has identified a small subset of components that pose a risk of human casualty. These components are currently limited to an iron ion thruster core and a

precision silicon-carbide optical component. In both cases, the material properties of the component in question are critical to the design and function of its parent assembly, through some combination of physical, thermal, or electromagnetic traits.

As a result of these careful design efforts, the NGSO system proposed by SpaceX can be expected to achieve safety levels well above U.S. and international norms. The DAS analysis submitted with SpaceX's application indicates a total spacecraft risk of human casualty rate of between 1:18,200 and 1:31,200 depending upon operational altitude. That level of safety more than satisfies the requirement of 1:10,000 established by NASA and regulatory authorities in other countries.[4] Moreover, as the DAS User's Guide makes clear, "[t]his part of DAS is intended to be a 'first cut' assessment tool" that provides conservative results.[5] It does not, for example, include any consideration of the degree to which people would be located within structures that would provide shelter from potential impact. In 2013, the International Association for the Advancement of Space Safety released a publication that suggests that 19% of the population is unsheltered, 59% is in light shelter, and 22% is in heavy shelter.[6] According to NASA, even lightly-sheltered structures provide protection against falling debris with up to a few kilojoules of kinetic energy.[7] Given that the DAS analysis assumes that debris with as little as 15 joules will result in human

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4 *See* SpaceX Application, Technical Attachment at 53-66 (discussing DAS analysis). *See also* ESA Space Debris Mitigation Compliance Verification Guidelines at 29 (Feb 19, 2015) (establishing 1:10,000 human casualty rate standard for ESA missions), *available at* http://www.iadc-online.org/index.cgi?item=documents.

5 NASA Orbital Debris Program Office, *Debris Assessment Software User's Guide – Version 2.1*, at 35 (Oct. 2016).

6 *See* Tommaso Sgobba, *Safety Design for Space Operations*, The International Association for the Advancement of Space Safety, at __ (2013) ("*Safety Design*"), *available at* http://iaass.space-safety.org/wp-content/uploads/sites/24/2012/12/Safety-Design-for-Space-Operations.pdf.

7 NASA Standard 8719.14A at § 4.7.3(d).

casualty, any level of shelter would significantly reduce the likelihood of injury. Although SpaceX has not undertaken an analysis that takes sheltering into consideration – since it already complies with U.S. and international standards – it is worth noting that this factor alone was sufficient to reduce the casualty risk of another NGSO operator by more than 400 percent.[8]

In addition, SpaceX has initiated with NASA a higher fidelity re-entry analysis. This analysis will employ NASA's proprietary Object Reentry Survival Analysis Tool ("ORSAT"), a more comprehensive model that provides more accurate results and a further level of insight over the standard DAS analysis. The results of that analysis will enable SpaceX to further refine spacecraft component geometries in order to maximize the probability of atmospheric demise. SpaceX plans to collaborate with NASA and leverage the agency's decades of re-entry experience in order to achieve a design that minimizes risk to people on the ground. SpaceX will continue performing this analysis on a periodic basis, ensuring that risk estimates remain relevant to future spacecraft revisions.

NASA's requirements (with which SpaceX already complies) ensure that the risk of human casualty due to naturally occurring space debris overall remains essentially unchanged, even by systems with a significant number of satellites. According to one estimate, over the last 50 years, more than 1,400 metric tons of materials are believed to have survived re-entry with no reported casualties.[9] On an average day, Earth is struck by between 50 and 230 naturally occurring space

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[8] *See* Letter from Scott Blake Harris to Marlene H. Dortch, IBFS File No. SAT-MOD-20131227-00148 (Apr. 28, 2016) (including consideration of sheltering in DAS analysis reduced human casualty rate from 1:4,400 to 1:20,000).

[9] *See Safety Design* at 21.

objects with masses between 10 and 1,000 grams,[10] and another 12 with masses in excess of 1 kg.[11] Thus, although the SpaceX system may seem to involve a substantial number of new objects, it remains insignificant compared to the large number of meteorites that strike the Earth naturally each year. In fact, any change in the rate of impact due to the gradual turnover and decommissioning of SpaceX satellites over time would likely not even be measurable against natural variation in the impact rate of meteorites and other space objects. In any event, as explained above, SpaceX intends to surpass even the very low preliminary casualty risk indicated in its original application and reduce the per-satellite risk to a level well below the exposure that would occur from natural sources.

6. Any information or analysis you may wish to provide with respect to treatment of this application under the Commission's environmental processing rules.

SpaceX has not yet determined final locations or designs for its gateway earth stations and other ground facilities. At such time as it does deploy those facilities, it fully anticipates that they will be sited in compliance with the restrictions set forth in Section 1.1307(a) of the Commission's rules, and will comply with the environmental limitations on human exposure to radiofrequency radiation under Section 1.1307(b).

SpaceX is unaware of any case in which the Commission has applied its environmental processing rules to the space stations of a GSO or NGSO satellite system.[12] There is no need to

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[10] P.A. Bland et al., *The flux of meteorites to the Earth over the last 50,000 years*, Monthly Notices of the Royal Astronomical Society, 551 (1996).

[11] Muriel Gargaud, *Encyclopedia of Astrobiology: Vol I*, 1030 (2011).

[12] The case cited in your letter did not involve space stations, but rather a network of repeaters for two-way paging services mounted on free-floating balloons. Given that the applicant in that case intended to launch more than 50,000 such balloons per year, all of which would return (with repeaters) to Earth, the Wireless

depart from that precedent here. As discussed above, SpaceX continues to refine its satellite system, with the goal of achieving a spacecraft design in which the risk from re-entry debris is well below the exposure that would occur from natural sources. In such circumstances, there is no reason to believe that the SpaceX system will have a significant effect on the areas and species listed in Section 1.1307, and thus the system should be categorically excluded from environmental processing.[13]

7. For optical inter-satellite links, please provide the wavelength, power, duty cycle, beam diameter at emitter, and beam divergence. In addition, please provide the power margin at the receiver at maximum operating distance.

SpaceX has dedicated considerable resources to developing the technology supporting its optical inter-satellite links ("ISLs"), and this information is highly proprietary and commercially sensitive, especially given that other NGSO applicants have also proposed use of optical ISLs with their systems. Accordingly, SpaceX is providing the requested information with respect to the current generation of that ISL technology under separate cover with a request for confidential treatment.[14]

8. Please indicate whether optical inter-satellite links will be coordinated with other systems proposed in FCC applications and with the DoD's laser clearing house, and, if such coordination has commenced, please address the status of coordination.

SpaceX plans to operate its optical ISLs at a frequency greater than 10,000 GHz. The Commission has consistently held that these optical transmissions fall outside its jurisdiction over

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Telecommunications Bureau found that the environmental processing rules should apply. *See Space Data Corp.*, 16 FCC Rcd. 16241, ¶¶ 24-27 (WTB 2001).

[13] *See* 47 C.F.R. §§ 1.1306 and 1.1307(a) (describing areas categorically excluded from environmental processing).

[14] A copy of the confidentiality request for this material is attached hereto.

radio communications.[15] This conclusion is consistent with international norms as well, where the ITU Convention defines the term "radio waves" as "electromagnetic waves of frequencies arbitrarily lower than 3000 GHz, propagated in space without artificial guide."[16] Indeed, the one time that the ITU looked into the possibility of adopting procedures for free-space optical links,[17] the U.S. took the position that "interference between inter-satellite links would also be rare due to directed and narrow beamwidths, and the vast geometry of space," and that therefore "there is no evidence to suggest procedures for free space optical links are needed."[18] The ITU agreed, and the underlying resolution to look into this issue was deleted.[19] Regulation would be especially unnecessary for the optical ISLs SpaceX plans to use, which operate at a very low power level – low enough to qualify as Class 1 laser, which cannot emit laser radiation at levels that are known

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[15] *See, e.g., TRW, Inc.*, 16 FCC Rcd. 14407, ¶ 20 (IB 20001) ("Optical beam communications are not considered a type of radio communication since they operate at frequencies above 300 GHz, and they are not within the jurisdiction of the Communications Act."); *Hughes Communications, Inc.*, 16 FCC Rcd. 14310, ¶ 16 (IB 2001) (same); *Teledesic LLC*, 14 FCC Rcd. 2261, ¶ 14 (IB 1999) ("Because optical ISLs do not involve wire or radio frequency transmissions, the Commission does not have jurisdiction over the use of optical ISLs.").

[16] Convention of the International Telecommunication Union, Annex, No. 1005 n.1 (2015), *available at* http://search.itu.int/history/HistoryDigitalCollectionDocLibrary/5.21.61.en.100.pdf. As part of its order implementing the results of WRC-12, the Commission recently extended the U.S. Table of Frequency Allocations to cover frequencies up to a maximum of 3,000 GHz (from 1,000 GHz). *See 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*, FCC 17-33, ¶ 47 (rel. Mar. 29, 2017).

[17] *See* ITU Res. 955 (WRC-07).

[18] *See* WRC-12 Agenda Item 1.6 (Resolution 955) – USA Proposals for the Work of the Conference, at 2-3, *available at* https://www.fcc.gov/us-contributions-sent-citel-pccii.

[19] *See* International Telecommunication Union, Final Acts – WRC-12, at 176 (list of resolutions approved for deletion), *available at* http://search.itu.int/history/HistoryDigitalCollectionDocLibrary/4.133.43.en.100.pdf.

to cause eye or skin injury during normal operation and thus are not generally subject to regulation.[20]

These same considerations effectively obviate the need for coordination of such ISLs between satellite operators. And, unlike lower frequency emissions within the Commission's regulatory purview, beams at or near optical frequencies exhibit virtually no emissions outside of that narrow beam. In addition, because optical receivers are also highly directional, interference on an optical link would only be likely if another satellite (1) itself used ISLs, (2) passed through the narrow optical beam from SpaceX, and (3) did so with its ISL receiver aligned parallel to the SpaceX beam. This combination of events is extremely unlikely and makes any formal coordination unnecessary. Moreover, even if such an unlikely event were to occur, orbital dynamics ensure that the conjunction would only last fractions of second and could only be repeated through deliberate action.

Likewise, SpaceX is aware of no general requirement for users of optical ISLs to coordinate with the Department of Defense ("DoD") Laser Clearinghouse.[21] This clearinghouse is intended for DoD users and others using lasers intentionally directed at DoD assets. SpaceX's proposed system does not meet either of these criteria. More importantly, as noted above, the very low power level and extremely narrow beam effectively mitigates any risk of harm. Notably, the DoD Laser Clearinghouse is operated by JSpOC. As discussed in its application, SpaceX works closely with JSpOC on a range of issues, including planning for its proposed constellation. SpaceX would,

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[20] *See, e.g.*, American National Standard for Safe Use of Lasers, ANSI-Z136.1-2014; International Electrotechnical Commission, International Standard 60825.1: 2014 – Safety of Laser Products.

[21] *See, e.g.*, U.S. Department of Defense, DoD Instruction 3100.11, *Management of Laser Illumination of Objects in Space* § 1.1 (Oct. 24, 2016) (limiting applicability to DoD owned, leased, or operated lasers and spacecraft), *available at* http://www.dtic.mil/whs/directives/corres/pdf/310011_dodi_2016.pdf.

of course, coordinate with other operators to the extent any such requirement is adopted or imposed.

* * *

Should you have any questions, please do not hesitate to contact me.

Sincerely,

William M. Wiltshire
Counsel to SpaceX

Attachment

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April 20, 2017

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REDACTED FOR PUBLIC FILE

Re: ***Request for Confidential Treatment*** *– IBFS File No. SAT-LOA-20161115-00118*

Dear Mr. Albuquerque:

Space Exploration Holdings, LLC ("SpaceX") respectfully requests that, pursuant to Sections 0.457 and 0.459 of the Commission's rules, 47 C.F.R. §§ 0.457 and 0.459, the Commission withhold from public inspection and accord confidential treatment to Exhibit A attached hereto (the "Confidential Materials") submitted in the above referenced proceeding. These materials contain sensitive commercial and technical information that fall within Exemption 4 of the Freedom of Information Act ("FOIA").[1]

Exemption 4 of FOIA provides that the public disclosure requirement of the statute "does not apply to matters that are . . . (4) trade secrets and commercial or financial information obtained from a person and privileged or confidential."[2] SpaceX is voluntarily providing this information "of a kind that would not customarily be released to the public" in order to respond to a request from the Commission staff with respect to the non-geostationary satellite orbit ("NGSO") system proposed in the above referenced proceeding; therefore, this information is "confidential" under Exemption 4 of FOIA.[3] Moreover, SpaceX would suffer substantial competitive harm if this information were disclosed.[4]

In support of this request and pursuant to Section 0.459(b) of the Commission's rules,[5] SpaceX hereby states as follows:

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1 5 U.S.C. § 552(b)(4).

2 *Id*.

3 *See Critical Mass Energy Project v. NRC*, 975 F.2d 871, 879 (D.C. Cir. 1992).

4 *See National Parks and Conservation Ass'n v. Morton*, 498 F.2d 765 (D.C. Cir. 1974).

5 47 C.F.R. § 0.459(b).

(1) Identification of the specific information for which confidential treatment is sought:

The Confidential Materials consist of technical specifications related to the optical inter-satellite links ("ISLs") to be deployed on SpaceX's non-geostationary satellite orbit ("NGSO") system that is the subject of the application in the above referenced file number.

(2) Identification of the Commission proceeding in which the information was submitted or a description of the circumstances giving rise to the submission:

The Confidential Materials are being submitted in response to a request for information from the Commission staff related to the NGSO system proposed in the above referenced file number.[6]

(3) Explanation of the degree to which the information is commercial or financial, or contains a trade secret of privilege:

The Confidential Materials contain specific, sensitive proprietary technical and commercial information relating to the advanced ISLs that are part of SpaceX's planned NGSO satellite project.

(4) Explanation of the degree to which the information concerns a service that is subject to competition:

SpaceX is subject to substantial competition from other commercial satellite operators (both existing and planned). For example, there are currently nine other applications pending in the NGSO processing round that includes SpaceX's application. Public disclosure of the Confidential Materials could allow SpaceX's competitors ready access to sensitive proprietary company information, which, under normal business circumstances, is not and would not be publicly disclosed.

(5) Explanation of how disclosure of the information could result in substantial competitive harm:

Among other things, such disclosure could enable unfair competition with SpaceX. Accordingly, public disclosure of any of the information contained in the Confidential Materials is likely to cause competitive injury and substantial irreparable harm to SpaceX, and it is therefore exempted from mandatory disclosure under FOIA Exemption 4, and Section 0.457(d) of the Commission's rules, 47 C.F.R. § 0.457(d).

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[6] *See* Letter from Jose P. Albuquerque to William M. Wiltshire and Paul Caritj, IBFS File No. SAT-LOA-20161115-00118 (Mar. 21, 2017).

(6) Identification of any measures taken by the submitting party to prevent unauthorized disclosure:

SpaceX has taken substantial and reasonable measures to prevent unauthorized disclosure of the Confidential Materials, including marking the materials as Proprietary or similar and, where appropriate, advising recipients of their Proprietary and protected status prior to making related oral disclosure(s). Any disclosure of the Confidential Materials to entities outside of SpaceX has been in confidence, subject to a binding non-disclosure agreement, and/or subject to attorney-client privilege, where applicable.

(7) Identification of whether the information is available to the public and the extent of any previous disclosure of the information to third parties:

To the best of the applicant's knowledge, as of the date of this submittal, the information contained in the Confidential Materials is not presently available to the public, and SpaceX does not presently intend for it to be released for unlimited distribution. The extent of previous disclosure of the information to third parties has been limited to agents, contracts and subcontractors, on a need-to-know basis and subject in each case to nondisclosure obligations.

(8) Justification of the period during which the submitting party asserts that material should not be available for public disclosure:

SpaceX requests that the Confidential Materials be withheld from public disclosure by the Commission for an indefinite period, or for the maximum permissible time. SpaceX has a proprietary right in its confidential commercial information. SpaceX has expended substantial financial and in-kind resources to organize and develop its business. SpaceX also has taken significant precautionary steps and measures to maintain and safeguard its confidential information, including the information contained in the Confidential Materials.

* * *

For the foregoing reasons, SpaceX respectfully requests that the Confidential Materials be granted confidential status and be withheld from public inspection. If confidential treatment is not granted for all or any part of this confidential material, SpaceX requests that all copies of these materials be returned to SpaceX.

If you have any questions, please do not hesitate to contact me.

Respectfully submitted,

William M. Wiltshire
Counsel to SpaceX

Enclosure

EXHIBIT A

7. For optical inter-satellite links, please provide the wavelength, power, duty cycle, beam diameter at emitter, and beam divergence. In addition, please provide the power margin at the receiver at maximum operating distance.

[REDACTED]