

**Before the
Federal Communications Commission
Washington, DC 20554**

In the Matter of)	
)	
LeoSat MA, Inc. Petition for Declaratory Ruling to Permit U.S. Market Access for the LeoSat Ka- band Low-Earth Orbit Satellite System)	IBFS File No. SAT-PDR-20161115-00112
)	
Space Exploration Holdings, LLC For Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System)	IBFS File No. SAT-LOA-20161115-00118
)	
Space Norway AS Petition for a Declaratory Ruling Granting Access to the U.S. Market for the Arctic Satellite Broadband Mission)	IBFS File No. SAT-PDR-20161115-00111
)	
Telesat Canada Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat’s NGSO Constellation)	IBFS File No. SAT-PDR-20161115-00108
)	
Theia Holdings A, Inc. Application for Authority to Launch and Operate a Non-Geostationary Satellite Orbit System in the Fixed-Satellite Service, Mobile-Satellite Service, and Earth- Exploration Satellite Service)	IBFS File No. SAT-LOA-20161115-00121

COMMENTS OF SPIRE GLOBAL, INC.

I. INTRODUCTION

Spire Global, Inc. (“Spire”) respectfully submits these Comments in response to the Federal Communications Commission (“FCC” or “Commission”) Public Notice regarding the above-captioned applications being “accepted for filing.”¹

Spire is a leading player in the small satellite (“smallsat”) market, operating a state-of-the-art satellite-based meteorological monitoring,² maritime monitoring,³ aircraft monitoring,⁴

¹ See Public Notice, DA 17-524 (May 26, 2017).

² Spire’s satellites currently perform GPS-Radio Occultation. GPS-Radio Occultation measures GPS transmissions that pass through the atmosphere. The magnitude of the refraction in the transmission will

and hosted payload service.⁵ Spire currently operates thirty-three (33) LEMUR-2 non-geostationary satellite orbit (“NGSO”) satellites on orbit.⁶

Spire requests that the Commission take the following actions with respect to the above-captioned applications:

- (i) require, prior to any potential license grant, LeoSat MA, Inc. (“LeoSat”); Space Exploration Holdings, LLC (“SpaceX”); Space Norway AS (“Space Norway”); Telesat Canada (“Telesat”); and Theia Holdings A, Inc. (“Theia”)

vary based on the temperature and water vapor concentration in the atmosphere. This measurement of the refractions will allow for enhanced weather forecasting models. *See, e.g.,* Anthony J. Mannucci *et al., Generating Climate Benchmark Atmospheric Surroundings Using GPS Radio Occultations*, NASA (Jul. 2007), <http://1.usa.gov/1bOUxEI>.

³ The satellite system will monitor Automatic Identification System (“AIS”) and Application Specific Messages (“ASM”) signals and provide critical near real-time data of interest to shipping companies, harbor operators, governments, vessel traffic service data providers, and financial services companies. Maritime vessels with gross tonnage of 300 tons or more are required by international law to carry AIS transmitters. *See* The International Convention for the Safety of Life at Sea, Nov. 1, 1974, 32 U.S.T. 47, 1184 U.N.T.S. 3 (Dec. 2002 Amendments); *see also Application Specific Messages collection, e-Navigation*, <http://www.e-navigation.nl/asm> (last visited Nov. 11, 2016) (noting that water levels, marine traffic signals, tidal windows, and clearance time to enter port information can be passed through ASM transponders). For example, ASM transponders mounted on the Panama Canal locks can emit signals to nearby ships alerting them as to the open/close status of the canal. *See, e.g., id.*

⁴ Spire plans to provide aircraft monitoring of ADS-B signals to help aircraft carriers meet regulatory mandates, including those promulgated by the Federal Aviation Administration, and to help complete a critical part of the U.S. Next Generation Air Transportation System. *See Airsafe*, Spire, <https://spire.com/data/aviation/> (last viewed June 21, 2017).

⁵ Spire’s satellites are built to accept new payloads quickly, allowing for an incredibly fast rollout of new capabilities. Spire has a launch already booked for nearly every month for the next 12-18 months. By leveraging Spire’s existing schedule, clients get access to nearly every reasonable launch heading to a LEO orbit. *See Bespoke Sensors*, Spire, <https://spire.com/data/custom-platform/> (last viewed June 21, 2017).

⁶ *See* Application of Spire Global, Inc., IBFS File No. SAT-LOA-20151123-00078 (filed Nov. 23, 2015) (“Initial Application”); Amendment Application of Spire Global, Inc., IBFS File No. SAT-AMD-20161114-00107 (filed Nov. 14, 2016). Spire’s Initial Application status is granted in part and deferred in part. *See* Stamp Grant, Spire Global, Inc., IBFS File No. SAT-LOA-20151123-00078 (granted in part and deferred in part Mar. 18, 2016, as corrected Mar. 24, 2016); Stamp Grant, Spire Global, Inc., IBFS File No. SAT-LOA-20151123-00078 (granted in part and deferred in part June 16, 2016); Stamp Grant, Spire Global, Inc., IBFS File No. SAT-LOA-20151123-00078 (granted in part and deferred in part Oct. 14, 2016); Stamp Grant, Spire Global, Inc., IBFS File No. SAT-AMD-20161114-00107 (granted in part and deferred in part Apr. 7, 2017); Stamp Grant, Spire Global, Inc., IBFS File No. SAT-AMD-20161114-00107 (granted in part and deferred in part May 18, 2017).

(collectively “LEO Operators”) provide additional post-mission disposal plans, giving further details on the risks of their transits across 400-650 km (how they will coordinate with users of such orbits, the calculations underlying their re-entry assumptions, and other details necessary to evaluate the risks they pose to smallsat providers like Spire, Planet Labs Inc., and others, which have or will have satellite constellations in the 400-650 km orbital altitude range);

(ii) condition all license grants, requiring modification of LEO Operators’ operations to bring them into accordance with any future rules or policies (*i.e.*, orbital debris mitigation rules) adopted by the Commission;⁷ and

(iii) require, prior to any license grant, Theia coordinate its use of the 1215-1300 MHz (active) (Earth-to-space) frequency band with Spire, as Spire passively monitors the GPS L2 (1217.37-1237.83 MHz) band and hopes to monitor the GLONASS L2 (1237.8-1254.2 MHz) and Galileo E5 (1166.215-1217.375 MHz) bands.

II. REQUIRE LEO OPERATORS PROVIDE ADDITIONAL POST MISSION DISPOSAL PLANS, SHOWING DETAILS ON THE RISKS OF THEIR TRANSITS ACROSS THE 400-650 KM ORBITAL ALTITUDE RANGE.

In the above-captioned applications, the LEO Operators propose to dispose of their satellites through atmospheric reentry. Specifically, the LEO Operators have suggested that, for post mission disposal through atmospheric reentry, their satellites will use elliptical orbits that cross through smallsat operators’ orbits or use circular orbits within smallsat operators’ orbits

⁷ See *WorldVu Satellites Limited Petition for a Declaratory Ruling Granting Access to the U.S. Market for the OneWeb NGSO FSS System*, Order and Declaratory Ruling, FCC 17-77 ¶ 26 (rel. June 23, 2017) (“*OneWeb Order*”) (“This grant of U.S. market access and any earth station licenses granted in the future are subject to modification to bring them into conformance with any rules or policies adopted by the Commission in the future.”).

from 400-650 km.⁸ Spire applauds these LEO Operators for taking efforts to minimize orbital debris concerns during post mission disposal.

However, considering current and future smallsat operators will have constellations in the 400-650 km orbital altitude range,⁹ Spire strongly urges the Commission to require these LEO Operators to provide detailed post-mission disposal plans so that the risk of these disposal plans can be properly assessed by existing operators in these orbits.¹⁰ In requests for information sent to the LEO Operators, the Commission asked the LEO Operators how they would protect the International Space Station, which is only one space station amongst many other space stations in the 400-650 km range. LEO Operators' submissions of additional details are necessary, so operators using these orbits can fully understand the impact of the plans.

⁸ See, e.g., Letter from Phillip R. Marchesiello, Counsel for LeoSat MA, Inc., to Jose P. Albuquerque, Chief, Satellite Division, International Bureau, FCC, IBFS File No. SAT-PDR-20161115-00112, at 7-8 (filed May 15, 2017) ("LeoSat Letter"); Space Exploration Holdings, LLC, IBFS File No. SAT-LOA-20161115-00118, Technical Attachment at 53-66 (filed Nov. 15, 2016); Space Norway AS, IBFS File No. SAT-PDR-20161115-00111, Petition Declaratory Ruling at 15-18 (filed Nov. 15, 2016); Letter from Elisabeth Neasmith, Director, Spectrum Management and Development, Telesat Canada, to Jose P. Albuquerque, Chief, Satellite Division, International Bureau, FCC, IBFS File No. SAT-PDR-20161115-00108, at 4 (Apr. 14, 2014) ("Telesat Letter"); Letter from Joseph Fagnoli, Chief Technology Officer, Theia Group, Inc., to Jose P. Albuquerque, Chief, Satellite Division, International Bureau, FCC, IBFS File No. SAT-LOA-20161115-00121, at 3-4 (Apr. 14, 2017).

⁹ For example, Spire plans to have 175 satellites operational on orbit at one time; Planet plans to have 200 satellites operational on orbit at one time. See Spire Global, Inc., IBFS File No. SAT-LOA-20151123-00078, Exhibit A at 2 (filed Nov. 23, 2015); Planet Labs Inc., IBFS File No. SAT-MOD-20150802-00053, Exhibit 43 at 1 (filed Aug. 2, 2015).

¹⁰ See also Statement of Commissioner Michael O'Rielly, *WorldVu Satellites Limited Petition for a Declaratory Ruling Granting Access to the U.S. Market for the OneWeb NGSO FSS System*, Order and Declaratory Ruling, FCC 17-77 (rel. June 23, 2017) ("However, those who read today's item will be quick to notice that the scope of these systems has raised many issues, such as preventing [...] orbital debris, which will need to be considered further.").

Finally, since LeoSat, Space Norway, and Telesat have not finalized their satellite designs,¹¹ license grants to these operators should be conditioned on a later submission of an orbital debris plan.

III. INCLUDE IN ANY LICENSE GRANT A CONDITION REQUIRING LEO OPERATORS TO MODIFY THEIR OPERATIONS TO BRING THEM INTO ACCORDANCE WITH ANY FUTURE COMMISSION RULES OR POLICIES.

Spire believes that close coordination between operators is the best form of orbital debris mitigation especially during post-mission disposal. In addition, the amount of mass and surface area proposed to be launched, and subsequently disposed of, by LEO Operators could meaningfully change the orbital debris environment in 400-650 km. So, if the Commission does create any new orbital debris mitigation rules for operations in low-Earth orbit, such rules should retroactively apply to the LEO Operators; otherwise, they are likely to be frustrated in their purpose and intent.¹²

IV. REQUIRE THEIA COORDINATE WITH SPIRE TO PROTECT SPIRE'S GLOBAL NAVIGATION SATELLITE SYSTEM ("GNSS")-RADIO OCCULTATION OPERATIONS.

Theia plans to use active radar in 1215-1300 MHz (Earth-to-space) band,¹³ where Spire passively monitors the GPS L2 (1217.37-1237.83 MHz) band and hopes to monitor the GLONASS L2 (1237.8-1254.2 MHz) and Galileo E5 (1166.215-1217.375 MHz) bands for its GNSS-Radio Occultation operations. Both parties had begun pre-coordination discussions; however, no coordination agreement was formalized as Theia noted that it was still finalizing its satellite design.

¹¹ See LeoSat Letter at 4; Letter from Phillip L. Spector, Attorney for Space Norway AS, to Jose P. Albuquerque, Chief, Satellite Division, International Bureau, FCC, IBFS File No. SAT-LOI-20161115-00111, at 4 (Apr. 14, 2014); Telesat Letter at 4, 6.

¹² See *OneWeb Order* ¶ 26.

¹³ See Theia Holdings A, Inc., IBFS File No. SAT-LOA-20161115-00121, Legal Narrative at 50-51 (filed Nov. 15, 2016).

Active transmissions in GPS L2, GLONASS L2, and Galileo E5 bands should be handled with extreme care. Operators such as Theia no longer just need to coordinate with the National Telecommunications and Information Administration when using GNSS bands. There are now commercial operators, such as Spire, with government-caliber space research capabilities that rely on GNSS. Therefore, prior to, or as a condition of, any license grant, Theia should coordinate its use of this band with Spire.

V. CONCLUSION

Spire applauds the Commission for expeditiously and thoroughly reviewing the various Ku-band and Ka-band NGSO processing round applications. At this time, Spire asks the Commission to protect the smallsat constellations that are quickly coming to fruition.

Accordingly, Spire requests that the Commission require (i) the LEO Operators provide additional post-mission disposal plans, giving further details on the risks of their transits across 400-650 km (how they will coordinate with users of such orbits, the calculations underlying their re-entry assumptions, and other details necessary to evaluate the risks they pose to smallsat providers) and (ii) Theia coordinates its use of the 1215-1300 MHz (active) (Earth-to-space) frequency band with Spire, protecting Spire's present and future GNSS-Radio Occultation operations in the band. Any license grants to LEO Operators should contain a condition requiring modification of their operations to bring them into accordance with any future rules or policies (*i.e.*, orbital debris mitigation rules) adopted by the Commission.

Respectfully submitted,

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CERTIFICATE OF SERVICE

I, Alex Orzulak, hereby certify that on this 26th day of June, 2017, I served a true copy of the foregoing "Comments of Spire Global, Inc." via first-class mail, postage prepaid, upon the following:

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