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

In the Matter of	)	
	)	
Comprehensive Review of Licensing and Operating Rules for Satellite Services	)))	IB Docket No. 12-267

REPLY COMMENTS OF SPIRE GLOBAL, INC.

Spire Global, Inc. ("Spire"),[1] hereby submits these Reply Comments in response to the comments of Iridium Constellation LLC ("Iridium"), requesting that the Commission initiate a separate rulemaking proceeding to impose additional regulatory obligations on operators of small satellites, including picosatellites, nanosatellites and cubesats (hereafter, collectively, referred to as "cubesats").[2] Iridium's laundry list of proposed cubesat regulations, framed as "inquiries," is completely unjustified and should be rejected.[3] As discussed below, Iridium's

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[1] Since the filing of its comments in this proceeding, the company has formally changed its name from Nanosatisfi, Inc. to Spire Global, Inc.

[2] *See* Comments of Iridium Constellation LLC (filed Jan. 29, 2015) ("Iridium Comments"). The Satellite Industry Association ("SIA") submitted an unexplained, two-sentence request seeking a separate rulemaking for cubesat operators (in an otherwise extremely detailed and dense 184-page submission). Comments of the Satellite Industry Association (filed Jan. 29, 2015) ("Part 25 is used to license some, but not the majority of "small satellites," a broad but generic term that includes cubesats, nanoatellites, and picosatellites. SIA urges the Commission to initiate a separate proceeding to address the myriad regulatory issues these satellites pose."). To the extent that request also seeks the initiation of a separate rulemaking proceeding to impose additional regulatory obligations on cubesat operators, it should be rejected for the same reasons stated herein.

[3] Iridium Comments at 1-2. Specifically, Iridium poses the following questions for the proposed rulemaking:

- Should all small satellite applications (experimental, amateur or commercial) be placed on public notice, and not just the ones that fall within Part 25, to ensure the Commission

implicit premise that cubesats are or will be a material source and cause of orbital debris is flatly refuted by the laws of physics. Moreover, the imposition of such unwarranted obligations would unfairly burden cubesat operators with regulations that will delay and impede innovative services from being offered on a new, alternative satellite platform.

The Commission should be circumspect about imposing burdensome regulations on a nascent industry. Indeed, if the Commission were to initiate a separate cubesat rulemaking proceeding, its focus should be on modernizing its rules to take into consideration the unique features of cubesats and facilitating the development of this evolving global industry.

I. There is No Basis to Initiate a Separate Rulemaking Proceeding to Impose Additional Orbital Debris Obligations on Cubesat Operators

The number of satellites in space is not a material factor in assessing orbital debris risk. As Spire explained in its comments, orbital debris risk is a function primarily of three factors: the satellite's surface area (or cross-sectional area), its mass, and its orbital lifespan.[4] Cubesats have much smaller surface areas, much less mass, and much short orbital lifespans than traditional satellites and, therefore, present little orbital debris risk and a very low probability of collision with other space objects. Moreover, current forms of cubesats possess no propulsion systems

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has complete information and to facilitate the protection of assets currently in orbit?

- Should there be an online registry for small satellite operators to provide anticipated launch dates and orbital parameters and final launch dates and orbital parameters?
- What should the de-orbit requirements be for small satellites and what orbital debris considerations should be taken into account?
- As small satellite networks proliferate, should there be a process for coordination of orbits?
- How will the physical protection of assets currently in orbit be ensured, since many of the satellites do not have maneuvering capabilities?

[4] *See* Comments of Spire Global, Inc. at 3 and Attachment (filed Jan. 29, 2015) ("Spire Comments").

and, thus, do not present the same risk of explosion as conventional satellites.[5]

To put cubesats in context, Spire estimates that *all* cubesats currently in orbit have a combined mass of 369 kg and a cross-sectional area of 5.24 m^2, which is 0.000000204% of the total surface area of *all* manmade objects in low-earth orbit ("LEO").[6] As a result of their typical low operating altitudes (*i.e.*, 400 km to 600 km), cubesats generally will re-enter the Earth's atmosphere (and be completely destroyed)[7] within a few years, which is well within the 25 years required under NASA standards.[8] Indeed, of the cubesats launched in 2014, Spire understands that more than 50% have already re-entered Earth's atmosphere. Because of the size and materials used in constructing cubesats, they are not expected (under NASA ODAR calculations) to survive reentry and, accordingly, present no risk of casualty.[9]

By comparison, for example, Envisat, a single inoperative LEO satellite, has a mass of 8211 kg and its antenna array alone has a cross-sectional area of 10 square meters.[10] It has an

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[5] *See, e.g.*, Matthew Sparkes, "US military satellite explodes above Earth," The Telegraph (March 2, 2015), *available at* http://www.telegraph.co.uk/technology/news/11444155/US-military-satellite-explodes-above-Earth.html.

[6] Spire's calculations are based on an open source database of launches and satellites in orbit. *See* http://www.planet4589.org/space/log/satcat.txt.

[7] The low altitudes in which cubesats typically operate have significant atmospheric density, which materially reduces the orbital lifespan of the cubesats.

[8] *See, e.g.*, Process for Limiting Orbital Debris, NASA Technical Standard 8719.14 at 21 (as revised May 25, 2012), *available at* http://www.hq.nasa.gov/office/codeq/doctree/871914.pdf. As an example, Spire's satellites are expected to remain in orbit only 7-8 years. *See also* Lemur-2 Orbital Debris Assessment Report, ELS File No. 0041-EX-PL-2015 (filed Jan. 29, 2015).

[9] *See, e.g.*, Lemur-1 Orbital Debris Assessment Report, ELS File No. 0213-EX-PL-2014 (granted Apr. 24, 2014) ("Summary of objects expected to survive an uncontrolled reentry (using DAS 2.0.2 software): None."); Flock 1 Orbital Debris Assessment Report, Application of Planet Labs, SAT-LOA-20130626-00087, at 17-19 (filed Jun. 26, 2013) ("Analysis performed under DAS v.2.0.2 shows that no part of the satellite is expected to survive reentry....").

[10] *See, e.g.*, http://en.wikipedia.org/wiki/Envisat (last visited Feb. 28, 2015).

orbital altitude of 790 km and an expected orbital lifetime of approximately 150 years.[11] Similarly, a single Iridium satellite from its next-generation 66-satellite constellation has a mass of 666 kg which is nearly double the mass of all cubesats in orbit.[12] According to Iridium, the satellite would have a proposed post-mission disposal orbit perigee of 500 km,[13] which would result in a predicted post-mission orbital lifespan of less than 25 years. By Iridium's own calculations the risk of casualty associated with the re-entry of a single Iridium satellite is 1 in 17,000, if certain sheltering assumptions are made, and 1 in 4,098, if those assumptions are not made.[14] These examples show that cubesats, even considered in the aggregate, present comparatively little orbital debris risk.

II. A Separate Cubesat Rulemaking Proceeding Should Focus be on Modernizing Satellite Regulations to Take Into Consideration the Unique Features of Cubesats and Facilitating the Development of Such Systems.

As Spire has explained, cubesats are different from conventional satellite systems in a number of material ways, including the time and costs associated with the development and construction of a cubesat system. Specifically, these small, but very capable satellites, can be designed and manufactured within weeks or months and launched into orbit just as quickly. This extremely short, system life cycle, especially as compared to the historic 15-year+ life cycle of

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[11] *See, e.g.*, "The Menance of Earth-Orbiting Space Debris," www.space.com (October 1, 2013), *available at* http://www.space.com/23039-space-junk-explained-orbital-debris-infographic.html; *see also* http://en.wikipedia.org/wiki/Envisat (last visited Feb. 28, 2015)..

[12] *See* Exhibit C, Application of Iridium, IBFS File No. SAT-MOD-20131227-00148 (filed Dec. 27, 2013). There is no readily available information on the cross-sectional area for the Iridium satellite.

[13] *See id*.; *see also* Letter to Donna Bethea-Murphy, Vice President, Regulatory Engineering, from Jose P. Albuquerque, Chief, Satellite Division, IBFS File Nos. SAT-MOD-20080701-00140 and SAT-MOD-20131227-00148 (Apr. 15, 2014) (requesting additional information to support Iridium's assertion that its satellites will meet the NASA 25-year limit).

[14] *See* Letter to Marlene H. Dortch, Secretary, FCC, from Jennifer D. Hindin, Counsel for Iridium Constellation LLC, IBFS File No. SAT-MOD-20131227-00148 (Oct. 29, 2014).

more conventional satellite systems, facilitates the rapid evolution of cubesat system capabilities. Rather than targeting cubesat operators for additional regulatory burdens, as the incumbent satellite operator Iridium proposes, the Commission should instead be considering changes to its current rules to encourage the growth of the cubesat industry.

For example, the FCC should revise its bond and milestone language to reflect that cubesats are often developed and manufactured entirely in-house.[15] Similarly, the FCC should consider a more streamlined licensing approach for cubesat operators, which typically deploy satellites as a secondary payload on launch vehicles and, thus, often do not know the final number of satellites that will be launched or the launch date, until a few months or weeks beforehand.[16]

III. Conclusion

The Commission should reject the request by Iridium to initiate a separate rulemaking proceeding to increase the regulatory burdens on cubesat operators that seek to use the same orbital resources as Iridium. If the Commission were to initiate a more general proceeding regarding cubesat systems, it should focus on changes to its current rules that would enhance licensing flexibility for cubesat operators and taking steps to facilitate the growth of this industry.

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[15] Spire Comments at 2.

[16] *See* Comments of Planet Labs Inc. at 2 (filed Jan. 29, 2015).

Respectfully submitted,

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March 2, 2015

Technical Certification

I, Peter Platzer, Chief Executive Officer of Spire Global, Inc., hereby certify under penalty of perjury that:

> I am the technically qualified person responsible for preparation of the technical information contained in these Reply Comments.
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> I am familiar with Part 25 of the Commission's rules and NASA's orbital debris standards; and
>
> The statements made herein are complete and accurate to the best of my knowledge.

/s/Peter Platzer
Peter Platzer
Chief Executive Officer
Spire Global, Inc.

March 2, 2015