Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of	)	
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Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters	)))	IB Docket No. 16-408

JOINT COMMENTS OF PLANET LABS INC. AND SPIRE GLOBAL, INC.

Mike Safyan
Director of Launch and Regulatory Affairs

Planet Labs Inc.
346 9th Street
San Francisco, CA 94103
(415) 317-6404

Jonathan Rosenblatt
General Counsel

George John
Legal & Regulatory Counsel

Spire Global, Inc.
575 Florida Street, Suite 150
San Francisco, CA 94110
(628) 221-5324

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I. INTRODUCTION

Planet Labs Inc. ("Planet") and Spire Global, Inc. ("Spire") (collectively "Planet/Spire") respectfully submit these Joint Comments in response to the Notice of Proposed Rulemaking released by the Federal Communications Commission ("FCC" or "Commission") in the above-captioned proceeding.[1]

Planet is an integrated aerospace and data analytics company that operates a fleet of Earth-imaging satellites collecting information about our changing planet.[2] Planet is driven by a mission to image the entire Earth every day and make global change visible, accessible, and actionable. Founded in 2010, Planet designs, builds, and operates small satellites, as well as online platforms that serve data to users, helping decision-makers solve our world's toughest challenges and entrepreneurs to build new businesses. Planet currently operates a constellation of 132 Dove satellites, which is the largest non-geostationary satellite orbit ("NGSO") constellation in the world.

[1] *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 (Dec. 15, 2016) ("*Large NGSO FSS NPRM*").
[2] *See Planet*, https://www.planet.com/ (last viewed Feb. 27, 2017).

Spire, which was formerly known as NanoSatisfi, Inc. and formed in Delaware in August 2012, is a private U.S. company headquartered in San Francisco, with offices in Boulder, Glasgow, and Singapore.[3] The enterprise grew out of a volunteer effort by four graduate students at the International Space University who began building a prototype nanosatellite as a platform for making space accessible and affordable to students. Early funding for the concept came from the crowdfunding website Kickstarter, where the original ArduSat (short for "Arduino-based satellite") concept raised more than $100,000 from nearly 700 private space enthusiasts. Two ArduSats were released into orbit from the International Space Station on November 19, 2013 pursuant to an experimental authorization granted by the FCC Office of Engineering and Technology. For this pioneering work related to the ArduSats, the Obama Administration recognized Spire Co-founder and CEO Peter Platzer as a "Champion of Change."[4]

Spire has manufactured and launched part of its LEMUR-2 NGSO constellation,[5] which will provide meteorological monitoring,[6] maritime monitoring,[7] aircraft monitoring,[8] and earth imaging services.[9]

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[3] *See Spire*, https://spire.com/ (last viewed Feb. 15, 2017).

[4] Peter Platzer, *Creating Next Generation Innovators Through Space Education*, WhiteHouse.Gov Blog (June 6, 2013), https://obamawhitehouse.archives.gov/blog/2013/06/06/creating-next-generation-innovators-through-space-education.

[5] *See* Application of Spire Global, Inc., File No. SAT-LOA-20151123-00078 (filed Nov. 23, 2015) ("Initial Application"); Amendment Application of Spire Global, Inc., 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., 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., File No. SAT-LOA-20151123-00078 (granted in part and deferred in part June 16, 2016); Stamp Grant, Spire Global, Inc., File No. SAT-LOA-20151123-00078 (granted in part and deferred in part Oct. 14, 2016).

[6] Spire's satellites will perform GPS-Radio Occultation. GPS-Radio Occultation measures GPS transmissions that pass through the atmosphere. The magnitude of the refraction in the transmission will 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.*,

In the *Large NGSO FSS NPRM*, the Commission proposes rules that update the operational requirements for current and future NGSO systems.[10] Planet/Spire support the Commission's efforts to update its Part 25 rules as new large NGSO systems come to fruition, and they request revision and clarification of some of the newly proposed rules. Since it is not entirely clear whether these issues will be handled in separate proceedings more applicable to Planet and Spire's separate NGSO systems, Planet/Spire respectfully file their comments in this proceeding.

II. ALL NGSO SYSTEMS SHOULD PROVIDE EPHEMERIS DATA.

To avoid in-line interference occurrences for those systems using the Ka-band, the Commission has inquired whether it should require interval sharing of ephemeris data by these NGSO operators.[11] Though Planet/Spire do not use the Ku- or Ka-bands and it seems clear that this part of the proceeding is limited to Ku-band and Ka-band operations, Planet/Spire support a

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Generating Climate Benchmark Atmospheric Surroundings Using GPS Radio Occultations, NASA (Jul. 2007), http://1.usa.gov/1bOUxEI.

[7] 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*.

[8] 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.

[9] Spire's satellites will have two sensors onboard. The primary sensor is an electro-optical imaging system, which operates in the visible band with a ground resolution of approximately 12.5 m. The secondary sensor is a low-resolution infrared imaging system with an approximate ground resolution of 1 km. The images will be used primarily with the maritime monitoring service as a supplementary data feature.

[10] *See Large NGSO FSS NPRM* ¶¶ 24-25, 31-34.

[11] *See id.* ¶¶ 24-25.

larger discussion of ephemeris sharing in the context of a comprehensive orbital debris mitigation rulemaking. This rulemaking would apply to all NGSO operators, which may operate technologically diverse systems, and a comprehensive rule on sharing of ephemeris data seems most suitable in connection with such a proceeding.

Planet/Spire support the policy of requiring sharing of ephemeris data but want the Commission to be flexible in *how* such sharing occurs. For instance, Planet/Spire are members of the Space Data Association, but that may not be the service provider of choice for all satellite operators. Some operators, such as Planet, already have an updating feed of ephemeris data published publicly on their websites, and there may be other mechanisms for the sharing of ephemeris data that are equally viable. Other operators, say those hosting government payloads, may be prohibited from sharing ephemeris data of some satellites publicly due to national security concerns. The Commission's rules should have flexibility for these different operator requirements and approaches and should drive operators to a preferred policy outcome rather than dictating the means.

In terms of the policy outcomes, Planet/Spire would urge that the Commission's rules answer the following questions: (i) how often ephemeris data should be shared, (ii) with whom it must be shared, (iii) what are permissible formats and sharing techniques, and (iv) whether the Commission or another government agency should provide an index or location for the sharing as a minimum/default option for operators.

III. IF APPLICABLE TO ALL NGSO SYSTEMS, THE NEW MILESTONE RULES SHOULD ACCOMMODATE THE VARIOUS TYPES AND SIZES OF NGSO SYSTEMS BY AFFORDING FLEXIBILITY.

A. It is not clear if the proposed milestone rules apply to only those NGSO systems operating in the Ku- and Ka-bands or to all NGSOs systems.

The Commission seeks to update its milestone requirements under Section 25.164.[12] Planet/Spire request clarification as to whether the newly proposed milestone requirements apply to NGSO systems operating just in the Ku- and Ka-bands or to NGSO systems operating in all frequency bands.

B. If the proposed milestone rules are intended to apply to all NGSO systems, they should afford more flexibility.

Under the proposed milestone rules ("Percentage Milestones"), a NGSO operator would be required to (i) launch and operate 75% of its authorized constellation within six years of the license grant and (ii) launch and operate 100% of its authorized constellation within nine years of the license grant.[13] Failure to meet these two Percentage Milestones would force partial or total forfeiture of a $5 million surety bond and/or reduce the number of authorized satellites under the license grant.[14] Planet/Spire support an update to the milestone requirements but request revisions to the proposed Percentage Milestones requirements.

The purpose of the bond requirement is to deter "'warehousing' of spectrum and orbital resources";[15] however, strict application of these Percentage Milestones would potentially materially prejudice certain NGSO systems for not meeting the Percentage Milestones for a host of reasons unrelated to spectrum warehousing. First, many NGSO systems operate in shared

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[12] *See* 47 C.F.R. § 25.164 (updated); *Large NGSO FSS NPRM* ¶ 32.
[13] *See Large NGSO FSS NPRM* ¶ 32.
[14] *See id.* ¶ 32.
[15] *See id.* ¶ 31; *Amendment of the Commission's Space Station Licensing Rules and Policies*, First Report and Order and Further Notice of Proposed Rulemaking, 18 FCC Rcd 10760 ¶ 173 (2003).

bands (*e.g.*, the Earth Exploration-Satellite Service, Non-Voice Non-Geostationary Mobile-Satellite Service, and/or Meteorological-Satellite Service bands) where spectrum warehousing is less of a concern. Second, many NGSO systems are launching novel and technologically-advanced constellations. While efforts have been made to anticipate the number, orbital position, and type of satellites needed to make these systems viable, there is not yet enough data to say for certain what the ultimate numbers will be. Third, many NGSO systems launch as secondary payloads with little to no control over their launch schedules. Fourth, many NGSO systems are subject to routine launch delays in the low-Earth orbit launch market. Fifth, many NGSO systems are short-duration satellites that require rapid replenishment, meaning that there is a very large difference between the number of satellites needed in "steady state" for a business case and the total number of satellites launched over a 15-year license term. While the Commission can continue its policy of waiving milestone requirements for good cause, the waiver process lacks certainty of outcome and requires numerous filings that need to be processed by the Commission. Many of the new NGSO operators are small venture-backed companies; losing a $5 million-dollar surety bond could have a material adverse impact on such companies.

Planet/Spire propose the following modifications to the proposed Percentage Milestones rules.

First, such a bond requirement should have flexible Percentage Milestones. The milestones should be linked to the number of operational satellites in the system licensed at "steady state" or perhaps even a stated minimum number necessary for commercial viability, but in any event, the milestones should not be based on the aggregate number across the license term. The aggregate number over a 15-year license term when applied to a system on a two-year

refresh cycle makes little sense. For instance, if Planet or Spire intended to have a constellation of 175 satellites operating at "steady state" and needed to replace their satellites every two years, they might apply for 900 satellites over a 15-year license term. But, Planet or Spire would never reach a point where they had 900 satellites operational, and any Percentage Milestone based on 900 satellites would be disproportionate to the number of satellites Planet or Spire actually intended to operate at any given time. In addition, to address issues around launch failures/delays that impact replenishment, dropping below the Percentage Milestone once achieved should not cause bond forfeiture.

Second, NGSO systems should have alternatives to maintain flexibility without forfeiting a bond of a material amount. For instance, NGSO systems should have the ability to amend their filing to reduce the number of satellites required and thus proportionately reduce the number of satellites required under the Percentage Milestone. This alternative would allow for flexibility as a system developed and reduce the number of total satellites on orbit, alleviating spectrum warehousing concerns and allowing other entrants into the market.

Third, the Commission should continue to have flexibility to waive the requirements for good cause. NGSO operators, such as Planet and Spire, cannot anticipate all the reasons that milestones may not be met or that bonds may not serve the policy against spectrum warehousing, so the Commission should retain this flexibility.

IV. REPLACEMENT SATELLITES SHOULD NOT BE SUBJECT TO MILESTONE REQUIREMENTS AND SHOULD BE RE-DEFINED UNDER SECTION 25.165(E).

The Commission proposes to clarify Section 25.164, noting that replacement satellites will not be subject to the same milestone requirements if they are brought into operation before retirement of the previous spacecraft.[16] Planet/Spire agree with this clarification.

However, Planet/Spire ask that the Commission re-define a "replacement space station." Currently, Section 25.165(e) states the following:

> A replacement space station is one that: (1) Is authorized to operate at an orbital location within ±0.15° of the assigned location of a GSO space station to be replaced or is authorized for NGSO operation and will replace an existing NGSO space station in its authorized orbit; (2) Is authorized to operate in the same frequency bands, and with the same coverage area as the space station to be replaced; and (3) Is scheduled to be launched so that it will be brought into use at approximately the same time as, but no later than, the existing space station is retired.[17]

To help accommodate new types of NGSO systems, Planet/Spire request a less-restrictive and more flexible definition for a "replacement space station," as the current definition would essentially preclude NGSO systems with diverse orbits and subject to launch as secondary payloads from qualifying for replacement station status (and thus materially increasing the burden and potentially decreasing the feasibility of meeting any Percentage Milestones requirements). Planet/Spire request this change as it relates to the milestone requirements. There may be other places where this definition is used and where a change is or is not appropriate, but that seems beyond the scope of this proceeding. Under clause (1) of the definition of "replacement space station," the Commission should consider satellites under the same license and which can fulfill the same mission in NGSO to be replacements even if they are

[16] *See Large NGSO FSS NPRM* ¶ 34.
[17] *See* 47 C.F.R. § 25.165(e).

not placed into the exact same "authorized orbit" (*i.e.*, altitude and inclination) as the station being replaced, as many NGSO systems do not need to be in the same exact authorized orbit.[18] Planet/Spire do not suggest that the "replacement space station" does not need to be authorized to be in an orbit listed in a license grant but merely that the "replacement space station" does not have to be in the exact same authorized orbit as the retiring station. Planet/Spire do not believe any changes to clause (2) of the definition of "replacement space station" are necessary. Planet/Spire believe that clause (3) of the definition of "replacement space station" should be amended to remove "but no later than" to enhance flexibility as many new NGSO systems may not know exactly when a satellite will need to be replaced and launch delays may cause the replacement station to occur later than retirement/failure.

[18] *See id.* §§ 25.116-25.117.

V. CONCLUSION

Planet/Spire support the Commission's efforts to update its Part 25 rules as new large NGSO systems come to fruition; however, they respectfully request revision and clarification of some of the newly proposed rules. In short, the Commission should (i) commence a larger discussion of ephemeris sharing in the context of a comprehensive orbital debris mitigation rulemaking, (ii) clarify the applicability of the proposed Percentage Milestones rules; (iii) revise the proposed Percentage Milestones rules, if they are applicable to all NGSO systems, to afford more flexibility and to accommodate the various types and sizes of NGSO systems; (iv) clarify that a "replacement space station" is not subject to the milestone rules; and (v) implement a less-restrictive and more flexible definition for a "replacement space station."

Respectfully submitted,

/s/ Mike Safyan

Mike Safyan
Director of Launch and Regulatory Affairs

Planet Labs Inc.
346 9th Street
San Francisco, CA 94103
(415) 317-6404

/s/ Jonathan Rosenblatt

Jonathan Rosenblatt
General Counsel

George John
Legal & Regulatory Counsel

Spire Global, Inc.
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