



May 13, 2016

VIA IBFS

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

**Re: Application of Spire Global, Inc. for Authorization to Launch and Operate a Non-Geostationary (“NGSO”) Satellite System to Provide Maritime Monitoring, Meteorological Monitoring, and Earth Imaging Services
File No. SAT-LOA-20151123-00078**

ORBCOMM License Corp. (“ORBCOMM”) hereby submits for inclusion in the record of the above-referenced application (the “Spire Global Application”) the attached copy of ORBCOMM’s May 11, 2016, Informal Comments (the “ORBCOMM Comments”) on the Application of Spaceflight, Inc. (“Spaceflight”), Request for Special Temporary Authority, File No. SAT-STA-20150821-00060 (the “STA Request”).

The STA Request relates to Spaceflight’s proposed SHERPA secondary payload satellite deployment mission (the “SHERPA mission”) on the SpaceX Falcon 9 Formosat-5 launch. ORBCOMM is filing this submission on the record of the Spire Global Application because 8 Spire Global spacecraft are among the approximately 90 secondary payload satellites proposed for inclusion in the SHERPA mission. Accordingly, the issues and concerns raised in the ORBCOMM Comments should be considered in connection with the Spire Global Application.

Respectfully submitted,

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Encl: ORBCOMM Informal Comments Re: Spaceflight STA Request

cc: Trey Hanbury, Counsel to Spire Global, Inc.
Jonathan L. Wiener, Counsel to Spaceflight, Inc.



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**Re: Informal Comments of ORBCOMM on the Application of Spaceflight, Inc.,
Request for Special Temporary Authority, File No. SAT-STA-20150821-00060**

ORBCOMM License Corp. (“ORBCOMM”), pursuant to Sections 25.154(b) of the Commission's Rules, hereby comments on the above-referenced Spaceflight, Inc. (“Spaceflight”) request for Special Temporary Authority (the “STA Request”) relating to the proposed SHERPA secondary payload mission (the “SHERPA mission”) on the SpaceX Falcon 9 Formosat-5 launch.¹ ORBCOMM just recently became aware of unresolved orbital collision concerns raised by the proposed SHERPA mission that could pose an in-orbit collision risk affecting the entire fleet of ORBCOMM’s Generation 2 (“OG2”) satellites.² As explained below, ORBCOMM requests that the Commission defer grant of the STA Request until the record demonstrates that the proposed SHERPA mission will not create an unreasonable risk of collisions with OG2 satellites, or impose an inequitable burden of collision avoidance on ORBCOMM.

The SHERPA mission is proposed as a secondary payload on the SpaceX Falcon 9 Formosat-5 mission. The primary Formosat-5 spacecraft is apparently targeted for deployment in a circular 720 km sun-synchronous orbit. According to the STA Request, a Falcon 9 second stage reignition burn is proposed to maneuver to a contemplated 450 x 720 km 97.4 degree-inclined elliptical secondary mission orbit. After the proposed SHERPA spacecraft release from the Falcon 9 second stage in the reoriented secondary mission orbit, the SHERPA mission plan contemplates a very dense single plane deployment of approximately 90 satellites.

¹ Application of Spaceflight, Inc., Request for Special Temporary Authority, File No. SAT-STA-20150821-00060; *Public Notice*, Report No. SAT-01130, January 22, 2016 (“*Public Notice*”).

² The *Public Notice* only mentioned the requested frequencies, but did not mention the orbital parameters of the mission or the large number of spacecraft proposed for deployment. As a result of discussions ORBCOMM has been having with Planet Labs and Spire Global, ORBCOMM only recently learned that the SHERPA mission entails the proposed deployment of approximately 90 secondary payload satellites into an orbit that would overlap with ORBCOMM’s OG2 satellites. ORBCOMM is also submitting a copy of this letter in the Planet Labs and Spire Global application proceedings, because it may be relevant to the Commission’s consideration of those applications as well.



Both the SHERPA spacecraft, and the approximately 90 secondary payload satellites, proposed for 450 x 720 km 97.4 degree-inclined elliptical orbit deployment on the SHERPA mission will intersect with the authorized 47 degree-inclined 715 km target operational orbits of ORBCOMM's entire fleet of OG2 satellites.³ Despite this overlap in orbits, the STA Request does not provide any analysis of the potential risk of collision between, on the one hand, the SHERPA spacecraft and the approximately 90 proposed secondary payload SHERPA mission satellites, and on the other hand ORBCOMM's OG2 satellites.⁴

Of equal or greater concern, the STA Request provides no assessment of the risk of in-plane collisions during the orbital life of the approximately 90 proposed SHERPA mission secondary payload satellites. These risks could well prove to be substantial, due to the contemplated very dense single plane deployment of so many spacecraft of varying designs and ballistic characteristics. The hazardous debris cloud(s) that could result from any in-plane collision(s) could significantly amplify the risk of further collision hazards; both within the proposed SHERPA mission orbit plane, and for the entire fleet of OG2 satellites.

ORBCOMM lacks the necessary information to adequately assess these risks, however, because it does not know the relevant technical parameters for many of the approximately 90 SHERPA mission secondary payload satellites, or any details relating to the proposed release order or orbital spacing for these spacecraft. Additionally, the proposed SHERPA mission secondary payload satellites have been separately developed by various Spaceflight customers, appear to vary substantially in design and ballistic characteristics, and apparently would not be under common control once deployed. The current record of the STA Request only provides a preliminary listing of the possible SHERPA mission secondary payload satellites, filed by Spaceflight on November 2, 2015. Several of the satellites on the November 2, 2015, SHERPA mission list also appear on manifests for other launch missions. The requisite collision risk assessments cannot be adequately performed until the final SHERPA mission manifest is provided, and critical information regarding the relevant technical characteristics of the SHERPA mission secondary payload satellites can be ascertained.

In any event, the Commission's Rules and policies place the onus on Spaceflight to demonstrate that the proposed deployment of approximately 90 SHERPA mission secondary

³ The STA Request does not indicate how or why the proposed 450 x 720 km 97.4 degree-inclined elliptical Formosat-5 secondary mission orbit for the SHERPA mission was selected. This is a matter of obvious concern to ORBCOMM, because this proposed orbit intersects with the authorized target orbits of the entire fleet of OG2 satellites.

⁴ *See, Mitigation of Orbital Debris*, 19 FCC Rcd 11567 (2004) at ¶ 50.

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payload satellites will not create an unacceptable risk of collision. As the Commission explained when it adopted its orbital debris mitigation policies:

We conclude, however, that in some instances the public interest would be served by a more detailed discussion of how an operator will avoid potential collisions. The first of these instances, as described in the *Notice*, is where a system will be launched into a low-Earth orbit that is identical, or very similar, to an orbit used by other systems. In such an instance we believe that the operator should submit, as part of its debris mitigation disclosure, an analysis of the potential risk of collision between the LEO systems and a description of what measures the operator plans to take to avoid in-orbit collisions. If the operator is relying on coordination with another system, the operator should indicate what steps have been taken to contact, and to ascertain the likelihood of successful coordination of physical operations with, the other system.⁵

Notwithstanding these instructions from the Commission, Spaceflight did not contact ORBCOMM prior to filing the STA Request, or since, to discuss collision avoidance, despite the overlap of the proposed SHERPA mission orbit and the authorized target orbits of ORBCOMM's OG2 satellite fleet.⁶

ORBCOMM is also concerned because the currently proposed SHERPA mission orbit will impose an unjustifiable burden on ORBCOMM to perform any necessary collision avoidance maneuvers. It is unclear whether many of the proposed SHERPA mission secondary payload satellites will be equipped with GPS or other high-accuracy position location capability. Furthermore, with one possible exception, ORBCOMM is not aware of propulsion capabilities being incorporated in any of the spacecraft proposed for deployment on the SHERPA mission.⁷ Additionally, despite claims to the contrary, ORBCOMM does not believe that differential drag or other non-propulsive techniques can be used for effective collision avoidance maneuvering in the tight timeframes associated with conjunction alerts. Thus, the burden would fall entirely on ORBCOMM to undertake any necessary collision avoidance maneuvers in the event of a conjunction alert with a SHERPA mission spacecraft. And such burdens would be very

⁵ *Mitigation of Orbital Debris*, 19 FCC Rcd 11567 (2004) at ¶ 50 (footnote omitted).

⁶ The authorized orbital parameters for the OG2 satellites are a matter of public record. *See, e.g., Public Notice*, Report No. SAT-01006, DA No. 14-418, released March 28, 2014.

⁷ Aerospace's OCSD B/C (Optical Communications and Sensor Demonstration), formerly known as IOCPs (Integrated Optical Communications and Proximity Sensors for Cubesats) apparently will incorporate Cold Gas Propulsion. And ORBCOMM understands that the 56 Planet Labs and 8 Spire Global satellites will not incorporate propulsion capabilities, but does not know the details of the other satellites Spaceflight proposes to deploy.

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significant, because using fuel for such avoidance maneuvers would shorten the lifetime of the OG2 satellites.

Spaceflight's STA Request ODAR appears to deny any responsibility for the collision risks posed by the satellites it proposes to deploy on the SHERPA mission, claiming that: "Once deployed, SHERPA will deploy satellites attached to the 5 ports on the exterior. (*These satellites must receive an FCC license and do not constitute debris*)."⁸ However, Spaceflight is the only entity that could reliably collect and provide the requisite information to perform the necessary assessment of the above-described collision risks arising from the approximately 90 secondary payload satellites it proposes to deploy on the SHERPA mission. Spaceflight presumably knows (or can obtain) the necessary information on all of the satellites it proposes to include in the final SHERPA mission manifest, and Spaceflight presumably knows how it will deploy those satellites vis-à-vis each other.

Spaceflight may also be able to arrange for SpaceX to lower the Formosat-5 and/or the SHERPA mission insertion orbit apogee sufficiently below ORBCOMM's authorized orbit altitude to eliminate ORBCOMM's concerns of collisions or having to expend fuel unilaterally in collision avoidance maneuvers. ORBCOMM would obviously prefer an STA Request modification adopting this approach. This solution would appear to be the fastest, easiest, and most practical way forward for all concerned parties. In any event, the Commission should also require the implementation of collaborative operator-to-operator procedures for the timely exchange of spacecraft ephemeris data to facilitate any necessary collision avoidance measures that may be possible following issuance of a conjunction alert from JSpOC, SDA, or any other duly recognized conjunction reporting entity. Finally, any grant of the STA Request should also specify clear criteria for aborting SHERPA separation from the Falcon 9 second stage, as well as release of the SHERPA mission secondary payload satellites, in the event of a launch mission anomaly that precludes release of these spacecraft in the authorized insertion orbit.

As explained herein, the Commission should not grant the STA Request unless it can be demonstrated to ORBCOMM's reasonable satisfaction that there is no unacceptable risk of

⁸ Spaceflight ODAR at Section 1 (emphasis in original). *See also*, Spaceflight ODAR Section 3: "Identification of any object (>1 mm) expected to be released from the spacecraft any time after launch, including object dimensions, mass, and material: There are no intentional releases other than payload deployments (see Mission Overview)."

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collision with ORBCOMM's satellite constellation. Grant of the STA Request as currently presented before the Commission, however, would clearly disserve the public interest.

Respectfully submitted,



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cc: Jonathan L. Wiener, Counsel to Spaceflight, Inc.,
Michael Safyan, Planet Labs Inc., and
Trey Hanbury, Counsel to Spire Global, Inc.

CERTIFICATE OF SERVICE

I, Walter H. Sonnenfeldt, hereby certify that on this 13th day of May, 2016, I served upon the party listed below via first-class postage prepaid mail a true and correct copy of the foregoing transmittal to the record of Spire Global, Inc. Application File No. SAT-LOA-20151123-00078 the May 11, 2016, Informal Comments of ORBCOMM License Corp. on the Application of Spaceflight, Inc., Request for Special Temporary Authority, File No. SAT-STA-20150821-0060.

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