

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

In the Matter of)	
)	
WORLDVU SATELLITES LIMITED)	Call Sign: S2963
)	
Petition for a Declaratory Ruling)	File No. SAT-LOI-20160428-00041
Granting Access to the U.S. Market)	
For the OneWeb NGSO System)	
)	

REPLY OF SPACE EXPLORATION TECHNOLOGIES CORP.

Space Exploration Technologies Corp. (“SpaceX”) hereby briefly replies to the Opposition and Response filed by WorldVu Satellites Limited, d/b/a OneWeb (“OneWeb”) in order to address two issues.¹ In its initial comments,² SpaceX raised concerns about the lack of technical sophistication in OneWeb’s system design and the resulting difficulties created for sharing valuable spectrum resources. OneWeb’s Opposition and Response reinforces SpaceX’s concern, as it makes clear that OneWeb expects other systems to bear the burden of accommodating OneWeb’s proposed operations. SpaceX also pointed out that OneWeb’s attempt to avoid providing information on its orbital debris mitigation strategies is not consistent with Commission precedent. OneWeb simply ignored this precedent. The Commission, however, cannot afford to do so. It must require OneWeb to submit this information for evaluation by all interested parties prior to taking any further action in this proceeding.

¹ See Opposition and Response of WorldVu Satellites Limited, IBFS File No. SAT-LOI-20160428-00041 (filed Aug. 25, 2016) (“OneWeb Opposition and Response”).

² See generally Comments of Space Exploration Technologies Corp., IBFS File No. SAT-LOI-20160428-00041 (filed Aug. 15, 2016) (“SpaceX Comments”).

A. OneWeb’s Approach to Spectrum Sharing Unfairly Burdens Other Operators and Would Set an Unfortunate Precedent for Future NGSO Systems.

As discussed in the SpaceX Comments, the system proposed by OneWeb includes very large and static service beams that cannot be steered or shaped, which will make sharing spectrum with other NGSO systems much more difficult than would be the case had OneWeb chosen to invest in more advanced capabilities.³ In response, OneWeb contests some of SpaceX’s specific criticisms while asserting more broadly that its system will be able to share spectrum with other NGSO/FSS systems.⁴

Yet OneWeb’s response reveals important assumptions underlying the way in which it apparently expects to share with other NGSO systems. OneWeb states, for example, that it “has provided its system details *to allow other NGSO aspirants* to develop their own systems with non-interfering technologies,”⁵ and “has provided significant detail about the operations of its system and satellites *so other potential operators* can employ techniques to protect and be protected from OneWeb’s limited and spectral-spatial envelope.”⁶ Similarly, OneWeb observes that other operators could “use different waveforms, alternate polarizations, angular separation, frequency agility or a host of other technologies to operate and share the spectrum with OneWeb.”⁷ It also recites sharing techniques identified by the ITU that other operators could employ to work around the

³ See SpaceX Comments at 8-14.

⁴ See OneWeb Opposition and Response at 6-11.

⁵ *Id.* at 6 (emphasis added).

⁶ *Id.* at 8 (emphasis added).

⁷ *Id.* at 6.

limited sharing capabilities of OneWeb’s own system.⁸ Notably, OneWeb’s own system is not capable of employing some of these same techniques.⁹

Clearly, OneWeb expects that other NGSO systems will shoulder the burden of designing and operating their systems to accommodate OneWeb’s proposed operations. Perhaps that is why it does not see its system’s limited capabilities as an impediment to spectrum sharing. Yet this one-sided approach is neither consistent with the spectrum coordination process anticipated by the Commission or the ITU, nor with the Commission’s overall approach to spectrum efficiency.¹⁰ The Commission should carefully consider the implications of allowing OneWeb to impose an unfair and disproportionate spectrum sharing burden on other NGSO/FSS systems.

It is also worth noting that spectrum sharing remains of critical importance even if, as supported by various commenters (including SpaceX), the Commission grants OneWeb’s request for waiver of the band segmentation requirement set forth in Section 25.157(e) of the Commission’s rules. As SpaceX pointed out, even if that band segmentation rule is waived so that OneWeb (and potentially other NGSO systems) are not constrained to utilizing a limited portion of the available spectrum at all times, there is still another rule (Section 25.261) that imposes band segmentation during in-line interference events—unless the affected operators can reach a coordinated arrangement.¹¹ If multiple

⁸ *Id.* at 6-7.

⁹ *See, e.g.*, SpaceX Comments at 13-14 (describing OneWeb’s inability to facilitate sharing through satellite diversity).

¹⁰ *See, e.g., Comprehensive Review of Licensing and Operating Rules for Satellite Services*, 30 FCC Rcd. 14713, ¶ 12 (2015) (systems “are expected to coordinate in good faith to accommodate, to the extent possible, networks with later protection dates”); ITU-R Resolution 2 (Rev. WRC-03) (a country whose space radiocommunication services have ITU priority must “take all practicable measures to facilitate the use of new space systems by other countries”).

¹¹ *See* SpaceX Comments at 15-16.

large NGSO constellations go into operation, such in-line events will occur frequently. Thus, even if OneWeb is granted the waiver it seeks, it should not expect to enjoy access to all of the spectrum it has requested unless it can successfully share that spectrum with other NGSO systems. As demonstrated in SpaceX's comments, OneWeb's system design is not conducive to spectrum sharing, and OneWeb's apparent attitude that other NGSO systems should bear the burden of sharing exacerbates that concern.

Although OneWeb attempts to respond to SpaceX's observations about the technological shortcomings of OneWeb's system design, those responses gloss over important considerations. For example, OneWeb argues that the large footprint of its Ku-band downlink beam cannot fairly be compared to the much smaller footprints of downlink beams from GSO broadband satellites using Ka-band spectrum.¹² While it is true that higher frequencies allow system designers to achieve somewhat narrower beamwidths, that effect is minuscule compared to the signal spreading that occurs from the altitude of a GSO satellite in relation to the spreading from OneWeb's orbital plane.¹³ In addition, OneWeb's attempt to compare the footprint of its own Ka-band downlink beam with those of GSOs is an apples-and-oranges comparison. OneWeb's beam is used for targeted transmissions to and from specific gateway earth station locations, while the GSO beams are meant to provide ubiquitous service to customers across a wider geographic area. OneWeb also

¹² See OneWeb Opposition and Response at 10.

¹³ For a given antenna diameter, beamwidth is inversely proportional to frequency. Therefore, comparing the Ka-band downlink (~18GHz) versus the Ku-band downlink (~12GHz), one would expect the beamwidth for the latter to be approximately 1.5 times larger. Because the size of a spot beam footprint varies by the square of the difference in beamwidth, one would expect the Ka-band footprint to be approximately 2.25 times smaller than the Ku-band footprint, all else being equal. On the other hand, holding the beamwidth and frequency constant, the spot beam footprint also increases by the *square* of the satellite altitude. GSO satellites operate at an altitude of 35,800 km, which is more than 30 times greater than the altitude of OneWeb's proposed orbital planes (1,200 km). Accordingly, all else equal, the GSO spot beam footprint would be 900 times larger than OneWeb's footprint.

asserts that its Ku-band downlink beam is “significantly smaller than GSO Ku-band footprints.”¹⁴ Yet GSO systems authorized over a decade ago had Ku-band downlink beams that were comparable in size to OneWeb’s Ku-band footprint¹⁵—even though they operate tens of thousands of miles farther from Earth.

OneWeb also claims that SpaceX’s estimates of OneWeb’s system capacity did not take into account certain techniques that OneWeb may use to increase that capacity. OneWeb contends that it will be able to squeeze additional capacity from its system through, for example, oversubscription and deploying high-gain user terminals.¹⁶ Such strategies could increase capacity on the OneWeb system only marginally. Yet even imagining a tenfold increase in OneWeb’s capacity relative to SpaceX’s analysis, OneWeb’s system would still reach less than 2 percent of Americans currently on the wrong side of the Digital Divide.

B. The Commission Must Require OneWeb to Submit Orbital Debris Mitigation Information

OneWeb continues to assert that it should not be required to submit information on the orbital debris mitigation strategies required of other applicants because the United Kingdom’s regulatory authorities will eventually review that information.¹⁷ As discussed in the SpaceX comments, however, the Commission has made clear that this exception only applies where the non-U.S. licensing authority has already reviewed and affirmatively

¹⁴ OneWeb Opposition and Response at 10.

¹⁵ For example, the EchoStar 10 satellite was authorized in 2006 to operate using 45 spot beams covering the continental United States using the 12.2-12.7 GHz downlink band. *See* Stamp Grant, IBFS File No. SAT-LOA-20051221-00267 (Mar. 27, 2006).

¹⁶ *See* OneWeb Opposition and Response at 10-11.

¹⁷ *See id.* at 18-19.

approved the operator's specific debris mitigation plan.¹⁸ OneWeb does not dispute that the Commission defers only to another administration's *actual approval* of a specific debris mitigation plan. OneWeb also does not dispute that no regulator has reviewed, much less approved, OneWeb's plan. Rather, OneWeb simply ignored the precedent cited by SpaceX.

The Commission cannot similarly ignore the application of its rules in this regard. Given the size of OneWeb's proposed constellation, the issues of orbital debris mitigation and post-mission disposal are critical to this proceeding. Operators must incorporate strategies for dealing with these issues during satellite construction. OneWeb indicates that it has already designed the first version of its satellites, major space hardware components have been tested, and construction of operational satellites will begin next year.¹⁹ Assessment of OneWeb's plan cannot wait until spacecraft are already rolling off the assembly line. Granting access to the U.S. market before *any* administration has received orbital debris information would create a serious risk to all space-based systems, as there would be no assurance that the operator had thoroughly evaluated strategies for minimizing or eliminating orbital debris and for safely and efficiently disposing of spacecraft at the end of their useful lives.

There is no reason for the Commission to defer to a foreign regulator where that regulator has not yet made any decision. Indeed, to do so presents substantial risks: for example, a foreign regulator could later decide to allow OneWeb to launch with a seriously

¹⁸ See SpaceX Comments at 19-21 (*citing John K. Hane, Esq.*, Letter, 26 FCC Rcd. 7996 (IB 2011), and *Carlos M. Nalda*, Letter, 28 FCC Rcd. 1050, 1051 (IB 2013)).

¹⁹ See OneWeb Opposition and Response at 3-4.

deficient debris mitigation plan. In other words, there is no way to know whether an overseas regulator's oversight was "effective"²⁰ until that review has actually occurred.

Accordingly, the Commission has adhered to the common-sense policy of requiring operators of non-U.S. licensed systems to provide complete orbital debris mitigation information unless a foreign regulator has reviewed and affirmatively approved specific debris mitigation plans. The Commission should continue to apply that policy in this case, require OneWeb to submit complete information on its orbital debris mitigation plans, and give all interested parties an opportunity to review and comment upon it, before taking any further action in this proceeding.

Respectfully submitted,

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²⁰ See 47 C.F.R. § 25.114(d)(14)(v).

CERTIFICATE OF SERVICE

I hereby certify that, on this 1st day of September, 2016, a copy of the foregoing Reply was served via First Class mail upon:

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