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BEFORE THE COMMITTEE ON COMMERCE, SCIENCE, & TECHNOLOGY
UNITED STATES SENATE

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Chairman Thune, Ranking Member Nelson, and Members of the Committee, thank you for the opportunity to testify before the United States Senate about OneWeb's mission to bridge the digital divide with our exciting new satellite technologies. This is a great time to discuss our progress as we are investing over $4 billion to build the world's first large scale satellite constellation, and will begin launching our fleet in the coming months.

In 2019 we will begin bridging the American digital divide by making low latency broadband available for every citizen in Alaska. The next year, OneWeb's broadband will reach every square mile of America and its territories, leaving no one behind. This means a brighter future for the half of America with substandard access to the internet, primarily in rural areas, and will be a foundation for ubiquitous 5G service, enabling the Internet of Things, connected vehicles, telemedicine and online education. Importantly, as a global system, we will connect American small businesses to the 50% of global markets that currently have limited or no access.

Our initial system with peak speeds of 500mbps is just the beginning. Our second constellation, planned for 2021, will augment the first and increase this speed, up to 2.5gbps, for every rural home. Beyond this we have a third constellation planned for 2023 which will continue to increase our total capacity until we can reach 1 billion users globally by 2025. In total we will potentially invest nearly $30 billion to achieve our mission of fully bridging the global digital divide by 2027.

OneWeb's capacity is more in line with a terrestrial system than historical GEO satellites. For instance, the total GEO satellite capacity today is several terabits per second (tbps). In comparison, OneWeb will have seven tbps in its first constellation, over 120 tbps in its second, and approach one Petabit per second (1000 tbps) by 2025.

Importantly, access to our services will be simple. The services will be offered by local ISPs and telecom providers. The terminals will be small, inexpensive, and lightweight so they can be installed by anyone. They will be low power so they can operate from built-in batteries or a solar panel. This unique aspect of OneWeb's system design will be a game-changer for those with intermittent power or those without power in emergency situations, rural areas and developing countries.

With thousands of satellites to build, hundreds of rockets to order and launch, and billions of people to connect to our system, this is not easy. But we have made significant progress. OneWeb's production satellites are under construction. The rockets are in place and our first launch is in May.

OneWeb's System Design and Accomplishments

In the past few years, OneWeb has made remarkable progress towards achieving its mission. As the first filed and announced direct to consumer NGSO constellation, OneWeb has been a trailblazer in design and manufacturing, and has achieved many milestones:

- Formed in 2012, years before any other applicant, OneWeb designed and filed for the first NGSO system capable of providing low cost consumer broadband;

- OneWeb has raised nearly $2 billion in equity from shareholders with deep industry and distribution expertise, including Qualcomm, Hughes, Intelsat, Coca-Cola, Airbus Group, the Virgin Group, and the Softbank Group;

- OneWeb is one of the world's largest launch purchasers and has reserved and/or manifested launch capacity from Blue Origin, Arianespace and Virgin Galactic;

- As the first applicant at the FCC, we spearheaded the use of NGSO spectrum combined with a sustainable satellite design to reach rural populations, and received the first U.S. market access grant from the FCC in June 2017; and

- OneWeb innovated the first low-cost, high performance NGSO satellites for mass production, leading to the creation of the world's first and largest purpose-built production satellite factory responsible for 250 new engineering jobs in Exploration Park, Florida.

To build this system we needed to break new ground in satellite manufacturing. Earlier this year we did just that, and our $85 million specialized facility in Florida will soon start production. Capable of producing 15 satellites per week, this new factory has also had multiplier effects for the regional economy. For instance, this summer RUAG, a space components manufacturer, moved its facilities from Switzerland to Titusville, FL to be near our factory. Their foreign direct investment in America is creating 80 new jobs in an area which has been hit hard following the retirement of the Space Shuttle.

Figure 1: OneWeb Satellites Factory under construction in Exploration Park, FL

Our Mission

OneWeb was founded with the mission to bridge the digital divide.

I have spent the past 15 years focused on this mission, one that is deeply held by many if not all of you. After selling my first company which specialized in semi-conductor cooling technologies, I traveled to Rwanda, Africa. It was then a country torn by history and without connectivity. In 2003, I began connecting hundreds of schools and rural communities to the internet, building the first fiber to the home and the first 3G network on the continent.

Figure 2: Fiber installation in 2003 in Kigali, Rwanda

With each connection, we saw the positive impact of community access on education, telemedicine and opportunity. I saw children who, for the first time, could explore their personal interests as deeply as they liked. With local teams, we pushed the boundaries to deploy the newest technologies in some of the hardest to reach and neediest rural populations in the world. It was there that I also saw the potential of small ISPs and telecom operators, which is why OneWeb will partner with, rather than displace, local operators and aspiring entrepreneurs, and much of our systems revenue will remain in the communities that it connects.

In 2007, I founded O3b Networks, which stands for the "other three billion" and has launched 12 satellites. O3b has several distinctions. Not only is it the fastest and lowest latency satellite system to date, but it is also the only NGSO communications system to not have gone bankrupt. Today O3b, now fully owned by SES, is considered a success, but there is an important lesson here. This is a fledgling industry where failure is normal, and building these systems requires a deep and passionate commitment for something more than just financial returns.

In 2012, I founded OneWeb, continuing the commitment to close the digital divide. Today, I am glad to see the Committee properly considering the leading role new satellite technologies can play in next generation broadband systems which will have higher performance, better reach and resiliency for emergencies.

Recently, Hurricane Harvey disrupted terrestrial communications networks across the southeastern U.S. Hurricane Maria also brought catastrophic damage to Puerto Rico, making cellular service almost nonexistent after damaging nearly 90% of cell sites.[1] In the aftermath of these natural disasters, satellite networks provide vital connectivity faster than any other option. And the faster communities reconnect, the faster recovery starts. OneWeb's highly resilient network will provide another level of critical connectivity to first responders and victims when tragedy strikes.

Challenges and Recommendations

Bridging the Digital Divide must include sustainable development. This means bridging the divide without harming space for future generations. We cannot overlap constellations in a way that would risk creating space debris, or endanger humans on Earth by using less expensive materials which do not degrade on re-entry. OneWeb has been focused on sustainable space development since the beginning.

We know that a single impact in space can cause thousands of debris fragments, fouling orbital altitude ranges for hundreds, if not thousands, of years. The Iridium/Cosmos event is just one of several costly, environmentally damaging examples. To prevent collisions and a cascading of damaging events, large scale constellations must have a minimum altitude spacing (MAS) for safety.

[1] https://www.washingtonpost.com/news/the-switch/wp/2017/09/28/this-is-how-bad-cell-service-in-puerto-rico-is-right-now/?utm_term=.d0502b304c7c

We were the first to design a large constellation and took great care not to overlap any prior filed system. For the sake of future generations, we cannot take the collision risk of overlapping constellations. There are many altitudes available for safe, separated operation, yet with tens of thousands of satellite filings in process, overlapping may happen as there are currently no meaningful regulations on this matter.

The last significant US regulation on space debris is more than 20 years old. The international treaty called the Outer Space Act was adopted in 1967. This has created a regulatory gap, and while many countries are drafting papers, this is a place where the United States can take a leadership position and drive standards of excellence and stewardship worldwide. NASA is conducting a study on large constellations due later this year, and at a minimum this can inform such standards.

We have worked with the industry, including Boeing, to develop best practices for an appropriate MAS. A MAS of 125km can help isolate the impact of any single system which suffers a collision. While many satellites have onboard propulsion and accurate station-keeping, we also know that satellites fail, and when they do the potential for collision rises. In such a case, keeping safe distances between constellations protects against cascading events.

OneWeb is also pioneering the use of grappling mechanisms for the removal of satellites. We will include these grappling mechanisms on all of our satellites for future space tugs, and we hope to open source these designs so every constellation may use a standard grappling interface to remove failed satellites. The development of satellite service technologies, like those at the West Virginia Robotic Technology Center, will play an important role in protecting altitudes from the many potential failed satellites.

OneWeb also pioneered new standards calling for de-orbit within five years. We carry enough onboard propulsion to safely and accurately de-orbit each satellite. We are glad to see others adopting this practice as well, as it is crucial to ensure satellites do not remain in the small and fragile LEO environment.

Related to the five year de-orbit period, we have also ensured our satellites will disintegrate on re-entry. We do not use materials which will survive de-orbit. While more expensive and more challenging, it is the proper practice rather than facing the possibility of fragments on the ground, and possibly causing re-entry casualties. While there is an old rule requiring individual satellites to have less than a 1:10,000 chance per year of causing a re-entry casualty, this rule needs to be updated to apply to large constellations that, unchecked, will drop tens of thousands of fragments.

Space is an unforgiving environment. Satellites can fail, and re-entry is always a concern. Just last year China lost control of its Space Station Tiangong-1. Operating at 349km, its re-entry date is predicted between October 2017 and April 2018. While this is only a single space object, the largest fragments that survive re-entry are predicted to be 220lbs. This is a near-term reminder that we should keep a vigilant eye on space-related safety as we look to launch thousands of objects over the coming years.

The positive news is that space safety can be straightforward when thoughtful, common-sense rules are applied. Operating costs and engineering challenges may increase slightly, but abiding by such minimum rules ensures satellites will continue to play a larger role in the nation's and the world's communications ecosystem, and that the American space sector will continue to grow.

We look forward to working with the Committee, other stakeholders, federal regulators, and others to address these issues and ones yet to emerge.

Conclusion

Mr. Chairman, Ranking Member Nelson, and Members of the Committee: thank you for the opportunity to testify today. As you have seen, we are on the cusp of bridging the digital divide using new incredibly high-performance satellite technologies.

We know you understand the moral urgency of this mission. We know you see the issues as you visit rural townships and populations, where millions of Americans live without access to quality education, telemedicine and entrepreneurial opportunities.

We are not here to ask you for Connect America Funding or other government subsidies. OneWeb was able to raise its funding because its novel technologies can sustainably achieve this goal without relying on such subsidies.

We are here to stand by your side, and with many others, help bring connectivity, jobs and economic prosperity to rural America and the world's rural populations.