

Here Come the New LEO Constellations

by Elisabeth Tweedie, Associate Editor

At the time of writing among the multiple filings for Low Earth Orbit (LEO) communications constellations, three are being taken seriously: Leosat, OneWeb and an as yet unnamed system from SpaceX. All of these are talking about being in service by 2020 with demo systems in orbit before that. Is this reality or just pie in the sky?

In order for this to happen, numerous “boxes” have to be ticked. This article will attempt to look at some of those boxes and how the three systems are stacking up.

ITU Filing: OneWeb was the first to file with the ITU for a 2GHz Ku-band system and has been granted the old Skybridge frequencies. These have to be used, i.e. at least one satellite has to be in orbit by 2019.

According to Elon Musk, founder, CEO and CTO SpaceX, it has also filed in the Ku band and plans to launch two demo satellites next year.

Leosat has a filing with the ITU for a Ka-Band system.

The ITU gives priority to established systems, meaning that it is the responsibility of any non-geo system, using the same frequencies as a GEO satellite in orbit, to ensure that there is no interference. So these systems will have to deal with the issue of non-interference with the numerous GEO satellites also operating in Ku and Ka-Band. An issue that is causing considerable consternation among some of the operators of those satellites. It is generally agreed that interference becomes an issue in the area 2-3 degrees north and south of the equator only, although some people believe that a much wider area will be impacted. At World Satellite Business Week in Paris this September, Tom Choi, CEO of satellite operator ABS said that they had thoroughly examined all publicly available data about OneWeb and come to the conclusion that OneWeb’s satellites would cross the path of a GEO 4,000 times a day, causing interference for two to three minutes each time. OneWeb seems confident that the design of its satellites incorporating “progressive pitch” takes this into consideration by tilting the satellites in such a way, as they approach the equator, so as to never cause interference when crossing the path of a GEO.

Landing Rights: All the systems will need landing rights for each country that they intend to come down in. Greg Wyler founder of OneWeb has said that the company has “operators in over 50 countries and territories.” Presumably these operators will supply the landing rights.

Mark Rigolle CEO of Leosat has said that the company is putting together a team to work on landing rights. Coming from O3b, he is well aware of the magnitude of this task: “it took O3b four years, it’s a big task, but it’s doable.”

SpaceX has been pretty quiet on this subject.

Finance: OneWeb is definitely the current leader here. According to Wyler the system – including launch – will cost around US\$ 2 Billion. Over \$500 million has been raised so far. Joining the founding investors of Qualcomm and Virgin are: Intelsat, Echostar (parent company of Hughes), Airbus, Bharti Enterprises, Coca Cola and Totalplay.

Some of these are naturally strategic investments. Airbus, as the manufacturer of the satellites is obvious. Intelsat, which invested \$25 million is looking for interoperability between Epic (a High Throughput GEO system) and OneWeb, particularly with regard to the ground terminals. The interoperability will also enable OneWeb to transition its customers to Epic in the equatorial regions, so mitigating the effect of having to reduce power in these regions. Intelsat has given a service commitment to OneWeb in exchange for exclusive access to the aeronautical, maritime, connected car and rail sectors and for specified U.S. Government and oil and gas applications. Among other things this agreement enables Intelsat to extend its service to the polar regions. This may become an increasingly important region global warming aiding the opening up of three shipping routes in the region: the North West Passage, the Trans Polar Sea Route and the Northern Sea Route.

Hughes will be developing the ground system including gateways and terminals and will also use OneWeb to provide service to its global customers and distributors.

Qualcomm will provide the chips for the hubs and terminals.

Virgin Galactic will be launching some of the satellites.

Bharti Airtel, which operates mobile networks in 20 countries will become a preferred distributor.

TotalPlay provides broadband and cable TV in Mexico – it’s not clear what it will be getting in return for its investment.

As for Coca Cola: “This project is exciting because it combines commerce with purpose,” said Bea Perez, chief sustainability officer of Coca-Cola. “We believe it will help spur local economic development where people are in the greatest need, while also helping our business by improving real-time access to some of the world’s most remote areas where we are already active in helping provide opportunities for entrepreneurs.”

In October it was announced that MDA will provide OneWeb with antennas for the satellite constellation and payload design and engineering services. Terms of the deal were not made public.

Earlier this year SpaceX received an investment of

US\$ 900 million from Google. At the time it was widely assumed that this investment was earmarked for the satellites. However this has since been categorically denied by Glynn Shotwell, President and COO of SpaceX. The total system is expected to cost US\$ 10-15 Billion and the profits from the venture are earmarked to fund Musk's dream of a city on Mars. Musk has commented that since there will be no infrastructure on Mars, a similar satellite system could be developed to provide communications on the planet.

The current cost estimates for Leosat are US\$ 2-3 Billion and one of Rigolle's primary tasks is to raise that money. Having succeeded in raising US\$ 1.5 Billion for O3b, he is no stranger to the challenges involved here.

Management: Leosat was founded by Cliff Anders and Phil Marlar, both former Schlumberger executives and therefore very familiar with one of Leosat's key target markets. Mark Rigolle, former CEO of O3b is now the CEO of Leosat, so he of all people is aware of the challenges of starting a global, telecommunications venture.

OneWeb was founded by Greg Wyler, founder of O3b, so he also is aware of the early challenges of this type of venture. Other former O3b executives include Dave Bettinger, Brian Holz and Bob Morris. Board members are Paul Jacobs, Executive Chairman, Qualcomm, Richard Branson, founder of the Virgin Group, Thomas Enders, CEO of Airbus and Sunil Bharti Mittal, founder and CEO of the Bharti Group. Matthew O'Connell, former CEO of GeoEye, has just been appointed CEO of OneWeb.

Elon Musk, founder, CEO and CTO of SpaceX and CEO of Tesla is of course leading the satellite venture, but as President and COO Glyn Shotwell is doubtless also actively involved. No one can dismiss Musk. He has no experience of manufacturing satellites, let alone 4,000 satellites and no experience building a global telecoms business; but he had no experience of building launchers or cars either, therefore he has to be taken seriously.

Target Market: OneWeb is primarily targeting the un or underserved and disaster situations, as well as busi-

ness, military and commercial aviation. Terrestrial service will not be direct to user devices; antennas mounted on roof tops or emergency vehicles will create local hotspots for 3 and 4G cellular services. These days, there is a commercial reason for those underserved areas. Laudable though, the intent is, to provide service to everyone; in most cases, inhabitants of those areas don't have the disposable income, to generate sufficient revenue for a service provider.



New LEO constellations featuring thousand of satellites are being planned by companies such as OneWeb which his backed by Qualcomm and The Virgin Group. (image: OneWeb)

O3b, started off with a similar intent, but quickly changed to include higher revenue commercial services. Aviation is already becoming a very competitive market, how much will be left by the time OneWeb

comes into service? And will there be an antenna that can cope with the necessary handoffs to serve a fast flying plane from even faster moving satellites?

SpaceX is being relatively quiet about its ambitions, and after an initial announcement of the intent to build 4,000 satellites, recent announcements have been more subdued, with Shotwell, commenting at World Satellite Business Week, that: "we are looking at this." The initial announcement referred to serving the unserved and also made reference to taking 10% business and consumer Internet traffic and the majority of long distance Internet traffic. This may not be quite as crazy as it sounds, as all three LEO companies are claiming that their systems will be faster than fiber. Nevertheless over 50% of long distance traffic is an ambitious target.

In complete contrast, Leosat is firmly focused on a small number of high revenue generating clients. As mentioned earlier, the company was founded by two veterans from the oil and gas industry and has its sights firmly fixed on a small number of high revenue clients. Target sectors are: oil and gas, maritime, backhaul and enterprise data services. Data rates will start from a minimum of 50 Mbps and could go as high as 1.2 Gbps in both directions, for a single customer. In order to generate revenue from its first two satellites Leosat will be offering batch processing. From

those two satellites it will be able to batch process a day's worth of data, that is currently transported by helicopter, so offering the oil and gas industry a significantly improved service. Serving these high value customers, is by no means a slam-dunk, but it seems to be an easier market to address and generate significant revenue from, than the under-served mass markets.

Satellites: OneWeb has selected Airbus Space and Defense to build its satellites. These will weigh less than 330lbs and the first launches should start in 2018. According to OneWeb's website, the complete constellation is 648 satellites. According to the press release from Airbus, the contract is for more than 900 satellites. That would seem to be an awful lot of spares. Total capacity will be over 10Tbps.

SpaceX's 4,000 satellites will be built by the company itself at a new facility recently opened in Seattle. According to Musk, these will be "an order of magnitude more sophisticated than OneWeb's." The satellites are expected to weigh "several hundred kilograms" and to use Hall-effect ion electric thrusters which it will build itself.

Thales Alenia has completed a technical study for Leosat which according to Rigolle validates the required design which includes on-board processing and free-space optics for Inter-satellite links. Data can be transported from any point to any other point without any interim landings. The full constellation will be 80-120 satellites, each one of which will be able to transmit and receive 20Gbps.

Terminals: The cost and capability of the terminals will be an important success factor for all three ventures. Leosat is targeting high-end customers with high data rates. It presumably can therefore afford to use a very expensive terminal. The estimated price is US\$50K for the high end falling to US\$10K for lower speed terminals. According to Rigolle, the company is talking to both Phasor and Kymeta at present.

Hughes will be building the dual-purpose (Epic and OneWeb) terminals for OneWeb. A target price tag has not been announced.

SpaceX's terminals are intended to be priced between US\$100-\$300.

Launch: OneWeb has a contract with Arianespace for 21 launches on Soyuz. The first launch will carry ten satellites. The remaining launches will carry 32 satellites. There are also options for additional launches on Ariane-6. Unsurprisingly as it is an investor, there is also a contract with Virgin Galactic for 39 launches on LauncherOne (currently in development). These launches will carry one to three satellites.

SpaceX obviously intends to launch its own satellites.

Leosat has not announced a

launch contract, but according to Vern Fothrington, Rigolle predecessor, it would most likely launch eight at a time on a medium class rocket "like Falcoln 9."

So, is it reality or pie in the sky?

These ventures face a lot of challenges, not least of which is the fact that no one has manufactured or launched sophisticated communications satellites in these volumes in the four to five year timescales, envisaged by these potential operators. Although an experienced satellite manufacturer (and owner of SSTL, manufacturer of small satellites) Airbus will have to build a production line in the US, to manufacture all but the first ten satellites. The antennas that the systems depend on are still in the development and testing phase, so more challenges there.

Even if this can be done – and that is a big "IF" can they get the distribution systems in place in time to generate a viable income stream? Of the three, Leosat has the least daunting task, as it is only targeting a few thousand customers. OneWeb is also ahead here, having struck some very strategic deals with Intelsat, Hughes and Bharti Enterprises.

As for financing, OneWeb is clearly the winner.

One thing, those of us that have been around the industry for a while, know for sure, is that almost without exception, any innovative product or service takes longer to come into commercial service than is originally envisaged, and costs far more than expected. There is no reason to think that any of these three ventures will change those paradigms.

The other question of course is: "Is there really room for three such innovative systems?" I very much doubt it. With its financing and strategic partners, OneWeb looks poised to move beyond the concept stage. Leosat is going after a very different market and if Rigolle continues his track record for raising finance, that venture also may move beyond the concept stage. SpaceX on the other hand seems to be seriously lagging at the moment. Since the primary motive for the SpaceX venture seems to be to fund Musk's vision of life on Mars, there is always the possibility that he will find an easier way of generating the money for that and this venture will fade away. A lot can happen in four years, watch this space!



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