Global, low-latency data network

LeoSat Enterprises was established in 2013 with the intention of launching a low Earth orbit (LEO) satellite constellation to provide a global, low-latency, enterprise-grade data network. The unique high throughput satellite (HTS) constellation was designed to serve the enterprise, government, maritime, oil and gas, and mobile backhaul markets, among others. Amy Saunders met with Mark Rigolle, CEO of LeoSat Enterprises, to find out more about the project, its target markets and its progress to date.

Mark Rigolle, CEO of LeoSat Enterprises

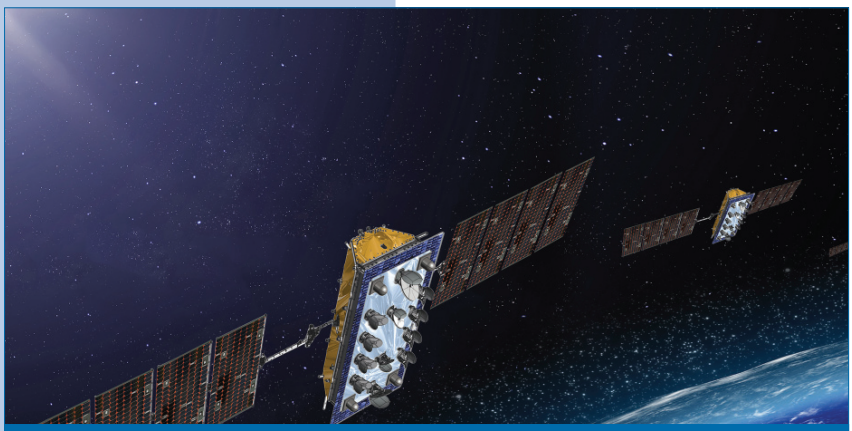
LeoSat Enterprises was established in 2013 by Cliff Anders (Chairman) and Phil Marlar (Chief Operating Officer), two former Schlumberger executives with a long history of working in the Oil & Gas exploration and cruise-line business. Realizing that the solution they were developing would also be perfectly suited to a number of vertical markets (Finance, Government and Enterprise), LeoSat was formed to leverage proven satellite communications technology to manufacture and launch a new low-earth-orbit (LEO) satellite constellation that will provide a truly global, enterprise grade, high-speed and secure data network.

In addition to the two founders, LeoSat comprises a strong team of seasoned business and technical professionals with a wealth of expertise and experience across the satellite, telecom, business and finance sectors.

Question: Can you provide an overview of the foundation of LeoSat Enterprises?

Mark Rigolle: LeoSat Enterprises was established in 2013 by Cliff Anders and Phil Marlar, its current Chairman and Chief Operating Officer. They set about designing a global low Earth orbit (LEO) satellite constellation to serve the oil and gas and cruise businesses, and after having finalized the design realized that it would also be well-suited for government, telecom backhaul and enterprise applications. Since then we have put together a team with strong backgrounds in the satellite, telecommunications, business and finance sectors to turn the project into an operational company.

Question: What can you tell us about the LeoSat constellation design?



LeoSat plan to launch two early bird satellites in early 2018. These will be smaller satellites to test part of our technology,

Mark Rigolle: We're developing a new constellation that has been designed from the ground up to offer an enterprise-grade service, which makes it different from all of the other satellite constellations that have been launched or announced. Our design will provide as much uplink as downlink bandwidth.

The constellation will feature 78 satellites in polar orbit in six planes, providing total ubiquity. We'll have better coverage in the higher latitudes than any other system, including GEO and MEO satellites. The data will be delivered point-to-point via a fully-redundant mesh network that works with inter-satellite laser links and a patent-pending routing protocol. Each satellite will have four laser links, and will be connected to the satellites ahead of it and behind it in the same plane as itself, as well as to the adjacent satellites in the two adjacent planes. As such, every spot on the globe will be covered by at least two satellites. Data will be uplinked from the customer's site, and if the destination is not in view of the first satellite, the data will be forwarded to the next satellite in the network and so on until the final destination is in view, where it will be downlinked to the client's device.

As traffic increases, we have the option to add more satellites, up to a total of 108, into the planes. In terms of customer-facing capacity, each satellite will have 10 Ka-band steerable antennas with up to 1.6Gbps of throughput each. There will be on-board processing, but in a simpler form than terrestrial networks. We will provision

primary, secondary and tertiary circuits for all of our customers in case of a problem somewhere in the network to ensure full reliability.

Each of the satellites will weigh 1.5t; essentially, they'll be very similar to the Iridium Next and O3b satellites. However, we need a little more real estate on the payloads, an extra 20cm on either side, to allow for the inter-satellite laser link hardware. The electronics on the satellites will be designed for a 10-year lifespan, but based on my experience so far, that's just the guaranteed life. In all likelihood, we'll be able to squeeze considerably more out of it in reality.

We think that at least 90 percent of our business will be point-to-point. As such, prior to the launch of the constellation, we're looking to establish just two gateways to cover the globe, which we can grow as required. The Iridium Next network is very similar, although it's more narrow-band and is optimized for voice. As we won't be competing with Iridium due to our different target markets, and because of the similarities, we may be able to co-locate with them.

Question: What can you tell us about the progress and expected timeline for the constellation?

Mark Rigolle: Right now, we've completed the design, selected Thales Alenia Space as the vendor, and completed a feasibility study with them. We've done our market research and identified our verticals as enterprise, Internet and cellular backhaul, oil and gas, maritime and government.

We plan to launch two early bird satellites in early 2018. These will be smaller satellites to test part of our technology, and also to provide certain services to some customers who don't want to wait for the full constellation launch. With these early birds, we'll also secure our frequencies by bringing them into use. While this isn't an urgent requirement as our filings are good until 2021, it will be nice to know that they're ours. In parallel, we'll be building our 78 satellites plus six spares, which we'll start launching in 2019. We plan to have the full constellation up by 2020.

For the launch, we'll be able to put eight satellites into orbit at once on a Falcon 9 vehicle, using the same dispensers as other operators. However, we plan to use a selection of launch service providers. As we'll have 13 satellites in each plane, if we launch eight at once, the math doesn't work, so we'll probably have to do one Falcon launch and one Soyuz launch per plane, for example.

In terms of funding, our cash-flow model is typical of most satellites. It'll turn cash-flow-positive very quickly after the constellation is fully launched, because the bulk of the cost is capex, which is all completed by the launch date. Better still from a cash-flow perspective, in our case, we'll also gain revenues as we build out the constellation, activating a partial service

that will improve with every launch.

We're looking at a total funding requirement of US$3.5bn. In December 2015, we launched our round A of funding, which will raise US$100m. This is faring well so far, and we've got a group of purely financial investors interested. Once round A is completed, we can move onto phase B, where Thales Alenia Space will detail out the design to the sub-component parts. That should take less than one year, and, when it's completed, we'll begin construction.

Question: With so many satellites in orbit on Ka-band, will interference be a concern?

Mark Rigolle: The International Telecommunication Union (ITU) is facilitating a coordination process between Ka-band LEO, MEO and GEO operators to protect the businesses of the users of this spectrum. They've decided to license up to five LEO constellations in Ka-band. Our filing is number two, so we're well-positioned.

To tackle potential adjacent satellite interference (ASI), our antennas will be gimbaled. We've set up our constellation such that, when one of our satellites comes within 3° of another satellite, the traffic will switch to the next satellite to avoid interference. It's an added complexity in the algorithm to provision the link, but it can be fully-automated.

Question: How will the LeoSat constellation compare with competing technologies?

Mark Rigolle: We don't think that we have any true competitors in the satellite sector. We are unique in the attributes that we will be able to deliver over our network. It's symmetrical and ubiquitous, which fibre will probably never deliver, and we can direct beams to enable immediate coverage – there's no waiting for two or three years for cable to be installed.

Our network is different from others, which have always been gap-filling ideas. The problem with any gap-filling-based strategy is that gaps tend to go away over time. If there are a sufficient number of satellite customers somewhere, telecommunications companies can justify installing fibre into that area, and satellite gets phased out. We are set up to compete with and even exceed fibre on its own turf.

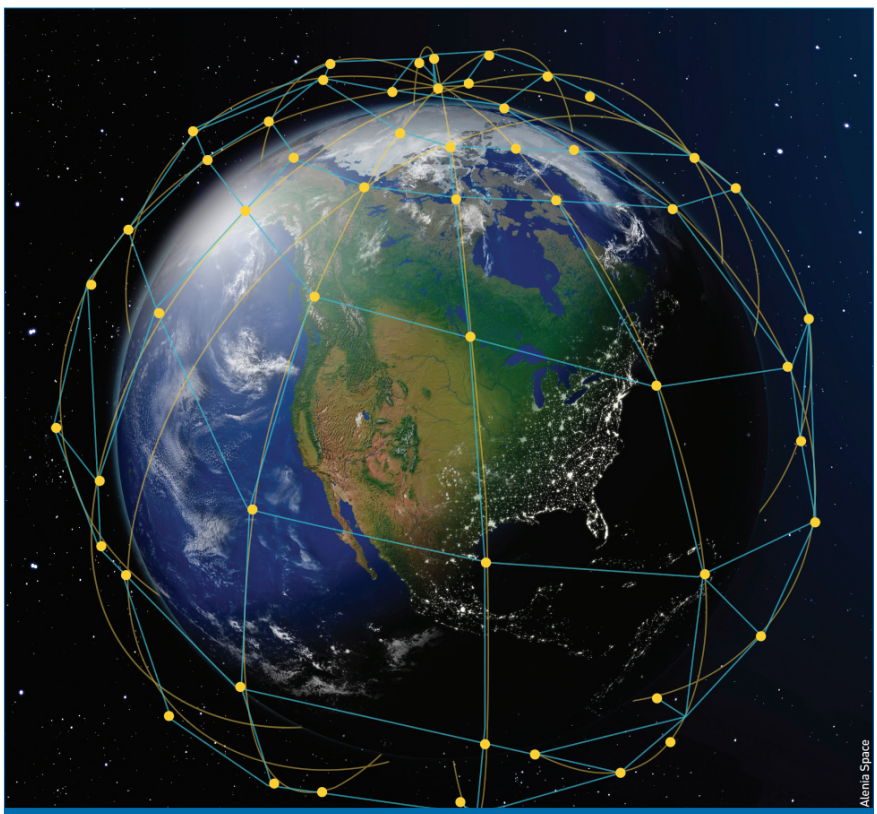
One of the greatest benefits of our network compared with alternatives is the low latency. As light travels faster in free space, thanks to our inter-satellite laser communication system, we'll reduce our latency to the bare minimum. We like to quote New York to Tokyo, which takes 200ms via fibre: We will be able to do it in 100ms.

The low latency means that our network is ideal for people with time-sensitive requirements. Latency usually isn't that important for contributing video across the globe, but when it comes to live sports, a second of latency can make all the difference, especially when it comes to betting. Trading, enterprise, banking and government applications all benefit from the reduced latency. In the oil and gas sector, if a customer is drilling in the wrong location, or the drill head is malfunctioning, that information can be relayed faster with our network, providing massive cost savings. For UAVs, the lower latency makes all the difference to reaction times and mission-critical data relays.

Question: What are the key differences between the LeoSat constellation and other constellations?

Mark Rigolle: This particular constellation is extremely capacity-efficient. In other LEO constellations without inter-satellite links, the satellites over areas of the globe with no population are literally doing nothing. This is a sub-optimal use of capex, as the satellite is still aging during that time. In our network, when a satellite is not being used at full capacity for data going up or down, it can instead be used to provision other routes, enabling productive use of all satellites and adding to revenue generation. The response that we're getting suggests that investors are very keen on that aspect.

No other satellite constellation has been set up to do precisely what we do. Our constellation has a very clearly identified target market, which can be reached without having to make customer installations at millions of homes. With business-to-consumer (B2C) models, the effort required to reach millions of homes is enormous. In contrast, in our business-to-business (B2B) model, we'll probably have less



A new constellation that has been designed from the ground up to offer an enterprise-grade service.

than 1,000 customers when we're full.

The fact that we don't need all of the 78 satellites in orbit to start generating revenue also sets us apart. As soon as we have 13 satellites in one plane, which is how we're planning our launches, we'll have coverage from the Poles to something like 72° North and South, which will provide a fully-continuous service in that region. We'll also have batch coverage globally, which means that every day, each of those satellites will see every part of Earth twice, which allows data transfers from oil rigs and such. As we add the next 13 satellites to a second perpendicular plane, continuous coverage expands to around 60° North and South. As soon as we have 54 satellites, we'll have a fully-continuous service over 100 percent of the globe. Increasing that to 78 provides redundancy at the equator, with two satellites in view of any location, the equator being a difficult area for us because of the spacing between the planes.

Question: What observations can you share about your target market?

Mark Rigolle: Even with the explosion of data usage that we've seen in the past 5-10 years, people don't realize what that explosion will mean if it continues further down the line. It's down to increased consumption per user, and also the growing number of consumers, both at the individual level and the enterprise level.

With the advent of 4G and 5G, people haven't even started to realize what that means for their systems. Cellular backhaul via GEO satellite, for example, is sub-optimal due to the latencies involved. In addition, all of the data packets have to be split into their component parts and then recomposed at the other end, which again is not ideal. In contrast, the LeoSat constellation has been designed based on a function of real needs that already exist and which continue to grow. Its low latency and ability to relay data in its native form makes it an ideal solution for the roll-out of 4G and 5G networks in the future.

There's also been questions of overcapacity and market demand. Nobody says that there's only room for one or two GEO satellites, that would be ridiculous. But when you talk to people about LEO and MEO constellations, they say, "Surely there isn't room for that many?" I respond, "Why not?" Satellites don't carry even one percent of the data being relayed around the world. If you compare our capacity to all of the satellites in orbit today, we're not adding capacity that will compete with them. We're adding capacity that will address existing and growing needs that would otherwise be filled terrestrially and will prefer LeoSat for reasons of speed and/or security.

The security issue is growing more important each day, as threats become ever-more sophisticated and pressing. When we do a data transfer from, for example, a bank in the UK to a bank in Hong Kong, that data doesn't touch another network. In contrast, with fibre, the data might be transported to a submarine cable landing point in Southampton, and then to somewhere in the Suez Canal or Dubai, and then on to another exchange on another fibre cable across the Indian Ocean, before reaching Hong Kong and being transferred to yet another network. There are so many places where that data can be intercepted or tampered with.