Innovation leads the way

NSLComm was established to develop large aperture expandable antennas that can provide more than ten times the bandwidth of traditional rigid antennas. The design, which enables the lightweight antennas to be folded into very small volumes during the launch, features a flexible sub-reflector that can correct any unfolding imperfections in orbit, while also allowing the coverage pattern to be altered on demand. Amy Saunders met with co-founder and Chief Engineer Daniel Rockberger to find out more about the company's progress and its plans.

NSLComm Chief Engineer Daniel Rockberger

Working in the field of satellite communications, NSLComm has developed antenna technologies to transform the efficiency of communications services, bringing supercharged bandwidth at a lower price per bit. NSLComm is revolutionizing satellite communications with a fabric-like, expandable antenna that may boost performance by up to 100x to 500x. By launching small and unfolding once in space, NSL's antenna opens a wide array of new applications in the $300B/yr space market.

Question: Can you outline NSLComm's innovative communications system, and how close it's getting to being space-qualified?

Daniel Rockberger: As we discussed last year, our communications subsystem has three main parts; the antenna, sub-reflector, and transceiver.

The antenna is constructed with a lightweight shape memory polymer (SMP), which means it can be folded up like a parachute for launch, and then be deployed in orbit with no mechanisms. Our antennas can be built small, at 50cm for CubeSats, all the way up to 5m for traditional larger satellites; the technology is entirely scalable. We've done a lot of research and development, but in the end, the antenna is quite simple and cost effective. With no mechanisms or motors, materials and manufacturing costs are going to be very low.

An expandable antenna is never going to be as accurate as a rigid antenna, there will always be creases after it has opened. That's where the sub-reflector comes in. It's an innovative, smart, flexible device which will allow us to change the shape of the antenna in space. We'll be able to repair any creases, or change the shape of the beam entirely to deliver different coverage. There's a lot of innovation in our sub-reflector design.

Today, we've finished our critical design review, which means that all the design work is finished, and manufacturing has started. We plan to launch our demonstrator satellite at the start of 2018. Once we've successfully demonstrated our system in space, we can start to sell it to customers. The most important thing for us right now is to get a demonstrator in space, to test the main elements.

The antenna is constructed with a lightweight shape memory polymer (SMP), which means it can be folded up like a parachute for launch

Question: What frequencies are you working with right now, and how are you responding to market demands?

Daniel Rockberger: Some of our team come from the small satellite arena so it's natural and easy for us to start with a CubeSat. It's a first product, but it's not only for demonstration; it will deliver a good service.

The 6U CubeSat that we're developing now is a Ka-band satellite, and, in order to cover multiple areas, we're designing it with three or four

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beams. We're sticking with Ka-band because we also plan to look at 5m antennas for GEO satellites, and because we want the bandwidth. All the satellite constellations that are planned or going up are Ku or Ka-band; if you want that bandwidth, you need to be on those frequencies, and we want to be a part of that. Our 6U CubeSat will be able to download 1Gbps - that's 500-1,000 times more than a traditional satellite of this size. We're turning small CubeSats into 'communication monsters.'

As well as Ka-band, we're also looking at higher frequency bands. V-band is very interesting to us because it's higher bandwidth, although it does come with a downside. The higher you go with the frequency, the narrower the beam gets, reducing it to something like 20-30km. That's why we need multibeams, to deliver more coverage. In addition, the higher the frequency, the more accurate the antenna needs to be. Ka-band already requires less than 1mm accuracy of the antenna, and V-band is even worse. However, with our technology, we don't need to make the perfect antenna; folding up something soft and then deploying it in space, there are always going to be imperfections. We just made sure that we could fix it in-situ.

We're looking at all the bands our potential customers are going to be interested in. Customers all across the world are looking at V-band, so we're looking at V-band.

Question: In 2016, NSLComm announced plans to deploy nanosatellites with 55cm diameter antennae that can be folded for launch and deployed in space. Can you provide more detail on this project?

Daniel Rockberger: We always said that we were starting out modestly. We're producing a sub-system for satellites that we're happy to sell, for both constellations and stand-alone satellite customers. Our longer-term plan is to be part of a constellation, but we're going about it by building up good revenues through our sub-system sales first, which will help us gain investors.

Because of our in-house experience, we know what it takes to put up a constellation, not only with regards to the amount of money, but also the partnerships that are involved. You need to build a consortium: You need a content provider, a satellite provider, and a ground network group of companies that will come together to build the constellation.

Question: What markets will you be targeting with your sub-system technology, and where do you expect to see the greatest uptake?

Daniel Rockberger: We've been speaking with a lot of potential customers in the field, and there's a big mixture in terms of applications. Of course, there's the GEO market, which have a big interest in our large antennas; 5m is the sweet spot that they're looking for. There are maybe two manufacturers today, they're American and very expensive, and we know that Europe is looking for an alternative with a lower cost and mass.

Today's satellite market is changing. Going forwards, the communications payloads are going to be more flexible; everyone wants to be able to use different frequencies, beam-hopping, and pattern shaping. With traditional antennas, if a satellite is launched with an antenna shaped for a specific market, and then that market doesn't develop as well as hoped, you can find yourself stuck. You can't just point that antenna somewhere else, it won't work properly.

Everyone is looking for flexibility when it comes to satellites, and there are two ways to answer that. One is to make GEO satellites designed to last for maybe seven years, instead of the traditional 15, before they need replacing. That's expensive though. The other option is to have flexibility on-board, with a sub-reflector that can change the shape of the antenna, across the lifetime of the satellite. That's an option that many companies have expressed an interest in.

The newer players are looking for something that is small, that they can fold up into a Cubesat or other small satellite. That's another market that is going to prove important for our company.

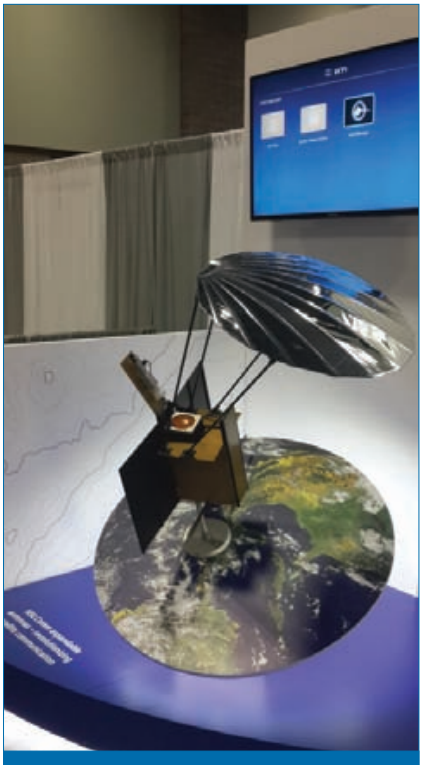
Question: What's on the horizon for NSLComm for the rest of 2017 and beyond?

Daniel Rockberger: For the rest of the year, we'll be building, testing, and getting our demonstrator satellite ready for launch. We haven't selected a launch company just yet. Once we know exactly when we'll be ready, we'll be making a contract for launch.

We already have our first customer, an Israeli customer, and we're going to do a sub-reflector project with them, although I can't go into too much detail. They're very interested in the ability to change shapes.

We're also going to be doing a lot more sub-reflector tests. We're still learning precisely how the sub-reflector acts, what we can do with it, and what the algorithm has to be to change shape and to achieve what we want to achieve. There's a lot of tests to come.

We don't have the internal funds to do a whole GEO project, but we are doing all the simulations that are needed. To add multibeam capabilities to a sub-reflector is a challenge; when a large array of beams has to look at a traditional 5m antenna, that's one thing, but when those beams need to look at a sub-reflector about 10 percent of the size, that's a bit more challenging. We're doing simulations to see how many beams we can get in, because for the high throughput satellites in GEO, more beams are required.



NSLComm develops expandable antennas