Episode 50 – Digitized Payloads, Shapeable Beams and Flexible Gateways

Guest: Stewart Sanders, EVP, Technology and O3b mPOWER Program Manager,SES –19 minutes

John Gilroy: Welcome to Constellations, the podcast from Kratos. My name is John Gilroy, and I will be your moderator. Our guest today is Stewart Sanders, EVP Technology, and O3b and Power Program Manager at SES. Stewart, how are you?

Stewart Sanders: Great, thank you.

John Gilroy: Well, here we are at the floor of Satellite 2019. You can hear all the people in the background, all kinds of buzz going around here. There's also buzz going around you and your company, you know. There's a lot of buzz about your new constellation. Tell us a little bit about this constellation, and how that fits in with the whole discussion here at Satellite 2019.

Stewart Sanders: Yeah, I'm really pleased to be leading this program, and it's something I've been involved in for three years now, since its inception. So it's doubling down on what we've been doing in the MEO constellation. Leveraging the lower latency of a MEO orbit with Ka band, and exploiting Ka band in that orbit to provide high capacity, high throughput, low latency services. But, importantly, with O3b mPower we're hooking into the latest technology to fully digitize the payload, to give us lots and lots of flexibility, lots of reuse, and a fully beam-forming phased array. Which means we can generate many more user endpoints than we can on the current constellation, over 5,000 per satellite.

John Gilroy: Can you give us maybe a little nutshell of this program, the O3b mPower and how it started and who owns it now, and how it really got put together?

Stewart Sanders: So, it started within O3b, when I was CTO of O3b. O3b consequentially bought by SES, my former company, SES had put the money behind this. So it's a fully funded program, which, frankly differentiates it from a lot of the LEO and MEO programs that we're talking about, it is fully funded, it is under contract, with Boeing to develop the satellites and they are on schedule, despite completely untrue rumors I've been hearing here, we are 100% on schedule, and we are looking at opportunities to actually accelerate the schedule for the benefit of the customer. So, the current expectation is launch in 2021, go into service Q2 2022, but we are looking at opportunities to bring that forward.

Stewart Sanders: My role now is to really build out the ground systems: user terminals, network, gateway, SOCs, NOCs, et cetera. And I've got a small dedicated team working on that within SES and it's really good fun.

John Gilroy: Tell me more about the satellites themselves. Why are they different?

Stewart Sanders: So, anybody that's seen a traditional geo satellite, there's a lot of hardware. They're big beasts. They wouldn't fit in the average living room of a house, they're that big. Some the HTS satellites I've worked on not too long ago, we're talking about Ace-900 up converters, down converters, a thousand switches, physical, metal switches. And so on and so forth. So, a lot of hardware pieces to fit together. A lot of weight, a lot of mass, a lot of size. This satellite is based on fully digitized payload, which basically everything is in the chip set, which sits behind the phased array element. It's a very small antenna, relative to its capabilities. Roughly a meter by meter by half a meter. Looks like a box. It's not particularly sexy from that viewpoint. But it packs a heck of a punch.

John Gilroy: Boy, I'll bet.

Stewart Sanders: You know, we set some targets when we went to market for this we didn't issue an RFP. We simply said these are the challenges that we're trying to solve, so, each of the satellite vendors, can you give us your best shot. Great response, huge problem for us, because we now have seven different, very different solutions to look through and try and figure out which is the best one. And we realized that Boeing had the best. We've hooked into the next generation of their payload processing, which is at a speed now where it can direct sampler RF, and the next phase of their phased array development, which is full-beam forming. Those two brought to market for a commercial operator I think it's the first time that that level of capability's been brought to market.

John Gilroy: If we just grab some random person walking by in a suit and tie, and we said, "Hey, do you know General Pete Hoene?" Yeah, and they're probably going to say "Well yeah, GEO and 150 satellites," and some people think that's what SES is all about. And you've elected to go with MEO, M-E-O. Why MEO and how is that helping?

Stewart Sanders: Well, we're not electing to go with one over the other, they both have a place to play within SES's growth going forward, and in fact we're the only operator operating commercially at MEO, and we're the only operator operating with a combined MEO-GEO capability. Our intent is to offer that combined capability to the market. Some customers will be better suited to a GEO environment, video distribution for instance logically makes sense to go through a satellite fixed in the sky so that you've got lots of direct to home antennas pointing at it. It's got reach, it just makes sense to do that for them. But for data services where low latency is a major factor in the performance of the services going to MEO makes sense. Leveraging Ka band at that orbit altitude we can provide very high throughput. Put the two together and provide the network topology to really leverage the two together we think we've got not just differentiated but world-beating capability going forward.

John Gilroy: World-beating? Well, I like to hear that.

Stewart Sanders: Yep, yep.

John Gilroy: You know when I look at your system and I try to look at it from a distance perspective here, I think you're going to deliver your product without a gateway infrastructure, and any kind of corresponding terrestrial overlay, from a gateway. How does that work?

Stewart Sanders: So it's not without gateways, we have gateways, part of the work we are doing here this week is to meet with gateway vendors specifically around the antennas initially, but we're also planning out where the eight core gateways will be. And a lot of the data that we push across the O3b mPower system will be going back through those gateways. Those will also be used for the command and control of the network.

Stewart Sanders: However, what we can also do with this network is a customer doesn't have to use a gateway. In fact, any terminal can be conceived effectively as a gateway. We can generate, per satellite, over 5,000 individual endpoint beams, and then each of those beams can be connected on a channelized basis in any configuration we choose. So if a customer wants to push some of his data to one of our core eight gateways he can do that equally if he wants to bring it back into country, or go to his own gateway we can do that as well. So it gives an enormous amount of flexibility. We've seen requests from customers to do these kind of things, and that's one of the reason we've driven this into the design of O3b mPower.

John Gilroy: Going from the satellite itself to the constellation, you know, I've read that there's going to be 30,000 fully-shapeable beams that can be switched in real time. So what do you mean by shapeable here in this context?

Stewart Sanders: So, a phased array can generate anywhere from one to a very, very large number of individual beams, and each of those beams can be weighted, or shaped to any configuration we choose. It's just the nature of the technology. It's a mathematical algorithm that drives the elements to produce shapes, the far field shapes that you want. Now, logic says that the optimal performing beams shape is going to be an elliptical or close to circular beam and that's generally what we will offer but we do have the capability of defining more irregular shapes, where it makes sense. Maybe to cover a constellation of end user points, for instance.

John Gilroy: So this would be software-defined shape? Software-defined network?

Stewart Sanders: It's an ability on the ground to drive how the chip set on the spacecraft is performing to drive, to build that far field waveform through the phased array.

John Gilroy: Well here we are in Washington, D.C., across the river there's the Pentagon, and I look at a steerable beam. Would that be of interest to government users?

Stewart Sanders: Yeah, for sure.

John Gilroy: Maybe in the military as well, huh?

Stewart Sanders: Yep, yep. We're getting a lot of traction across all of our segments and I don't want to single out the government alone to be the one whose most interested in it, but of course they're interested. We have the ability to provide field use cases that I don't think they've been able to see before from satellite vendors. That's something that we're busily discussing with them and other segments, for sure. So it works for fixed data because it's low latency, high throughput, it works for mobility because we have that complete flexibility to steer the beams in any configuration that the customer wants, and optimized for the individual customer, based on the antenna size they're using at the far end.

John Gilroy: From an antenna perspective will they need specialized antennas to receive that?

Stewart Sanders: Nope. There's no difference in the antennas that we are currently using on O3b current. They have to be able to track the MEO constellation but, we already have those terminals rolling out. All of the terminals are on O3b current. We'll be fully forward-compatible with O3b mPower, but we will be bringing new products and terminals to the market over the coming years as we go into service. It's a great opportunity. Partly because we can operate higher throughputs to lower terminals than we can on O3b current. The link budgets are improved. But it's also because the satellite constellation itself will enable many more types of service and a lot of them may be thinner throughput than we're traditionally done with O3b current.

John Gilroy: Stewart, I know you live in Europe. Believe it or not, thousands of people from all over the world, even Europe, listen to this podcast. If you are listening now, and would like to get alerts when new episodes are available, simply go to Google and type in Constellations Podcast, and Kratos will be right there and it'll sign you up. When I was doing research for this interview I came across kind of a strange phrase. I don't know if it's applicable or not. The phrase is intelligent software. Does this artificial intelligence or intelligent software... what does this mean to your application?

Stewart Sanders: So it's something SES has been I think quite forward-thinking in. We already have a contract with IBM Watson. We're going to use it for part of our command and control, spacecraft command and control infrastructure specifically to look at spacecraft telemetry in a more intelligent way. The intelligence in the software is you can teach it to do things in an automated way. And it learns effectively. You have to spend a lot of time in framing how it does that but effectively it can learn what it needs to do and it will reduce the overheads of what we need to do.

Stewart Sanders: One of the key pieces for O3b mPower is something called the system dynamic resource manager. We have an awful lot of capability in the spacecraft with it generating so many beams. We are going to contract for very shortly a system dynamic resource manager (SDRM). That will allow us to determine what the right throughput, beam shape, beam pointing, for each customer is based on a number of factors. What the customer is drawing in terms of throughput at a particular time, where they are if they're a mobility user because as the they move we can update the beam pointing. But there is a place for intelligent software within that. We've been working with MIT for a while. We're funding some development work at MIT on two specific projects. One of those we fully expect to see some output which we can plug into this SDRM concept in the coming years. That will help in later years with dealing with contention as we fill up the satellite as we expect to do to optimize the performance for the customers and for the resource itself.

John Gilroy: When you think about dynamic allocation of resources, and using some powerful artificial intelligence to accomplish that, then you apply that to something like virtual fiber networks, talk about flexible. No wonder you're talking about thousands and thousands of beams. This just gives you all kinds of flexibility that no one ever dreamed of that before.

Stewart Sanders: That's right. It is easy to get lost in the complexity of this. I like to frame it in a vision of something in the future. And that's a vision where a customer of ours can go into a web portal, order a service, through the web portal, and choose what they want that service to do. They want to connect certain geographic locations over a period of time, maybe some of them are mobility, they want to choose some features around those services, maybe they want some caching maybe they want encryption. Maybe they want analytics. They want that service to last for a period of time. Which they can define. They press a button, and it's self-provisioned.

Stewart Sanders: And the network itself will provision that, orchestrate the solution, and it will move the customer's data, on a bit by bit basis, as that data can best be moved across the network in terms of what that data needs. So if it doesn't require low latency, it can go one route. If it does require low latency it can go another route. But there's an inherent intelligence to that kind of network. What we will see more and more is the integration of the space segment with the network segment, business applications. So a customer doesn't need to care the fact that their moving across a satellite constellation at all. It's just another piece of infrastructure. But it's a very sophisticated piece of infrastructure. That's where we're heading.

John Gilroy: In doing research on your project here, I've read a couple of things that you've written, maybe someone else has written. They talked about end users becoming creators of content. What does that mean?

Stewart Sanders: So, anybody that's got kids knows just how much they're generating, Facebook input, et cetera. I think if you look at a lot of HTS satellites that have been built recently, they're very optimized for a forward-dominant link. I.e. they're pushing more data towards the user than the user is pushing back. And that's because traditionally people have been using these links for pulling video down, podcasts, whatever, streaming data, et cetera, et cetera. But there is a trend, it appears, to the individual user generating more data. That balance between forward and return is moving, in some instances, more towards symmetry. And in some segments we have segments that will be more return-dominant i.e. the end user will be pushing more data than they're taking. We think that we have again a differentiation with O3b mpower. It's thin-pipe technology, it doesn't require a particular terminal to interact with it, and it will support any ratio of forward-return mix. It's not optimized just for one segment and therefore has a lot more flexibility in the segments it can serve.

John Gilroy: I want to dig a little deeper into the differentiator here with your offering. Is it using Ka and Ku band as well? Is that a differentiator with your particular network?

Stewart Sanders: See we are just using Ka band, and the reason for that is we feel it was the best band to use for the MEO constellation exploitation for O3b current, as we're now calling it. But if you talk about differentiation, even before you get into the technicalities of what we're doing, we're funded, we're in business, we have customers up on a non-GSO platform, we're the only commercial operator that does that and we're the only one that combines it with GEO. I think that's a heck of a lot of differentiation.

John Gilroy: I think only O-N-L-Y that's the differentiator here. Name another one that does it! Only.

Stewart Sanders: Yep, Yep.

John Gilroy: So what is a customer edge terminal?

Stewart Sanders: So it's a device that sits at the edge of the network that is assigned to a particular customer. What we're looking at doing, not just in the terminal, but edge computing in general, is to integrate the network with the space segment topology so that we can bring a higher level of computing capability to the customer. So that yes, they may be cloud-connected, but they don't necessarily need to reach right back into the cloud to do whatever it is they need to do. Whether it's analytics, whether it's running some application. Working with partners to extend that cloud connection to provide that kind of capability at the edge. It is a mix of intelligent terminals, but it's also just edge computing as part of the network stuff.

John Gilroy: Crystal ball time here, Stewart. Where do you see the future of the MEO constellations going, four to five years out, where do you see this whole business transforming itself to?

Stewart Sanders: Well, my intent for what we're doing is to double down on the bet we've already made and just keep growing O3b mPower but, augmented. We're already looking at what we can do for higher latitudes, bringing in incline, looking at an inclined equatorial MEO combined with GEO combination combined with a very developed network topology. That's a really impressive infrastructure going forward and I think it's going to bring next generation capabilities to the market. That's exciting.

John Gilroy: Stewart, unfortunately here we are running out of time. Now, if you're listening to this, and there's snow on the ground, and you're trying to figure out what we talked about, you want to type this into Google it's O3b mPower Program and get all kinds of information on it. Sometimes British accent and American accent will kind of throw these things out O3bm power and people can't find it. That's the best way O3b mPower Program.

John Gilroy: I'd like to thank our guest, Stewart Sanders, EVP Technology, and O3b mPower Program Manager at SES. Thank you, Stewart.

Stewart Sanders: Thank you very much.