



Episode 88 – MicroGEO Satellites, Software-defined Radio and Getting the World Online

Speaker: John Gedmark, CEO and Co-Founder, Astranis – 19 minutes

John Gilroy: Welcome to Constellations the podcast from Kratos. My name is John Gilroy and I'll be your moderator. Our guest today is John Gedmark, CEO and co-founder of Astranis. Startup companies are becoming more prevalent in the satellite industry by the day. Many of these companies provide fresh new solutions to problems we face. In today's Constellation's episode, we will focus on how MicroGEO satellites improve communication in remote areas of the world. To guide us through this topic, I'd like to welcome our guest, John Gedmark, CEO and co-founder of Astranis. John will break down the advantages of MicroGEOs and how they help us unlock new possibilities in communication. John, every year technology is getting smaller and more advanced which brings us to MicroGEOs. Can you explain to our listeners what they are, how they're different, and what advantages they bring?

John Gedmark: Yeah, for sure. Thanks so much for having me here today. So first I think it's probably best to start with a good visual representation. A MicroGEO, when we say a microsatellite what we mean is a satellite about the size of a mini-fridge or maybe a little bigger or a little smaller. And that is in comparison to the traditional, the behemoth satellites that are put up in geostationary orbit. That are typically around the size of a double-decker London bus. Right so you can imagine just that size difference alone is a huge, huge difference. And then there's also the difference of how we're using them. So the traditional big satellites, which might cost couple hundred million dollars each, they're really designed and always have been historically going back to some of the earliest days of the space age, to cover an entire continent with satellite TV channels or now more commonly broadband internet.

John Gedmark: In microsatellite, instead what we're doing is a business model of individual country-by-country approach. So each satellite can be dedicated to a small or medium-sized country. And that means that some of these countries around the world will be able to have their own satellite, adequate satellite just for them for the very first time. So they're not sharing a satellite with anyone else or sharing the capacity with anyone else. And also the costs to them, it's more right-sized for what they need. So we're just seeing a huge amount of interest for this around the world. And also here in the United States where our first customer is in Alaska. So of course not its own country but a very similar approach. We are going to be putting up and launching next year a satellite for Alaska, that will be the state's very first dedicated satellite just for Alaskans.

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John Gilroy: When I think of these huge satellites and all the complex nature of them, and I think of a smaller satellite, I think of one factor. And so what was it difficult for you to get all that technology into that small form factor? How did you overcome some of these obstacles of size?

John Gedmark: Yeah, that's a great question. I mean what we saw was that there was a number of advancements over the last 20 years. Things like lithium-ion batteries, originally in the satellites were designed to use big heavy lead-acid batteries. And a lot of the big satellites were not taking advantage of this technology, or at least not fully. So maybe they had made the move to lithium-ion batteries, but they didn't redesign the satellite to be more optimized for that. Instead, they just used the same battery bay and just put a very small stack of lithium-ion batteries in it. And they just had this giant empty cavity. That's just this big cavern inside the satellite. So we had this opportunity with a clean sheet design to really take advantage of some of these advancements. And that includes the battery technology, that includes a number of electronic improvements, that includes electric propulsion.

John Gedmark: So using ion thrusters, which have much, much better performance than traditional liquid rocket engines. So we were able to take advantage of a lot of things that had come before us. But the real technology challenges were around building a flexible software-defined radio for space. We knew that was something we needed from the very beginning. I am happy to talk more about that. And then also there's a big thermal challenge with something like this. So really trying to pack as much capability in a small form factor as you can, then you end up with, you can have some real thermal challenges just with all the electronics, and power, and fires and everything running really hot. And how do you get rid of all that thermal energy, excess waste heat. So there were some very real challenges in developing satellite for sure.

John Gilroy: Now John, when I think of smaller satellites in a more logical sense, it would take less time to build and with the number of satellites they can put on launch vehicles now more cost efficient launches. I guess it's possible. Can you see a scenario where microGEOs, they might replace these full sized GEO satellites sometime in the future?

John Gedmark: You know that answer is yes, of course they do. Maybe not literally every application that the big GEOs are used for today. Sure there's certainly circumstances where you really do just want and need that continent-wide capability especially for satellite TV or maybe for some other applications. But for a lot of them we see the advantages as multiple folds. You're not just getting these cost advantages at the speed to deploy something new. So as you said it is faster, the satellite is so much smaller. You can actually, you can assemble it in a few months not a few years. And then you can add capacity just as it's needed, right? That's the other primary advantage is just, you have this granularity

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where you can start with one satellite and provide a small or medium size country just what they need at that time.

John Gedmark: And they're not paying for anything they're not using, which is I think the problem today. And then they can add more capability over time until you have a group of these small satellites, we call it a cluster, that are providing the same effective service as a large satellite. And in fact it's more flexible and more resilient as well. With the big satellite really you have all your eggs in one basket there if something goes wrong. So we do see a, just a number of different advantages that when all combined, we think it's going to take over a lot of what's being done today with the big satellites

John Gilroy: Earlier you mentioned this concept called a software-defined radio. And there's some people who are listening that know it well. Some people that may be kind of awkward with defining it. Could you maybe give us a little thumbnail description of what a software-defined radio is and what's the benefit of even using one?

John Gedmark: Absolutely. So I think the best way to think about it is that the satellite world has been unfortunately stuck in the analog radio age up until very, just recently. By which I mean these satellites will have these radio waves going up to the satellite. They will take in those radio waves and essentially repipe them back down without ever digitizing the signal. It just stays this analog wave all the way through. Similar to how if you imagine back when people were listening to old analog radios in their homes, listening to FDR's fireside chats. That was just an analog way of going directly from whatever microphone FDR was speaking into through the airwaves, into their radio and then still analog, to the speaker and vibrating the speaker. It was analog all the way through. There was no digitization coming into play there that just hadn't been invented yet.

John Gedmark: Well, unfortunately in the satellite world it's been the same way until literally just a few years ago. Which is sort of crazy when you think about it. And so when you actually move into the digital world from the analog world, you have a huge range of benefits. It's almost impossible to list them all with the time that we have. It's like moving from vinyl records to MP3s. It's where you can, you just mentioned all the things you can do with the digital MP3 file including the compression and all the rest, higher quality compared to an old analog vinyl record. It's just a tremendous difference. So you get higher performance, you get a cleaner signal and maybe most importantly for us, you get this flexibility where the satellites can be agile across these big wide ranges of frequencies. And so you can actually put up satellites without having to worry about exactly what location they're going to be going to, or what area they're going to be serving. And you just dial that into the software when you need to.

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- John Gilroy: I was at your website and let's pull up and take a look at the whole company itself Astranis. Give us some background on the mission of the company and what have been some of your biggest challenges.
- John Gedmark: Yeah, our mission is to get the world online, right? That is the ultimate goal here.
- John Gilroy: And what about next week, John? That's quite a mission there.
- John Gedmark: Yeah, it's not a small thing. It is going to take all of our efforts plus all the efforts of all of our brethren to get, to even try and make a dent in it. Four billion people not having real broadband access to the internet is just such a toll order. It truly is one of the world's most epic problems. So we're using this country-by-country approach to try and make a dent in it as best we can. We're really optimized for speed and being able to provide so many additional service that needs it as soon as we can. Again we can build these satellites very quickly. But yeah, it is a big problem. And it's, in our view is a first order problem.
- John Gedmark: Meaning it's really at the top of the list. If you imagine Maslow's hierarchy of needs for a community, getting them reliable communications and really access to the world knowledge, that is the internet, that is at the top of the list. It allows them to do everything from getting all the healthcare information that they need, to doing telemedicine, telehealth, getting education, being able to take online courses and also being able to be active in their community and in civil life and be able to maintain their safety. It's really something that just cuts across everything and can really improve people's lives across the board. So it's just an incredibly important mission for us. And that's why we are so focused on it here at Astranis.
- John Gilroy: You know, John thousands of people from all over the world have listened to this podcast. Go to Google and type in Constellations podcast to get to our show notes page. Here you can get transcripts for all 84 interviews. Also, you can sign up for free email notifications for future podcasts. Going to give you a shot to brag a little here. So during this journey of Astranis here, what have been some of the accomplishments that you're most proud of?
- John Gedmark: Ah, great question. I think we are incredibly proud first of all to successfully put a test satellite into space. Space is hard and nothing is given, nothing comes for free. Any kind of success comes through enormous hard work, and we have an incredibly talented team that I'm also very proud of, that has come together to execute on this mission. But we did launch a test satellite. This was a couple of years ago to basically demonstrate some of our technology around the software defined-radio concept that I was talking about earlier.

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John Gedmark: And then, I'd say next step to that is, we're just very proud to have been selected to provide this service to Alaska, right. And be now the source by which many hundreds of thousands of people in Alaska will have access to broadband internet. And for many of them that'll be the first time ever. I mean there are parts of Alaska that are extremely remote. There are Native American communities there, there're other very remote communities there that, they are going to have a broadband internet for the first time. So we're very proud of that deal and having that opportunity.

John Gilroy: Earlier you mentioned four billion people still have no internet access. Bringing internet to remote parts of the world is something that other companies are trying to accomplish as well. I think there's SpaceX Starlink constellation, and Google is using the internet balloons to bring internet connectivity to remote parts of Africa. So what's the special sauce? What makes your solution better than the others or different from the others?

John Gedmark: Yeah, absolutely. So first of all, I'll just say, as I said. This is one of the world's most epic problems. I think it's going to take everybody working together and all of these companies essentially putting as much stuff up in the sky as we can possibly get up there. And only then maybe we'll have a hope putting a dent to the problem. The reason we chose the approach we did, was we looked at what was the main thing stopping people from getting service today. And if you go into some of the more developing countries in the world. What you'd find is that, it's not like these people have never been on the internet ever. The problem is that the internet is really only available in a sort of a small city or town that's near where they live and they have to travel for an hour or more to get there. And then, they could get on WiFi in a coffee shop or something like that.

John Gedmark: But what they really want is what we have. Internet on their handset. And all of these people have cell phones. So internet on their phone wherever they go. But to do that, you need to have a low cost way to deploy cell towers out in the middle of these very remote areas and connect those cell towers to the internet. Well, we've been talking to telcos all around the world and what we've found is, they are happy to deploy cell towers into very remote areas. That's no problem. The problem is connecting those cell towers to the internet. What we've done in the United States is connect every single cell tower with fiber. Running fiber for hundreds of thousands of miles. But that can't be done for less than costs in the many billions of dollars.

John Gedmark: It's just a total non-starter in a lot of these countries. And a lot of them have rougher terrain than we have in the United States. They have much more rugged mountains, jungles, deserts, and that just adds to it. So you got to find a way to connect the cell towers to the internet. And we found satellite as the key solution to solve what we think is the most important problem in the chain. So

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that's how it works. And that's the place where we'll be slotting in to help solve those problems,

John Gilroy: Four billion people boy, that's kind of a big picture and you seem to be a big picture guy here. So let's assume that you're successful with this. So how do you foresee these remote areas utilizing the new found access. The key word I'm thinking is transformation. What do you think will change most in the areas as a result of your success?

John Gedmark: Yeah that's a great, it is something that I think about a lot. And I would really put it into three categories of changes that we'll see. So the first category is there's a lot of people where it'll change their lives pretty substantially for the better. And as I said it gives them access to health information, to information about what's going on in their local community. It will really be this great force, this title force that will lift up whole communities or allow them to lift themselves up.

John Gedmark: The second category is for some people, it will completely change their lives because there'll be able to take online courses to become say an engineer. And if you can imagine how much a software engineer located in one of these countries if you can take online courses. And you're someone who has that talent and that capability to do that. And you just need access to the knowledge to be able to learn those skills. That's going to be transformational for their lives. They could make money that is many times what they would ever make just getting some kind of a local job. And that will be an enormous driver for good both for those individuals but also for their communities. They're going to have all this extra spending power that will be just this great thing wherever they live.

John Gedmark: The third category is people that I think what we'll find is that the next Einstein or Isaac Newton may be in one of these communities. And that will be transformational not just for those communities but for the whole world. To allow us as humanity to have access to another thousand potential people of that caliber. So that's the third category.

John Gilroy: Yeah, I agree it's going to be transformational. I saw a press release with a guy named Dan Goldin and he's kind of a big dog. It looks like there's a technical advisory board that you folks have there. Can you tell us more about this board, who's serving and what they going to achieve?

John Gedmark: Great question about the technical advisory board. Yes, we're very proud to have Dan Goldin, former NASA Administrator joining as a key advisor to the company. And he has assembled just this magnificent board of technical advisors that have expertise across every aspect of building a satellite. And

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there's a lot that goes into building a satellite. There's as I mentioned earlier, there's the thermal challenges, you have mechanical challenges, you have software, you have all kinds of electronic challenges, and then systems engineering challenges. And he's been able to assemble this fantastic group. We're very, very fortunate to have Dan. And I'm very fortunate to have him advising us and advising me personally just as a great friend and mentor. He's really been very generous with his time. And we're very thankful for that.

John Gilroy: Well John, if you could get out the crystal ball and look 10 years in the future it's almost impossible to do, I know. But let's project out 10 years here. What improvements in the world do you think will be a direct result of the work you're doing today?

John Gedmark: Oh, wow. Yeah I think the most important right is economic activity and growth in some of these parts of the world where people really are struggling with not having internet access today, right? That is the single most important aspect of it. So if we can reduce the cost of internet access and increase the coverage to get all these people online, then you could see huge amounts of economic growth. And of course that benefits us all. That benefits the whole world as we see some of these countries have an opportunity to do a quantum leap in their economic activity.

John Gilroy: Serving an underserved market, that's great. You know you did a great job here with this interview, John. Our audience is always interested in next generation telecom satellites. I'd like to thank our guest John Gedmark, CEO and co-founder at Astranis.

John Gedmark: Thank you so much, thanks for having me.