Constellations Podcast

Episode 153 – Nanosatellites, IoT over Satellite and 5G IoT solving Industry Problems

Speaker: Jaume Sanpera, CEO and Co-Founder, Sateliot – 28 minutes

John Gilroy: Welcome to Constellations, the podcast from Kratos. My name is John Gilroy and I will be your moderator. We know that we can use satellite Earth observation technology to better understand our world, but now it seems possible to leverage satellite to maximize operational efficiency across multiple industries. During today's podcast, we will discuss nanosatellites, the evolution of IoT over satellite, and how 5G IoT can solve big problems in agriculture, transportation, energy industries, much more.

To go over this fascinating topic, we have invited Jaume Sanpera, co-founder and CEO of Sateliot, a company launching the first LEO satellite constellation based on the 5G standard, allowing commercial unmodified cellular IoT devices to connect from space. That's quite an accomplishment. So Jaume, there's a lot of buzz around LEO, low Earth orbit, or on these market opportunities, and the many companies trying to capitalize in. What is your outlook on LEO market opportunities for small sat manufacturers?

Jaume Sanpera: LEO, for many reasons, is the future of a lot of applications inside the satellite industry. Let us start with those observations, what's easy to understand is that as close as you are to the objective, as it is you have a much better definition of what you are looking for. Okay? But this observation is clear, but in telecommunications, it's happening exactly the same. Most of us, we have been connected once to internet by satellite, and the rate, the latency, it kills completely the experience of a high-speed navigation. Then, LEO solve exactly that, okay? It's not the same.

When you work with an internet by satellite through a GEO satellite, this means that a minimum of 600 milliseconds which at the end it's one second of delay between you click and what you want. This is absolutely unusable for gaming, for example, for voice transmission. It's annoying because it's like, "Hello, what are you doing?" "I'm doing well." Okay, there's a lot of delay between answer and that. And IoT is exactly the same, IoT is super beneficial to work with LEO because we are talking small devices with very low power transmission, and to be at 500 kilometers instead of 20,000, it's a huge difference.

John Gilroy: Yeah. So you say that LEO is the future. Now, you folks already have experience with LEO. In fact, Sateliot has experienced success in LEO with nanosatellites,

which are part of a new and growing 5G standard constellation. So Jaume, can you share with us a little bit about what a nanosatellite is and what makes nanosatellites different from other LEO, MEO, and GEO satellites in the market today?

Jaume Sanpera: I believe that the best way to explain what a nanosatellite is to base, it's the reason that it's based on a fully standard device. What does this mean? This means that when you build a nanosatellite, you are building something that is based on subsystems that they have their own legacy. Legacy means that they have already tried on space. Then, the construction, the building up of a nanosatellite based on a standard CubeSat, it means that all subsystems you buy out of the shelf, that are much cheaper, much more durablebecause they have been already out there, and much faster. You don't have to design everything from scratch. Okay? The solar panels are solar panels that you buy it and you know that they have been already working under hard space conditions.

Now, on the other side, nanosatellite against the GEO satellites, they are positioned in a lower constellation. That means that they're going around the world several times per day, it's like every 90 minutes, and they go over the North Pole. And this helps that there is space much more of these devices. The GEO stationary satellites, they are positioned on a fixed orbit that would be something kilometers away on the Equator. Then, there are very limited spaces. By the way, there is no space for more GEO satellites today. Okay? They are all occupied by, most by ex-public companies that today they are using the spaces of each of each of the countries.

John Gilroy: So the way I understand, nanosatellites are smaller than the other satellites out there, so I would think there's less power. What kind of a ground infrastructure is needed to support a nanollite constellation like that? Is it different?

Jaume Sanpera: No, there is not much difference there. The reason why is because they have much less power, that's clear, but they are much closer. What's difficult is that the ground station has to compensate the doppler effect which is something that, as you know, it happens because the nanosatellites travel at an incredible speed compared to the Earth's rotation. We are talking about 20-something kilometers, 20-something miles, 20,000 miles per hour, okay? Which is a huge speed, that the frequency shift and then this is something that is not that difficult to compensate, but it's an additional difficulty.

For the rest, the ground infrastructure, maybe one difference is that the nanosatellites, they go around the world, they are not on the same place, and then you need much more ground infrastructure if you don't have inter-satellite links. These are the two main differences between the huge constellations like Starlink, for example, the last generation wasstandard, they already have inter-satellite links. This means that the satellites, they connect each other, then

there you may have much less ground stations. If you don't have inter-satellite links, you'll need a ground station in each place that you have a customer, which makes it super difficult.

John Gilroy: During the introduction, I think mentioned narrowband IoT devices and there may be listeners that know what they are, some listeners don't know what they are. Can you give me some examples of standard narrowband IoT devices and how satellites can work together with them?

Jaume Sanpera: Yes. Let's talk about IoT. In IoT, there are several protocols that work with IoT, with internet of things. The most common use by telecom operators is NB-IoT. It's called 5G IoT. This is the standard that all the mobile operators are using in the world. Today, in the part of the world that is not covered by the mobile operators, which is 85%, if you want to connect something, you need to use a satellite device. These satellite devices are based on proprietary protocols. This means that an Iridium device does not work with an Inmarsat device, and it does not work with an Intersat or Viasat device. Okay? Each one has their own device.

And they do not have economies of scale because there are few devices of those, some few millions of devices are like these ones. And this results in a super expensive, you are talking about some two, three, four, 500 of dollars each device. Okay? When we go inside the mobile world, a 5G IoT device, it costs you five, $10, not more. Okay? Because you have to think that we have around five to 10 million satellite devices in the world, and we have five billion 5G IoT devices in the world. Okay? Then it's a relationship of 1,000 between one and the other. This huge difference means that in 5G IoT there are incredible economies of scale for all different use cases.

If you want to control cows, there are 100 companies in the world that manufacture different types of devices for controlling cows, exactly the same for agriculture, we have hundreds of companies, or any other. Then, what we have done is taking these 5G IoT devices that are super cheap, and making it connectable with our satellites. This hasn't been easy at all, okay? At the beginning, the hardware was there, but the software needed to be modified. Now, what we have done is we went inside the 3GPP.

The 3GPP is a global organization that sets up standards for the mobile industry. We have been working for the last three years doing contributions to the 3GPP in order to see that they standardize what we are using to connect to our satellites and we succeeded. Last year in June 2022, the new release of the standard was approved and from that moment, all the devices that come with 3GPP Release-17 will be able to connect seamlessly, the same $5 device will connect seamlessly with our base station when it's inside the city and with our satellite when it's outside the city, with our satellites. We are doing just

roaming, we are an extension of coverage of Verizon, of Claro, Telefonica, or KDDI in Japan.

John Gilroy: Yeah. I watched a YouTube video this morning of you, and I was surprised at the number of IoT devices. You talk about billions. It seems like there may be more IoT devices than humans on the planet now. How many IoT devices are out there? Billions and billions sounds incredible.

Jaume Sanpera: Yeah. The forecast is that within five years it will be five to 10 IoT devices for each human, on average.

John Gilroy: Really? Wow, that's incredible.

Jaume Sanpera: Yeah.

John Gilroy: Yeah. Let's talk about IoT applications. What are some IoT applications that satellites would work best for and why?

Jaume Sanpera: Our constellation, we will start the next year with five satellites. Five satellites means that you are going to have five to 10 messages in average per day in any place of Earth. This is not a lot, and some applications, that's really not enough. Then, we are starting with applications like agriculture, or cattle management, or infrastructure. So when we talk about the infrastructure, we talk about not only all the ducts, gasoducts, but high-power lines, railways, all these have to be controlled, that all this infrastructure that is getting old, we need really to monetize and it's super expensive and impossible to do it as it is today.

These are the ones that needs few messages per day. After, we go to a bunch of applications that need around one message per hour. And here, we enter on the logistics. The logistics is amazing because there are millions and millions of containers and packets that go around the world, and they need to be controlled. First, you got the first ones that really need it, it's the ones that are refrigerated. We are talking about different companies have more than, have a million containers refrigerated that brings food from one place to the other of the world and needs to control the temperature, the humidity, and where it is.

After, there is a lot of people that wants to control the doors of the container because not just people stole things, but sometimes people introduce things in the containers that are not, that they haven't to be there. There are companies that says that they lose thousands of containers per year, that they are just stuck in some places, that they have not to be in a developing country harbor where there is no coverage, and they do not recover no more.

There is a company in US that we are working with that is doing a tech that they have printed an NB-IoT, a 5G IoT chipset. This means that you have the ability of

tracking your box that you are sending everywhere in the world. Of course, there is a lot of applications that will love it that we're working with NGOs in order to control, for example, endangered species. Today, we are working with global fund or our Wi-Fi tracking in Africa that allow that all these, the rhinos, in the world there are 20,000 white rhinos, today, there are just few hundreds that are controlled. We are offering them, free of charge, because we have capacity there, that it's going to be a non-use, the capability of controlling all these.

We are working with SOS Amazonia in order to control the forestry fires and the cut of trees in the middle of nowhere. Then, there is a lot, when they discovered, these people, because this is not us, okay? This is all the resellers, these people that manufacture things that needs to be connected, when you tell them, "Okay, you are going to have the capability for $5 to have a tracker or to have a sensor," then the imagination is infinitive. They just start thinking about what dollar...

The last month comes here a man who is manufacturing millions of life jackets. Do you imagine that most of people dies in the sea because they are not localized, because they are not geo-localized in time, okay? They get freeze. Then people say, "Okay, for $5, I'm going to put one in each of the life jackets," and it will be... This is something that I'm sure that with very few time it will be compulsory because it's super expensive to look up the people and there is a lot of lives that they are lost because of that.

And as we were talking before, mountain biking. Sometimes I do mountain biking in the middle of nowhere and if you have an accident, there is no way that you could ask for help. With these small devices that are super cheap, everybody will have one for sure.

John Gilroy: The Constellations Podcast was launched back in 2017. It was a small step for man, but a giant leap for podcasting. Today, thousands of people from all over the world listen to Constellations and thanks to you, we've grown into more than just a podcast. Sign up for the Constellations newsletter to receive articles on current industry issues, podcast summaries and contributed blog posts at constellationspodcast.com.

Well, we talked about life jackets in the oceans, we talked about containers in the docks, now we're going to talk about cows in the field, or let's talk about agriculture here. Let's focus on it a little bit. So, we are working on solutions to support very fast-growing populations through the United States, and connectivity can be part of that solution. Can you explain what precision agriculture is and how satellite technology enables precision agriculture to improve yields?

Jaume Sanpera: Oh, yes. The interest part here is that we are not just imagining what is going to happen, we are just based on the pilots that have already been developed, because in some places of Europe, in some places of US, there is already very good coverage of the mobile operators and there is precision agriculture there. Then, what we are talking about is extending this increase in yield to all the places. Then, in agriculture we are mainly talking about less water expenditure, we are talking about 40% less water that it needs to be used. We have to think that in most of the countries, 50% of the water, it goes in agriculture.

Then, we are talking about huge savings in water. In the case of yield, we are talking the detection of the illness of the plants, the needs of having more or less water, more or less care. Then, all this is detected, and at the same time, for example, in wineries, they know exactly which one is the part of the winery that have to be done first, second, third, et cetera. Then, all this, it's amazing, in livestock, the pilots that people have developed, it takes us to a 20% less illness of cows, 20% less death of cows for illness, which is an incredible jump on this aspect. Because most of the cows, they are in the middle of nowhere and they do not detect or know when a cow is ill.

Then, with this small and cheap device that they just put it in the air, you detect everything in the cow. It sees if it's pregnant, if it's got right or wrong, if it move, it doesn't move, all this. They do virtual fence. When a cow goes out of the virtual fence, they just stopped via a small vibrator, and all this is working today. What we are just allowing them is to extend this to the rest of the world. And in countries that that's amazing, because Brazil, which is one of the countries that we are working more that have 24... 25% of the GDP of Brazil is agriculture. And they have millions of cows in the middle of nowhere, then for countries like this, it may have an impact on the GDP. Spectacular.

John Gilroy: Well, if you grow something in the field, you got to get it to market, and that normally involves trucks and transportation. So you have applications in transportation as well. Can you share with us the differences between Sateliot's narrowband IoT with terrestrial options for asset tracking in this transportation industry?

Jaume Sanpera: Yeah. Basically, it's coverage. Okay? Today, the terrestrial options for asset tracking, it works in the middle of the city perfectly, and we do not want to substitute that. It doesn't make any sense to put a base station in the middle of the desert, as well it doesn't make any sense to do satellite connectivity in the middle of the city. Then, we are just an extension of the coverage of the mobile operators. And we are doing it in a very efficient way because at the end, what we have done, and this is something that is super innovative, we have connected our constellation to a 5G core.

A 5G core, as you know, it's what controls all the base stations that has a mobile operator, and it's what allow us to do a single roaming agreement with the

mobile operators that we are extending the coverage of their customer, which is perfect for them because this means that we don't have to integrate with a system. They are just signing on roaming agreement with us, and at roughly the same that would cover to Canada or to Mexico, and you automatically work with a Mexican or Canadian mobile operator, you will have it when you be in the middle of nowhere without coverage.

John Gilroy: We talked about life jackets and food increases in GDP, it sure seems like satellite IoT connectivity can positively impact humanity in many ways. So in addition to agriculture, transportation, energy industry can also benefit from this type of connectivity. Can you explain how and why satellite IoT can help in the area of energy?

Jaume Sanpera: In the area of energy, there is one aspect that is revolutionizing the energy sector which is called a smart grid. A smart grid is something that is happened for the last year. 20 years ago, there was 10 places, 20 places where they generate the electricity and millions of places where they consume it. This was quite easy to control because the generation of energy may be controlled for these 20 places and the consumption was in the rest of the points. Today, with the renewable energy, we have thousands of different places where they generate energy.

Then, it doesn't make any sense to put energy, to inject energy on the line when there is a nice sun and there is a lot of energy generated by the solar panels. You need to have a lot of smart, intelligent speed between all these points, and this is the smart grid. The smart grid concept is super important, but what it needs is connectivity because solar panels, wind turbines, all these, they are in the middle of nowhere. Then, you have to control all these in order that they inject the energy when it's needed and does not do it when it's not, and to do it in a much efficient way.

The measurements of people like a General Electric, it says that the full smart grid functioning may reduce the use of energy by 15%, which is a lot of money and a lot of savings in this planet that really needs that, the resources to get optimized.

John Gilroy: I've been involved in the world of technology for long enough to know that there's always challenges in new technology and making these changes. Directing the question you, so what are some of the challenges that you face in achieving the direct-to-device integration that it takes to support these 5G IoT applications? What are your challenges?

Jaume Sanpera: The most difficult one was the change of the standards, that it has take us two years and a lot of efforts in order to convince all the ecosystem, all the industries sector that they integrate to our contributions. Okay? This was the

number one. The number two is the one that we are facing now, it's the building up of the radios that are able to connect with these small devices, because it was fundamental that devices not have modifications. This is the key point of all the go-to-market strategy, that they have to be super scalable, and that it's fully seamless for the final user. Then this radio, it's a radio that it has take us a lot of time and money to build it up, and it's the one that is going to be flying on this satellite that we are launching in these days.

John Gilroy: In all of my interacting with humans over the years, I can tell you that humans in Spain, humans in the United States, humans in Brazil, no one likes change, they have to force it upon them. So if we talk about digital transformation here, this is a change, so this has to have this motivation here. What I found is that oftentimes it comes down to cost for producers and providers in these industries as they analyze the adoption of this digital transformation. How is it possible to provide connectivity in this cost-effective way?

Jaume Sanpera: We go back to one of the first questions on nanosatellites. GEO satellites, they are super big satellites that it costs a lot of money and with a lot of redundancy, and they are used for a lot of things. When you launch a GEO satellite, it has weather, it has defense, it has communications, it has observation, it has all inside. Okay? This made a super expensive device. Nanosatellites, they are specialized just in one service. Okay? Our nanosatellites, it only does NB-IoT, nothing else. They have no redundancy, well, the redundancy is made when you have more satellites.

Every time that you launch four satellites, we launch a fifth one that is used in order that if one of those satellites stop working, we just make it enter on the mortar to get destroyed, and we put in the other on its place. And the timeframe, the life of a nanosatellite is much shorter, but we are talking that GEO satellites, it has a life span of 15 years, and nanosatellite, it has a life span of two or five years, which is perfect because it's much more in line with the speed of development in the telecom industry.

John Gilroy: Yeah, an innovation all the time. Final question here for you. So Jaume, what are your expectations for the continued advancement of small sat technology and the ways it can make our lives better here on Earth?

Jaume Sanpera: Well, I believe that one of the things that nanosatellites will bring us is connectivity everywhere. And we are talking about connectivity today is the opportunity of having access to all the information in a much more homogenous way. There are a lot of places in the world that they... Knowledge is power, and power is richness, and this will allow the development of all these regions that today they're underdeveloped. There are some analyses of United Nations which is super clear, that there is a straight line, a straight relationship between connectivity and development. I believe that will be the huge impact of these new constellations in our world.

John Gilroy: Good, good. Well, Jaume, it sure looks like you've given our listeners a very, very good idea of how unmodified cellular IoT devices can connect from space. And we're running out of time here, and I'd like to thank our guest, Jaume Sanpera, co-founder and CEO of a company called Sateliot. Thank you, Jaume.