Constellations Podcast

Episode 186 – Integrated Space Systems, Multi-Orbit Terminals and the Future of SATCOM

Speaker: Michael Geist, Vice President of Product Management, SES Space and Defense – 17 minutes

John Gilroy: Welcome to Constellations, the podcast from Kratos. My name is John Gilroy and I will be your moderator. Today, our guest is Michael Geist, Vice President, Product Management, SES Space and Defense. Today's episode will be focused on multi-orbit capabilities and why this capability suddenly seems to be on everyone's mind. I introduced our guest, Michael, earlier. I'm just going to jump right in with the questions here, so here we go. Michael, there are three main types of satellite orbits, LEO, GEO, and MEO. Most of our listeners know that. That's pretty obvious. But why is there interest from the government and industry and having them work together?

Michael Geist: Hi, John. First, thanks for having me. It's great to chat with you again. As you said, there are three primary orbits for connectivity, and those are geostationary orbit, which is roughly 36,000 kilometers from the Earth's surface, there's medium Earth orbit, which is about 8,000 kilometers from Earth, and there's low Earth orbit, which is less than 2000 kilometers from the Earth's surface. Each orbit has certain attributes and disadvantages and is best suited for certain types of applications. GEO, geostationary orbit, for example, provides maximum coverage per on-orbit asset per satellite, but it has the longest latency. Typical applications that are really good for geostationary orbit include broadcast applications.

Then you've got sort of the medium Earth orbit, which has good coverage per on-orbit asset. It's useful for cloud-native applications from a latency standpoint, but its RF requirements are more similar to GEO, so the ground infrastructure has to be a little bit stronger. And it's well-used for enterprise uncontended requirement capabilities, LEO relay services, basically using that next lower orbit down and relaying services over a longer distance, and other defense-related applications like missile warning and missile tracking, for example. And then, you've got low Earth orbit, which is, as I said, about 2000 kilometers from the Earth's surface. It has the smallest coverage per on-orbit asset, but it has the lowest latency as well. And so, that makes it really good for applications like internet connectivity and Earth observation and so forth.

And so, that's the difference in those, and what's happening within the government marketplace is that times have changed. Technology has changed in a good way. Our potential adversaries and their capabilities have changed in terms of the types of threats and so forth. And as a result of all of those things, the convergence of all of those things has led the government to desire to collapse networks because of this massive shift in supply of capacity in order to create new forms of resiliency of connectivity across those different orbits so that basically they can abstract applications from systems. And they can pass those applications, that application information, across any satellite across any orbit in order to gain the effectiveness of resiliency from a defense posture perspective.

John Gilroy: Yeah, it's interesting. It looks like all three orbits have strengths and weaknesses, and what we're talking about today is maybe optimizing and taking advantage of all those strengths and weaknesses together. Good. The military has been working towards creating a commercially integrated environment for multi-orbit capabilities. So Michael, what do you think they're hoping to achieve?

Michael Geist: Yeah, so one of the things that I've heard in the marketplace is the terminology that is resilience through diversity. The government can't afford to build bespoke resilience. And as this shift in supply has occurred, as I had mentioned with all the new players coming in to the non-geostationary marketplace, commercial industry is providing that resilience in terms of additional supply, additional capacity, new orbits, new capabilities. And they have many reasons to do it, many commercial reasons to do it, whether those commercial reasons are better, faster rural broadband connectivity, GSM backhauls, or cellular backhaul, or whether it's for things like Earth observation for farms or mines or oceanography and things like that. So that resilience is coming along because of the commercial demand for connectivity and capacity, and the government doesn't have to afford the bespoke resilience that they once had to or once tried to.

And so, now it's a matter of, well, how does the government utilize what commercial industry is putting before them? And that's where you start to move into things like hybrid space architectures, which get into moving capacity around through different orbits and different connectivity mediums, LEO relay services, how do you get interoperability between different orbits and different constellations, and things like that.

John Gilroy: And so, I guess what you're saying is that they want to include commercial integration in this whole interoperability argument. Is that right?

Michael Geist: They do. Absolutely, and that is a highlight of Space Force strategy, of DoD strategy at large, is to not augment MILSATCOM with commercial satcom, but integrate, I think you said the word exactly right, to integrate commercial satcom with military satcom more tightly.

John Gilroy: Michael, with the ongoing popularity of MEO and LEO, do you think there will be less interest in GEO in the coming years, or will it get left behind?

Michael Geist: Actually, I don't. I think that the emergence of non-geostationary certainly has created that shift in supply that I talked about earlier, but it's enabled a massive expansion in business direct-to-consumer services. But it hasn't taken away from the traditional means of business. I mean, as an operator, as a geostationary operator, probably one of the largest, if not soon to be the largest, geostationary operator, we're not seeing a significant shift away from geostationary communications in the services and networks that we deploy to customers. But by the same token, we are seeing an increase in demand for medium Earth orbit services as well as for low Earth orbit satellite services where we're partnered with the primary service providers in each of those orbits. And so, we fully believe in an all-orbit or multi-orbit strategy for the delivery of connectivity services to our customer, and I don't think geostationary is going to get left behind at all.

John Gilroy: Michael, can you talk to us about the Commercial Augmented Space Reserve, I guess it's called CASR, and how a commercial company could plant to support military satellites in orbit on demand? It seems difficult.

Michael Geist: Sure. So Commercial Augmented Space Reserve, or CASR, it's an emerging concept for the satellite communications industry. Other industries like aviation have been doing this for years in what they call the Civil Reserve Air Fleet program. So it's nascent in that, depending upon a company's business model, their customer base, or their infrastructure architecture, supporting CASR could be easy, or it could be challenging. And those things are still working themselves out.

For offering CASR in one orbit alone is mildly interesting, right, as an augmentation. But as a multi-orbit operator, we're looking at how we provide CASR across multiple orbits for customers and deliver outcomes as opposed to additional capacity. And so, we're working through some ideas that we have on how to address CASR for the government, and we have to test those hypotheses and see if the outcomes are meaningful for government customers in the way we expect them to.

And that involves things like the user terminal that a customer has. That user terminal in the future is going to have to be able to operate across multiple different orbits, perhaps multiple different frequency bands, perhaps multiple different either tightly or loosely integrated architectures. And so, we have to develop solutions or create solutions that are going to enable CASR to work across all of that, not just one piece of that. And so, we're at the very beginning stages of that, and we hope to accomplish that and work with the Department of Defense over the coming months and perhaps years to realize what we think that the government's really after.

John Gilroy: Yeah, there's so much innovation in the world of space and satellites. We've got to ask about this new concept. So what exactly is a hybrid satcom architecture?

Michael Geist: Yeah, so we sometimes refer to it as hybrid space architecture or hybrid satcom architecture. It's very similar. The government is focused on it in terms of that terminology that I mentioned, hybrid space architecture, which is, it's simply the meaningful delivery of application outcomes across orbits and across networks. It's what I was describing earlier in terms of having resilient connectivity. It's the terminology for resilient connectivity.

And so, if we think back to the days when space, or satcom, was the biggest bottleneck in meaningful connectivity, systems were necessarily designed to accommodate applications. So for example, you would have a GPS application, Global Positioning System application. You would have a command and control application. You would have an ISR application. You might have a MWR, Morale, Welfare, and Recreation, application. And each of those applications were different. They were different in terms of how the capacity was being utilized. They were different in terms of what orbits they were operating over or what modems they were using or what antennas they were using.

And so, because connectivity, because capacity was the choke point for those networks, the systems would have to be specifically designed to optimize for the finite capacity pipe that you had. And so, when you think about things like ISR, which is return link dominant traffic, as opposed to global broadcast service, which is forward dominant connectivity, the two systems that you would design are completely different from one another. Well, now with that shift in supply, space is no longer the bottleneck. So those applications, again, can be abstracted from the systems, and networks can be collapsed and combined, offering significant opportunities for resilience and ultimately financial savings to the government as well.

John Gilroy: We're doing this podcast, we're having a nice conversation about Commercial Augmented Space Reserve, but the real challenge is how to make it successful. How do you make CASR successful?

Michael Geist: Yeah, that's a great question. I think the answer to that is that we've got to get through this multi-orbit capability development and testing that we're doing right now to verify and validate that it's going to provide capabilities as we expect them to, or else they deliver capabilities to the government as we expect them to, without impacting our commercial services.

The difference between what we do in satellite communications and what the aviation community does with that Civil Reserve Air Fleet program that I talked about before is that the Civil Reserve Air Fleet program provides business-to-consumer services. When you go buy an airline ticket, you're a consumer, you're buying from a business. And if on a needed basis, the aviation community needs those planes to transport military things, they can cancel your trip, and they can reschedule you the next day. It's business-to-consumer, happens all the time when we have weather delays and things like that.

But in the space industry, in the satellite connectivity industry where the industry's largely been business-to-business oriented prior to the emergence of high capacity internet providers, either in the geostationary space or the low Earth orbit space like SpaceX and Amazon with tightly integrated systems that are business-to-consumer, our business traditionally has been business-to-business. And so, we have long-term enduring contracts with sharp teeth, with customers that we have to be very careful about how we would interrupt those services in order to provide services to the DoD at a time of emergency.

There are ways that we can do it. There are technology advancements that we can employ to do it, and those are the things that we're working through now and communicating closely with the government. And so, we'll get there, completely confident that we'll get there. And then, inherently the low Earth orbit guys and internet connectivity in general guys, they're natively already there. And so, we'll work to bring those things together as a multi-orbit solution and deliver that to the government, full stop.

John Gilroy: Well, Michael, you did a real good job of describing hybrid satcom architecture, so I'm going to give you another one. So can you explain what a space data relay service is and why a demonstration of a multi-orbit, multi-band commercial space relay service would be significant?

Michael Geist: Yeah. So space data relay service, think about Earth observation satellites, satellites that are watching erosion of the polar caps or things like that. They have a need to move that information. Sometimes, that's real-time. And if you think about low Earth orbit satellites, those low Earth orbit satellites, they fly around the Earth, they take pictures or do scans of whatever it is that they're doing. But they hold that data, right? They track, they record the data, and they hold it until that low Earth orbit satellite flies over a region that hosts a downlink gateway for them. Well, then that information really isn't real-time in that case. But sometimes information that you need is more real-time.

And so, in those cases where real-time information is necessary, sometimes it's better to point your antenna up to the next orbit up, which has a greater coverage area, than it is to point your spacecraft antenna down to the ground and wait until you get over top of the ground station. So space relay services is simply moving that Earth observation data up to the next orbit, whether that orbit is MEO or whether that orbit is GEO, and then bringing that down immediately for real-time service delivery to the end user.

John Gilroy: Hey, Michael, I got a final question for you here. In the world of MILSATCOM, what do you see as the biggest technology disruptor right now?

Michael Geist: Yeah, so this is an interesting question, both from a, are we talking right now or in the future? And I would even liken it to say that that disruptor probably is true for both MILSATCOM and commercial satcom. And I would say right now, the right now answer is that digitization has been a huge disruptor for the satellite communications industry. That's the gateway technology to automation of a host of different satellite networking functions that have previously been manually intensive. As we digitize our infrastructure as a commercial company, as the government digitizes their infrastructure, then we can begin to move what was once only analog information around teleports and gateways more easily, even to the cloud when it's appropriate. We can begin to automate our operations, which have lagged other industries for a long time.

Once we accomplish that, then we can bolt on things like network function virtualization, things like modem function virtualization, orchestration, advanced analytics, and things like that. And then, we'll eventually get to the point where we can add in machine learning and artificial intelligence to configure, maintain, enhance, and tear down networks automatically for our customers. And so, that's both your sort of right now capability as well as long-term where we see satellite networking going, whether it's MILSATCOM or commercial satcom. We're in an extremely exciting time right now for innovation within the satellite communications industry. It's the right place to be at the right time.

John Gilroy: Yeah. You're really giving our listeners a great idea of how to use LEO, MEO, and GEO altogether. I'd like to thank our guest, Michael Geist, Vice President, Product Management, SES Space and Defense. Thanks, Michael.

Michael Geist: Thank you, John.