



## Episode 1 – Big Data, HTS and Drone Races

Speaker: Skot Butler, President, Intelsat General – 23 minutes

John Gilroy: Welcome to the Kratos Podcast. My name is John Gilroy. I'll be your moderator today and our guest today is Skot Butler, President at Intelsat General Corporation. How are you Skot?

Skot Butler: I'm doing well John, thank you.

John Gilroy: Well, probably most of our listeners have heard of Intelsat. Just give us a quick 30 second, maybe, nutshell of what your company does please.

Skot Butler: Sure, so Intelsat is the world's largest geostationary satellite operator, communication satellites. We've been around for about 50 years. In fact, we sort of created the business. We were an inter-governmental organization in the start, signed into being by President Kennedy. Since that time, we've privatized. I've been there about 11 years. Actually, 11 years this week. My group focuses on government and related commercial users and delivering Intelsat's capabilities into that market space.

John Gilroy: The trending topic today, if you go to twitter, in front of the trending topic is going to be new space. Everyone is talking about new space. I teach in the classroom, they're talking about new space out in the streets, so let's talk about some concepts involved in new space and where Intelsat fits in. I guess you can't pick up a newspaper without reading the word 'big data.'

Skot Butler: Absolutely.

John Gilroy: And people understand that satellite communication is involved intensely with big data.

Skot Butler: That's right. That's right. Really, we're in a transformation here with devices needing to be connected everywhere all the time, all devices. Your refrigerator needs to be connected. Eventually, your car, so I think that has really driven a lot of the innovations that you're seeing. You mentioned new space out in Silicon Valley. There are all sorts of companies looking to start up and provide different types of services, but it's all really around this idea of everything being connected. We are connecting a lot of the world today. We cover about 99% of the world's populated regions today with our spacecraft and what are we doing on the innovation side?

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A couple of things. High-throughput satellites, which are a major part of our architecture now and I know we'll probably talk more about that. So that's the space segment side. But there's also a lot of innovation going on on the ground, in particular, in user antennas. So flat, small, portable, very easy to use, user antennas are a part of that story too and the combination of those two things together is really sort of a powerful game changer.

John Gilroy: When you have something like a high-throughput satellite, it puts through a lot of data and that's where we get big data. The real question is this; how can with the increase in big data through a high performance satellite, improve quality and speed of decision making? That's the real question, isn't it?

Skot Butler: Sure, so that's exactly right. The high-throughput design essentially allows the users to get much more out of every bit of data, so it's a much more efficient, up to 300% more efficient than a traditional wide beam satellite. And so we can move more data and move it faster and again, the user terminals come into play here as well. And for any type of user, but in particular for users that are in special mission areas, they can get that data faster, which means that they can improve their decision making. Their actionable intelligence becomes much better.

John Gilroy: I talk to people all the time about petabytes and yottabytes and all these big fancy terms and I have a five word definition for big data and it is real simple; you are going to need a bigger boat. There's just so much out there and the question is, what about analytics? Can current analytics keep up with the amount of data that your satellites are providing people on the ground?

Skot Butler: Well, I certainly hope so because we've got a lot to deliver, not just with our own constellation, but as you know I believe, we're investors in the OneWeb constellation. It's a Leo constellation, meaning lower orbit, so it's closer to the Earth, there's more of them. They're going to provide true global coverage including the poles and what's really unique about that particular constellation is I like to think about one web is sort of hitting a sweet spot in the knee. If you think about your traditional satellite phone, it works anywhere on the globe today, but it's a pretty narrow bandwidth. You can't put a lot through it and when you're talking about big data, that's exactly the point.

Traditional geosynchronous satellites like ours can handle lots of data and push a lot of data. Don't quite cover the poles and so what we're going to get is a combination of those two needs and you're going to have these small hand-held man-pack, could be on a vehicle, but these antennas are going to be very small and you're going to be able to deliver that same level of high-throughput data into those small terminals, so big data, getting it off of sensor networks, getting it off of aircraft, and things like that. Those same antenna technologies will be on those platforms as they're moving and allow for the, what we call the 'back

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hall' of that data where the analytics will take place then. It could be in multiple places at once.

John Gilroy: You know smartphones surely have had an impact on the whole mobile world and that's what's happening now. The mobile world's impacting your company, isn't it?

Skot Butler: Oh, very much so. A big part of our future is around mobility. Aeronautical is very much in the news these days because everyone knows as they sort of fly in their personal commercial flights, they're able to get that connectivity. Some of them regret that they can now get it, like me. Sort of used to wish that you had that time to maybe read a book and now you don't have an excuse anymore and you're communicating real time and participating in meetings and so forth while you're flying at 35,000 feet. It's pretty incredible.

That mobility extends though to the maritime world. More and more, maritime vessels, so think apart from your standard shipping. Think down to the fishing trawley, think to the super yacht. Our partner, Kymeta, who's developing an electronically steered flat-panel phased array antenna, not to get too technical. But those are going to be very small and they're able to go onto much smaller platforms than in the past and it is amazing how interested super yacht owners are in getting rid of the big dome antenna. They really care about the aesthetics. That's just one thing.

John Gilroy: Well I have to admit, I've seen pictures. They're kind of cool looking, aren't they?

Skot Butler: They are. They are very cool looking.

John Gilroy: I keep thinking of televisions went from the bubble TV's to the flat panel was cool looking. Now, you're going into something that it's really modernistic, the whole shape of the new panel, isn't it?

Skot Butler: It is. It's really about sort of the ease of access. Those antennas are going to allow the user to be brought into a network without them really doing anything. Sort of the way your cellphone works today. You don't think about that. You don't have to do anything to join the network. It's just there and that's one of the things that those antennas are going to enable.

John Gilroy: So will they require more gateways than the traditional satellites?

Skot Butler: Well, yes. To have all these satellites and in the case of OneWeb, 648 satellites in their first generation going around the world. They're moving fairly quickly

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and you do need more gateways to make sure that you're always in contact. But that's just a design trade off that you make to get that global coverage.

John Gilroy: Speaking of coverage, there's all kinds of new sensors out there in everything from toasters to cars to airplanes. You deal with big data. You deal with something called IoT. IoT is directly in your sights too, isn't it?

Skot Butler: Yeah, right. Well we want to connect everything and really some sort of wireless technology is really the only way to do that to connect everything, those things, whether they're in an austere environment or whether it's just the sheer number of devices. So you can think about that for something as simple as the current cellphone network, but it goes much beyond that. In particular, when you need to connect something other than ... you know that requires a little bit more throughput, as you point out. You want to get large amounts of data off of airplanes and things like that and from sensor networks that may be remote somewhere, full motion video, those kinds of things. You really need a broadband sort of channel and that's where we're really seeing the evolution.

John Gilroy: When you talk to the aeronautic people, I'm just amazed at these numbers. I can't even understand the numbers. For example, the Boeing 787, it produces a half a terabyte of data per flight. All those sensors on the different components of the airplane trying to project out maintenance and whatnot. It's just the IoT, it's so much information, and it is hard to even understand it.

Skot Butler: Well, that's exactly right. You make an important note there because in something like an aircraft, mostly as consumers, what we think about is what we're getting onto the aircraft. We want to exchange our email or ultimately we want to stream probably our Netflix while we're in flight.

John Gilroy: The flight panel antennas.

Skot Butler: Yes, but there's so much more to it as you point out. Getting the telematics off of the engines and things like that, safety of flight things. All that information getting broadcast out really, really makes for a large amount of data that needs to be transmitted.

John Gilroy: People are estimating 26 billion units by 2020 of IoT. I keep thinking McDonald's with billions and billions. This is going to be billions and billions. So how are these individual units going to impact IoT connectivity do you think?

Skot Butler: Well, the sheer number is unbelievable, but I think you have to remember that there isn't going to be a single technology. Satellite will be one technology that serves the IoT world, but again, IoT could be anything from your refrigerator ordering your new mayonnaise when you run out to highly critical, mission

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critical sorts of sensor networks and other things where the data has got to get in a timely and reliable fashion from point A to point B or maybe multiple points simultaneously.

John Gilroy: So remote access and sensor networks, these are very, very practical in the military community and practical in the commercial community too. It's a very different way from looking at strategy than before, isn't it?

Skot Butler: Yeah. I think one good example is what we call the 'connected car,' which really is just a subset of an IoT sort of application. Again, we think as consumers about the rear seat entertainment piece of it, but the auto manufacturers are looking at it very differently. They do a lot of recalls for software. Well, if they can update that software over the air, rather than having to bring those cars back, that's more efficient and saves them money. They might be able to perform that over cellular network, but a global auto manufacturer that has vehicles literally everywhere would have to contract with something like 50 different cellular operators to deliver that data. We can provide them over satellite, this ubiquitous coverage, this sort of guarantee of delivery for the updates and can control that over time and things like that. It's going to be a really important part of the future.

John Gilroy: So what Intelsat can do is give a company, Ford Motor Company, a strategic advantage over a terrestrial deployment by using your services.

Skot Butler: That's exactly right. And we've talked about Kymeta already and Kymeta has a partnership with Toyota today. And those antennas are going to be in the roof of the vehicle. You won't even be able to see them. They're very small and initially again, the idea is let's do something that the auto manufacturers can build into their model, but beyond that, there is the entertainment piece as well. As well as things like telematics like we talked about for the air born.

John Gilroy: We really can't talk about new space without talking about unmanned aerial systems and I have to tell you, I live in Loudoun County and my son has a friend and they race drones. They have drone racing leagues now all over the country and these concepts that seven, seven or eight years ago would have been, "No. This is like Star Wars or something." This is what is going on and I think the uses of satellites in the future are going to be ... We couldn't even put them on a piece of paper. For managing drone racing across the country or something? Who knows where it's going to head?

Skot Butler: Sure and not just drones that fly, but drones that drive across farmland as well.

John Gilroy: And under water.

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- Skot Butler: And under water as well, so it's exciting. Of course drones, we use unmanned aerial vehicles around unmanned aerial systems typically rather than drones, but they span everything from the thing that your son races to, to vehicles that the Air Force uses, which are almost as big as a traditional aircraft.
- John Gilroy: By the way Skot, it's pretty cool to race drones in case you're wondering.
- Skot Butler: I bet.
- John Gilroy: They have their headsets on and they crash all the time. Mechanics are the most popular people out there.
- Skot Butler: You can buy those things for almost nothing these days too.
- John Gilroy: Right. Hey, it crashes, so what? Get another one. Put on your goggles and race. Now, earlier we talked about mobility and you casually mentioned maritime and bang, it all kind of ties together. Maritime could be unmanned. I saw one of the Tweets from your company talked about vehicles that are underwater as well. So all kinds of implications here for safety, for recovery, and in the military.
- Skot Butler: Yes, absolutely. Surface and under water both for the maritime applications and they could be connected to networks of buoys and so forth, that they carry data transmissions from the undersea vehicles to the surface and so forth and so really, it's about creating these networks that inter-operate sort of seamlessly and often autonomously largely and then the humans can spend their time worrying about the analytics piece that you brought up before.
- John Gilroy: I have to admit in the last few weeks, my wife has been watching the development of different hurricanes and nice pretty picture, data visualization is great, but I don't know if she or I even realize how much is dependent on sensors from all over the oceans and the sky and a lot of the sensors that ... Information collected via satellite. Maybe all these projections can be attributed to the advances in satellite technology.
- Skot Butler: Sure and I think from that perspective, it's satellite imagery as well as communication, so we're primarily in the communications business as you know. But the imagery and then the combination of those two, the ability to retransmit that data in other places and we've spent a lot of time over the years investing in helping customers stand up disaster recovery networks. So while satellites are very good for responding when disasters happen and we, and the satellite community at large, often provide services and hardware into those stricken areas. Planning for it with disaster networks, satellites in particular, where if everything else goes down, the satellite is still going to work.

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John Gilroy: Tell us about this Epic constellation. What does it mean for our listeners?

Skot Butler: Sure, so Epic constellation is Intelsat's high-throughput system. So, if you think about a traditional, what we call wide beam satellite, one satellite beam might cover the entire continental United States. That means you're spreading all that power across that entire region. What we do with the high-throughput satellites, is we create lots of small spot beams. Almost looks like a cellular network when those are depicted, sort of that honeycomb sort of look but these are more circular. But we concentrate and we reuse the spectrum in multiple places, multiple different of those spot beams. And then therefore, we can concentrate that power.

What does it mean? So it means that that user, as we talked about before, who wants that handheld device or that device that they carry on their back, is going to be able to get a much higher performance from those same size, that same sort of form size that you would get traditionally through a much larger terminal that maybe had to be fixed in one location. So it's a mobility answer as well.

John Gilroy: When it comes to mobility applications like cars and trains and even boats, what are the biggest challenges that you face?

Skot Butler: Well, right now I think the biggest challenge for the entire industry is just getting the devices out there that are really going to be that game changer. So I talked about the combination of the innovation and the space segment with the innovation that's on the ground segment and really being able to leverage the benefit of having those two things together. So companies like Kymeta that are really out on the edge on these things are pressing as fast as they can, but to proliferate those devices out there and get them installed on platforms is really an important element.

John Gilroy: I want to bounce back to HTS and talk about the satellite operators out there, the backbone. Are they taking different approaches to HTS or is it the same technology basically for all operators?

Skot Butler: Well, HTS is really a sort of generic term. Underneath the umbrella of HTS, you may have different frequency bands. You also may have different architecture. So Intelsat's architecture is an open architecture. It's backwards compatible. You can bring different types of equipment and operate on our system. Some other operators have chosen to have more of a closed system where there's a specific technology that you need in order to operate. Then you brought up gateways earlier and that's another important point. Depending on the kinds of applications that you want to serve, some architectures require you to go back to a specific gateway. Ours actually allow you to connect from any one of those

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spot beams to any other spot beam. You can connect via our digital payload that's on board the Epic spacecraft.

John Gilroy:

So it gives good flexibility.

Skot Butler:

Lots of flexibility. Lots of options for users and when you have users that have lots of different application types, when we run across ... Our businesses go across media, broadband, enterprise, government, everything, you need to be really flexible in that fashion.

John Gilroy:

So how do you think operators will differentiate themselves from each other?

Skot Butler:

Well, you're already seeing it now. I mean one differentiator, although it's not so much a performance thing, but it does affect the hardware, is the frequency band that you're going to use and others are offering services in different ways. Traditionally, in the satellite market, particularly in the wide beam satellite market, you would buy megahertz of capacity and you would own those megahertz and you would do what you like with those and what you're seeing now is more of a move to a managed service model, so much more like your cellphone. So in a OneWeb world, you will have the same sort of idea where you have a subscription and you can use it where and when and you pay based on the type of service that you buy. You can do a usage base or a full time.

John Gilroy:

Good parallel. There's a lot of parallels here between bubble TV's, flat screens, phones, and satellites, all kinds of technology here.

Skot Butler:

Yes. Absolutely.

John Gilroy:

When you think of phones and email and Equifax comes up and security. Cyber security has to be dealt with everything. You talk about cars and cyber security. You talk about high speed networks and cyber security. You talk about big data and cyber security. So there's a think tank called the Chatham House and they identified the intersection of space and cyber security as a potential significant vulnerability of the world's critical infrastructure. Wow. Sit down and take a cup of coffee with those words, huh?

Skot Butler:

Actually.

John Gilroy:

Critical infrastructure. Well, that's what happened in Florida.

Skot Butler:

Well, we're very focused on security overall. I think your point is exactly right. When we talk about all of these billions of devices connecting, you know every device that connects creates a new vulnerability within the system. So we've been very focused since 2000. We've had a chief information security officer in

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place since that time. And we've been evolving and staying very close with the government standards and keeping up on all the important pieces that go around cyber security and initially, I think it was about building defenses around your networks and now it really is about much more than that. It's about anticipating and characterizing and we participate in a lot of industry and government working groups and so forth, so that we can share best practices and what we see on the network. Our CISO has been interviewed multiple times on this topic and it's really pretty impressive, the level of maturity that our cyber program has because we do realize that it's critical both for the traffic that our customers are passing across the network, but also for the control of our own network and our satellites themselves.

John Gilroy: I was thinking about your CISO and I've talked to Ron Ross up at NIST and they've moved from what I call 'checklist security' to 'continuous monitoring.' 24 hours, 7 seven days a week all over the world. Hey, get some NoDoz, huh?

Skot Butler: Well the key is, you got to have a team that does nothing else and that's what we've had for a decade or more now. But you're exactly right and NIST is a big player in this. And essentially, what we did is we took all of the US government standards and all the commercial best practices and we took the most stringent in each of the categories and we sort of constructed our cyber security program around that.

John Gilroy: Let's say you are at a satellite conference, you sit down next to someone, they turn to you and say what cyber security concerns do you have?

Skot Butler: Well, I mean our concerns are largely that you know any other company that builds ground hardware that connects directly to our network again, creates potentially a vulnerability. So we spend a lot of time. We actually pay third parties to test some of the hardware that we use within our ecosystems that our partners provide, so that we can ensure you know that they're meeting the standards that we believe that they need to make. And by the way, we do that on our own system as well. We have third party attestation of our cyber security posture and we do that on a routine basis. We actually ask them to try to hack into our network. They have not been able to I'll say so far. But we go beyond that even and we say, "Let's assume that you did get past this first ring. Let's see what you would do if you were inside." And so we really take it to a very extensive level to make sure that ... because at the end of the day, if we can't protect our own network, it means our customers' information isn't secure.

John Gilroy: So frequently want to do these... I call them 'penetration tests' or pen tests. Pretty frequently or how often?

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- Skot Butler: Well, it's an ongoing thing. It's cyclical in nature in some ways because there are always findings because you know cyber security and the threats are always maturing. So there are always findings, there are always things that you can do better. And we'll get those findings and then we'll go through a period of remediation where we'll take specific steps to prevent those. And then we start again.
- John Gilroy: If we can go old-school here, maybe the older satellites didn't have a whole lot of beams. New ones may have dozens or hundreds of beams. Does that present any kind of threats in the cyber security space?
- Skot Butler: Well actually, in some ways we have more security when we have these beams, so you know one of the threats against satellite is jamming and oftentimes, most of the time in fact, that it's unintentional. But in the cases where it might be intentional, we can much more quickly find the source of jamming when it's in a small spot beam because they essentially have to be in that beam in order to jam. Whereas in a wide beam world, they could be across on the other side of a continent and with the right frequencies, they could potentially still do that.
- John Gilroy: Unintentional consequences is the plague of many complex systems and I think that moving to this more complex system with massive amounts of data, it could lead into areas of vulnerability that we couldn't even estimate, that maybe your system may not even be able to predict today. It is part of the difficulty with this rapidly changing new space world, isn't it?
- Skot Butler: Well, that's exactly right and because we handle lots of customer traffic as well, it's not only our own network that may be targeted, but someone, even a national state actor could potentially be targeting a specific user, customer, of our network and therefore we have to be vigilant against that as well.
- John Gilroy: I want to just touch real quickly on the FAA. Should they take a greater role in on-board space, flight safety, and situational awareness or should they back off or another organization should address that?
- Skot Butler: Well, I think there is kind of maybe three key things when it comes to the space traffic management. One, I would say the first and foremost is do no harm. The Air Force has had a program in place for a long time and the commercial industry over the last couple of years through an organization we call the Commercial Integration Cell, is actually participating in joint efforts with the Air Force. So, let's not do anything to harm what's already being done. Beyond that, let's not harm our commercial interests around the world. And thirdly, it is a global problem or a global challenge and it needs to be a global solution.

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John Gilroy: Yeah, because just one national organization is not going to impact the people all over the world on this problem, is it?

Skot Butler: That's exactly right.

John Gilroy: Well, unfortunately Skot, we are running out of time. I'd like to thank my guest today Skot Butler, President at Intelsat General Corporation. And thanks for listening to the podcast. This is a podcast from Kratos where we try to keep you on top of developments in the satellite world. If you liked the podcast, subscribe, and tell a friend.