Constellations Podcast

Episode 94 – Inclined Orbits, Detecting Change and Having a GPS Moment

Speaker: Brian O'Toole, CEO, BlackSky – 24 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 Brian O'Toole, CEO of BlackSky. We will discuss artificial intelligence and machine learning, concepts that are fundamentally altering Earth observation and the geospatial industry. Technological advancements are transforming the industry in delivering insights that were not even possible a decade ago. Data has become exponentially richer and advanced geospatial analytics have been ingrained in countless sectors, including archaeology, disaster response, urban planning, even government services. A recent report projected that Earth observation and the geospatial industry will grow from 239 billion last year, to 500 billion in 2024. Well, Brian, you've been on the right horse with BlackSky, didn't you?

Brian O'Toole: I think so. I think so. Good to be with you today, John.

John Gilroy: Yeah. Tell us a little about BlackSky, please.

Brian O'Toole: BlackSky, our mission here is to give our customers the first-to-know advantage, and what we're about is using the economics of small satellites to monitor the Earth and then bring that data down, combine it with a lot of other information, and provide information, geospatial intelligence, almost on a real-time basis, to deliver insights for decision-making to customers in a way that they have never been able to have that information before.

John Gilroy: Wow. If you look at this from 40,000 feet... You've been in the game for 30 years, you've seen the transition and changes. Can you tell us a little bit about how this technology has changed? It seems like a great deal of the need for custom-launch vehicles, satellites, and even hardware has switched over to being software-based. Do you see that, too?

Brian O'Toole: I see that. I think the couple of big trends, the economics of small satellites are enabling us now to be able to monitor the planet in near real-time with swarms of satellites, as opposed to very large, expensive satellites that are primarily designed for mapping the Earth. And by having a large number of sensors observing the Earth, we can begin to monitor and see how things change. And it's one thing to get the data from the observation satellites and sensors, but it's really what you do with it to provide the insights that end-users are looking for, so cloud computing, high-performance computing, combined with the advancements in AI and machine learning algorithms, are a huge enabler to providing those insights to the customers. They ultimately are about getting

timely and relevant information for making decisions. It's a long way from just getting a picture from a satellite.

John Gilroy: BlackSky was one of the first to put smallsats on inclined orbits. What is meant by a low-inclined orbit and why is that even important?

Brian O'Toole: Historically, the constellations that are up there now, are in what's called a sun-synchronous polar orbit. That means when they take a picture, no matter where they are, it's at the same time of the day, so 10:30 in the morning, 1:30 in the afternoon, et cetera. What we've done by putting our satellites in an inclined orbit, it accomplishes two things. We're imaging from dusk to dawn. Now we're able to see things happening that are... Things go on in the world besides 10:30 in the morning and 1:00 in the afternoon, right? We can see things going on all day long, but they're also optimized for this revisit so that we can look at the same location multiple times a day. And that ultimately is moving us into where this really wants to be, and that's detecting and understanding change. The real users of geospatial intelligence, GEOINT 2.0. 1.0, is about mapping. This is about monitoring the Earth and detecting changes and anomalies that could impact the operations of whether it's a government or a commercial organization.

John Gilroy: Earlier in the interview, you talked about first-to-know, so I would think it's one thing to notice a change over an annual basis, but what you mean by first-to-know is that this revisit rate gives you the tools to provide that for your customers. Is that right?

Brian O'Toole: That's right. If you think about it, when you look at maps today, they're fairly static, and you don't really have a good understanding of what typically goes on in that place every day, how much crime, or what is the typical behavior at a border crossing in terms of the number of trucks going through, et cetera. There's just endless examples, right? But if you're looking at the Earth all the time and you're building a database of these types of activities, you then can understand what's normal and abnormal. And that's when you can get into real change detection and it goes beyond changes to the physical earth, like new buildings and things like that, but can go into what's happening on the Earth in terms of transportation, what people are doing, human geography, a whole level of rich, new information that will lend itself to be super important to the future decision-making of a lot of organizations around the world.

John Gilroy: Brian, if I'm correct, I think your company recently launched your fifth and sixth smallsats into the BlackSky constellation. How many satellites do you plan on launching, and how many satellites do you need to be fully functional for critical revisits?

Brian O'Toole: We're fully functional now. We're very proud of that last launch, I think you might've seen some of the reports. We went from launch to delivering imagery and generating revenue in 58 hours, which is unbelievable, a very big testament to the architecture that our engineers have built. And we're growing the constellation to a baseline of 16 satellites. We're already delivering reasonable revisit and very good time delivery performance to customers. What you're going to see us do is add more satellites over the course of the next year, to get to that 16-satellite baseline. The other thing we recently announced was our investment in our Generation 3 satellites, which provide improved spatial resolution and some additional spectral bands. And that's been underway for a while and those satellites will begin to dovetail into this constellation out in the 2022, 2023 timeframe.

John Gilroy: When you talked about the launches, I was watching your Twitter feed and boy, very, very... I don't know if you have professional artists design your tweets, but it really reinforced the fact that you were successful and let all the people in the industry know what BlackSky's up to. I think that was just a great approach for you. When I read about what you're doing and other companies are doing, we've done over 90 interviews here, it seems to me that if you paint this picture, we're looking at a combination here of several different revolutions, the rise of the small satellite, the ability to get into space quickly, mainstreaming of geospatial content, and let's not forget big data analytics like machine learning and AI. Essentially, I think we have a real-time view of what's happening anywhere in the world. If you are in crisis response mode, how soon from the time you start taking pictures, can you get meaningful data to one of your customers, and how do you get it to them as well?

Brian O'Toole: Let me give you a really specific example. If you look back at that explosion at the port in Beirut, back in August, you remember that event, a massive explosion. And in the old days, you would have waited for that to be reported or someone to pick that up, someone would have called and placed an order to task a satellite to go get a picture, and then that would have been delivered, maybe you get a picture within a day, and then you deliver it several hours later. What we do is, we're monitoring new social media, all different kinds of feeds, to look for events like that. We picked that up automatically with our AI and machine learning algorithms, and then we tip and cued collection of the satellites, and because we're in these mid inclination orbits, we picked up a shot, and I think at 8:00 in the morning, and had that in the hands of customers within an hour or so, and all without human intervention.

Brian O'Toole: We're using AI and machine learning to monitor for these relevant activities, automatically get the data by tasking the satellites, and then deliver those insights, put that into the hands of the customers through a real-time feed. That also really kind of dovetails into this first-to-know strategy, so if you're looking for those things and you pick them up, and because of the proprietary

constellation we have, we could get that data ahead of anybody else and provide that to the customer so they're the first ones to know.

John Gilroy: Now, in the world of cloud computing, some people have this acronym called RPA, Robotic Process Automation. And that's what I heard in your voice, it was an automated way that, if you have a customer that wants to know what's going on in a certain area, bang, Brian doesn't have to get up in the morning, get his coffee, and drive into work, and turn on his computer. It's right there, isn't it?

Brian O'Toole: That's right. And that's really the difference between monitoring the world in real-time and looking for things that are relevant, that our customers care about, and making sure they get that information, hopefully in the future before they think they need it. And if there is an emerging event that might disrupt their supply chain or might disrupt their operations, might give you insights into emerging events, say humanitarian-related crises or things like that, the earlier you can provide that warning, quicker and earlier, people can respond and save money, save lives, et cetera. It's all about that speed to insight and trying to get ahead of the detection and understanding of things that really matter.

John Gilroy: Earlier in the show when I introduced you, I talked about geospatial, and I think it's possible that geospatial right now is having a GPS moment, the convergence of several foundational elements combined to create a GPS moment, constellations, chips, and smartphones. I think the equivalent is happening with geospatial intelligence here. How has this impacted your ability to deliver insights and inform predictive decision making? Has it changed the method or speed in which you deliver, and what about future geospatial insights?

Brian O'Toole: Hey John, I think you're right. We are at an inflection point in the industry. I think this GPS moment for remote sensing, and the broader industry is right in front of us here. The ability to get information about our world in near real-time and put it in a geospatial context is going to provide real-time intelligence databases that can be tapped into for building up the next wave of applications. If you think about it, that doesn't exist right now, but it's very close. When you think about the data coming from smartphones, information that is going to come from imaging satellites, or radar satellites, or signal satellites, drones, et cetera. If you can start to capture and bring all that in with the power of AI machine learning, you can start to enable access to a database of geospatial intelligence that doesn't exist right now. And when that does, then you're going to have an explosion of applications that we haven't thought of very much like what happened with GPS when that was enabled into phones.

John Gilroy: If you ever attend an AI conference, I'm sure there's a little, whole group of discussions about training the data, and you need a certain amount of data just in order to train it, in order to have AI be effective. And that's what we're having with all these sensors out there, we're having launch options, all kinds of things

that maybe five or six years, you never dreamed were possible. Besides the satellite imagery from your own satellites, what kind of data is gathered by BlackSky, and who collects it?

Brian O'Toole: We bring in a lot of data. As I mentioned earlier, we bring in news, social media feeds, and we bring in the multi-lingual, text-based feeds as well. We've been working on the backend processing, around natural language processing of that, in the geospatial context, for five or six years now. We also bring in IoT sensor data, so things that might give us feeds on the locations of ships, trains, aircraft, trucks, et cetera. And now we're bringing in other types of remote-sensing data, like radar and signals intelligence. My view John is that our world is going to be awash in sensors, all these just represent different types of sensors. And what the market is looking for is, how do you bring that together or make sense out of it, and deliver it in a way that people can get access to the information they need to make decisions. That's always been our strategy and I'm excited about where we are in all this right now, because I do think, over the course of the next 18, 24 months, you're going to see this next level of convergence around these big trends.

John Gilroy: Brian, 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 91 interviews. Also, you can sign up for free email notifications for future podcasts. In my world, you have the public cloud, the private cloud, and something called the hybrid cloud. And when you were talking about those different data sources there, I was thinking, this is really a hybrid environment, and all kinds of terms thrown around in this area here, so would you call this data fusion?

Brian O'Toole: Yeah. That's a great question. I consider it both, it's data aggregation and data fusion. I think in a lot of sense, in a lot of respects, there's a whole layer of information that's not available today. Just understanding what our normal activities in a particular location can be a new information layer that's not available today. You have a layer today that tells you where buildings are, and who's in them, and when they're open, and when they're closed. You don't have a database that tells you about all the temporal activities that go on around that building that you can tap into. To get to your question, in some respects, there's organizing that level of new information, which is an aggregation and a normalization of temporal information. And then there'll be how you combine that with all these other information sources to deliver new insights, which gets more into data fusion and more intelligent processing and leading you into predictive analytics.

John Gilroy: Not too far here in Virginia from the Pentagon, and the phrase they use there is, force multiplier. They love using that phrase.

Brian O'Toole: Yeah.

John Gilroy: And I'm listening to your conversation, I'm saying, well, it seems like you've got this organic capability here, but you're wise enough to know that you can merge with other data sources. And all of a sudden, you have a force multiplier here for business information, for military information, just about any agriculture information, is that true?

Brian O'Toole: That's right. We have taken a very, I'll say pragmatic approach, to how we look at the market. I think we don't need to own every sensor, we don't need to own every algorithm, but there's a lot of value in some proprietary information like we have with our satellites. But I think there's even more value in having a platform that can bring all this together very rapidly and turn it into insights. And we'll partner, we'll buy, we'll do what we need to do to make as much data and information available, and it doesn't need to be ours.

John Gilroy: Well, you know Brian, we're in the middle of a pandemic, so we have a mandatory talk about health here, so we got to mention it a little bit here, but it fits right in with the discussion. The classical story of geospatial analysis was repeated in a recent magazine, Directions Magazine, about this cholera outbreak in 1832. It spurred the first application of geospatial analysis when a guy named Charles Picquet created a map, illustrating hotspots for the disease in the 48 districts in Paris. Okay, let's jump forward 200 years here, numerous organizations are mapping the spread of the COVID-19 pandemic. Technological advances are transforming the geospatial industry and delivering interactive insights that were not possible even 10 years ago. Brian, how do you monitor the spread of COVID-19 from space and can you get close enough to monitor something like social distancing?

Brian O'Toole: Well, now you may not do it from space, but you may do a portion of it from space. In the old days, a lot of these models that would predict the spread of disease were based on how people move around. Now, you have the ability to see where smartphone devices are and where they're traveling, and there's companies that are providing that type of data now so you can get a much richer understanding of how these things might travel from IoT and mobile data. That's one new dimension that will provide better insights into what the spread of this might look like. And then recently, we just won a new contract with the Air Force to then begin to monitor the impacts of COVID-19 on military force readiness, supply chain impacts, et cetera. You can start to understand like, okay, are the same number of people showing up in these facilities due to the pandemic? What might that be doing to the supply chain? What might that be doing to the readiness of your forces, et cetera?

Brian O'Toole: There's a physical set of observations that can be made and correlated to some of the other information that you can get. To me, we're just in the early days of

the potential here, but I think COVID, if anything, back to the first-to-know analogy, I think we're finding that the ability to detect emerging events and what their impact might be on our planet, there's no better example of what happened in COVID. And it's not about capitalizing on it, it's about understanding that the ability to detect and get an early warning at events like that, and understand how to get out in front of it, is what this industry is ultimately going to be all about.

John Gilroy: Brian, earlier, you talked about global monitoring and I kind of contrast that with global mapping, maybe for our listeners, you can differentiate the two.

Brian O'Toole: Yeah. Global mapping, the way that I think about it in the past was, you'd collect the Earth at some frequency, whether it's with satellites or aerial photography, and you were building maps, you were building roads, and new buildings, and things like that, modeling the contours of the terrain. And over time, the frequency of that got better and better, instead of building a map of a country once every three to five years, you could do it once a year, and then once every couple of months. And you see a lot of that in Google Earth. To me, global monitoring is a completely different paradigm. You still can look for changes in the physical world, like new buildings, but it's also about what's going on, on top of the Earth, what people are doing, what cars and ships and trucks, and it's the activity. And when you can combine those two things, now you get to these new layers of geospatial intelligence that weren't available before.

John Gilroy: Yeah. This is the fusion you're talking about, huh? An advanced level to really make decisions based on data here. Global spatial companies like yours have been integral in monitoring global catastrophes, conflicts, natural disasters, and even migrations. I think they're also busy harnessing data from the world sensors and signals to create predictive analytics, and we've touched on that earlier. How does big data, artificial intelligence, and machine learning... What about that fusion? How does that all come together?

Brian O'Toole: Yeah. I think John, where this comes together now is what I indicated before, is now we can start amassing databases, really deep and rich databases, about what goes on in a place, everything from the raw observations from all these sensors, to some of the derived data products that can tell us what's typical activity in a port, for example. And then once you get to that, and this will all be being done behind the scenes, bringing this data in, running your algorithms, making sense out of these observations, fusing that to create new data layers, once you can expose that to the larger application development community and the other parts of the market... Because geospatial is very horizontal, it cuts across everything. You want to unlock this data to the much larger market, as you started this interview off citing the growth from $230 billion economic impact, to potentially a $500 billion economic impact due to the presence of

geospatial intelligence. I just see it's now the ability to amass this information and make it available in ways that have never been done before.

John Gilroy: Speaking of amassing information, when I'd done my research on sensors, I have this mnemonic I use, that by 2024, there's supposed to be 24 billion new IoT devices all throughout the world. These sensors are pouring in all kinds of data, and there's got to be companies that can actually use that data. Much of that date, of course, is going to be geospatial data as well. My final question for you is an example question. Can you give me an example of how geospatial companies have been integral in monitoring global catastrophes, conflicts, natural disasters, migrations, and pandemics?

Brian O'Toole: Yeah, I think we're definitely seeing there's obviously a number of military applications. The applications we're seeing in the market are particularly interesting around supply chain. We've done some things in the past where you can monitor, say iron ore facilities, to get a sense of what type of supply is available in the market. But then you combine that with monitoring the activities at a particular port due to IoT data from ships, verifying that with overhead satellites. And in this particular case, it was looking at predicting impact to commodity pricing if tied to port backups and disruption. At the end of the day, you had all this Earth observation and IoT analysis going on, but it ended up in a monitoring service that said, look, there's going to be a disruption here that has the potential to impact the ability of supply, which ultimately could impact pricing. There's an endless number of those, but we're seeing these examples emerge every day of those types of insights that had never been available in the market before.

John Gilroy: Brian, we're in touch with our listeners and they always appreciate stories that involve artificial intelligence, especially giving them fast answers to complex problems like you're solving here. I'd like to thank our guest, Brian O'Toole, CEO of BlackSky.

Brian O'Toole: Thank you, John. Good to be with you today.