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Chad Anderson:

This is the Space Capital Podcast, and today we are speaking with Jonny Dyer, who's co-founder and CEO of Muon Space, a company developing the world's most capable earth sensing satellite platform to power data driven decisions in the era of climate change. We invested in Muon's, uh, seed round last year and again in their series A, um, really based on the quality and the experience of the team, and we're incredibly excited about what they're building. In addition to leading Muon, Jonny's also an operating partner at Space Capital, he's a former technical advisor at MethaneSat, former senior director of engineering at level five autonomy at Lyft, principal engineer at Google, chief engineer at Skybox Imaging. And has Bachelor's and Master's degrees from Stanford in mechanical engineering so he is uniquely qualified to help us understand the opportunity in climate solutions and mission as a service. Jonny it's, um, great to have you on, I've been looking forward to this conversation. Thanks for joining us.

Jonny Dyer:

Yeah, I'm excited too it's good to be here Chad.

Chad Anderson:

Okay. So, um, first of all just wanna say congrats on, on closing your series A, um, especially in this market. I'm sure you must be very busy, so, um, just wanna say, you know, appreciate you taking the time to talk to us.

Jonny Dyer:

Yeah you bet. No, it's been a busy time, but we're, uh, I think getting through that has, has given a, a little bit of breathing room, so (laughing)

Chad Anderson:

Great yeah.

Jonny Dyer:

Timing's good.

Chad Anderson:

Absolutely. Um, so you have a, a very interesting and very applicable background. Um, and you've worked at startups, growth stage companies and established companies. Um, to kick things off, uh, would love to hear, uh, the origin story. Can you tell us a bit about, you know, yourself and your background? What has led you, um, to want to start a, a new company focused on, on mission as a service and, and why now?

Jonny Dyer:

Sure. Yeah, I mean I'll, uh, I guess going back, you know, long time I mean I've kind of always been a space geek from when I was a kid. And, you know, growing up built rockets in my backyard and blew stuff up and scared my mother to death doing it, things like that. So I've always been kind of super into the, the aerospace, space, rocket, uh, world. And then, you know, a lot of my career has kind of circled around that. Um, had a really, you know, formative set of experiences, uh, very, I feel very privileged to have gone through the Skybox experience. I think that was a really unique team and unique opportunity

that, that, you know, that ride was fantastic. And I think probably something that would be, you know, very difficult to replicate anywhere else in any other time so that was, that was amazing. Um, and you know, after Skybox, you know, did a few other things, um, got interested in learning about what was happening, um, in sort of the robotics and AI world and, and spent some time, as you mentioned, um, doing autonomous vehicles and, and learned a lot from that as well.

Jonny Dyer:

Um, and in the background had been continuing to kind of keep my, you know, keep my feet in aerospace and satellites, uh, through the, the MethaneSat project which you had mentioned and, and have been an advisor on that ever since it started, um, four or five years ago. Um, and in that, you know, kind of in the course of going through my, my experiment with autonomous vehicles and, and, um, and really kind of deciding that, that long term I wanted to get back into aerospace. And then that coupled with the work I was doing in MethaneSat, and some of the folks I met there that had ended up becoming co-founders with me at Muon Space. Um, really started aligning on, uh, this idea that, you know, there was a huge opportunity or really gap to fill in, um, remote sensing still as we think about the, the problems the world is going to confront, um, in a changing climate. And I think that our perspective, and this was, uh, catalyzed in a lot of ways from the work we saw at MethaneSat, is that, um, data was kind of a, good data about the earth and the way the climate system is changing and, and emissions and things like that is really an underappreciated, uh, need in the climate solutions world.

Jonny Dyer:

I think we're starting to see more and more people recognize that just, you know, fairly recently even in the last year or so. Um, and that, you know, satellites are uniquely positioned to, uh, make truly global, uh, high precision repeatable, uh, low latency measurements of a lot of key, key parameters about the earth that are important for making decisions in that context. Um, and so, you know, we were kind of inspired by MethaneSat as a, as a, um, sort of an existence proof of a very climate focused mission being done with a satellite in a very nontraditional way, not funded by, you know, NASA or, um, or ESA. Um, and, and thought, man, we really need to figure out ways to make more of this, uh, happen, make more of this go that's it's gonna be critical to, um, the world's being able to, to live in this new normal. And also we saw it as a huge opportunity from a, an economic perspective. Um, and so that was really kind of the, the catalyst that drove us to start the company, um, about a year and a half ago.

Chad Anderson:

Sure. And then so you, um, have described, uh, Muon in the past as, um, you know, what SpaceX has done for launch Muon is doing for everything else. Um, you know, what, what did you mean by that and what is it that you're actually, actually building at Muon?

Jonny Dyer:

Yeah, that's a great question. So if you think about, you know, what it takes to, and, and, and I'll, I'll, I guess I'll kind of clarify that a little bit. I think we wanna do everything else for these type of remote sensing missions. Um, I don't think we're trying to, you know, boil the ocean, solve every potential space mission that anybody can come up with. But we want to get to a point where there's a cadence of launching sensors into space, uh, that is low friction, low cost, um, and very quick, uh, for a whole variety of end users, in the same way that I think, uh, SpaceX has really made that happen for launch. And if you think about what it takes to, um, you know, deploy high quality sensors to space, uh, launch is obviously the key component and that's, you know, has really been transformed over the last year

largely, uh, thanks to SpaceX. Um, but it's really just, it's just really the first step in terms of being able to, uh, you know, get a sensor in space, um, have it highly calibrated producing high quality data, getting that data back to users at low latency, managing it, etcetera.

Jonny Dyer:

And so, um, our goal is to build out essentially a platform that enables, um, you know, that touches all of the other points that are required to host sensors in space, um, manage them and get data back at high quality and low latency. Um, and I think what we've seen, you know, part of the reason for this is that if you look at the industry today, um, there's a lot of people interested in remote sensing and a lot of different flavors. Um, but for the most part, everybody's kind of reinventing the wheel every time they wanna put a new sensor type, uh, in space. And we think that that's just a sign of an immature, uh, kind of industry capability. And that where the world needs to move is very much in the same way that like for instance, um, uh, you know, uh, tech, i- internet technology has moved to the cloud and, and platformization-

Chad Anderson:

Mm-hmm.

Jonny Dyer:

The same thing needs to happen, uh, for getting these sensors into space and getting data back so that, you know, much smaller teams, uh, can get things up quickly without having to have the same sort of, um, deep expertise, uh, bench of rocket scientists and deep, deep capital, uh, pockets to get to a proof of concept. So that's kind of the idea.

Chad Anderson:

Absolutely. And, um, I definitely wanna dig into that a little bit, um, more in a minute. Um, but I'm, I'm curious you were at MethaneSat, um, working with a lot of really smart people, um, on a really hard problem, and decided to, um, uh, take this idea and run with it. You know I'm curious when did you realize the opportunity, and what made you think that a commercial company was the right mechanism to, to go this route?

Jonny Dyer:

Um, I think that we realized the opportunity when we started again thinking about and, and when I say we there, two of my co-founders were also involved in that project, I should just mention that quickly. Dan McCleese, uh, who's the head of the science advisory group for MethaneSat, and, and Ruben Rohrschneider who is the instrument chief engineer are both co- co-founders with me. And I think, um, you know, Muon really started to click when we started thinking about the, um, diversity and variety of additional measurements like the ones that MethaneSat is making that really need to follow. So MethaneSat's great, but it's one very particular measurement, they're trying to measure methane in the atmosphere. You know, in brainstorming you can come up with 30, you know, additional measurements that are going to be super critical moving forward, uh, to being able to both, uh, mitigate and adapt to things like climate in the future.

Jonny Dyer:

And so you really need, um, the capability not just to do this kind of thing once, but to do it repeatedly, uh, to do it, um, agilely, you know, be able to deploy these things quickly and at low cost. Um, and then really have a, a large diverse, um, set of sensors collecting diverse data, um, but all are using kind of common reusable building blocks. And so I think kind of that, you know, looking at the existence proof of MethaneSat and then thinking like man, there needs to be so much more of this, um, is really what kind of drove us to okay, well, how do we make that happen? And it seemed like a commercial company really focused around deploying diverse sensors in space, uh, was the best way to catalyze that. And that's kind of what drove us to then start the company.

Chad Anderson:

Got it. And, um, you have assembled a really, um, incredible, um, one of a kind team,

Chad Anderson:

... um, that really started at- at the exception of the company. You mentioned your- your co-founders. I mean, um, these are- are incredible, um, uh, folks, uh, JPL ... Former JPL chief scientist. Um, uh, you know, and- and Reuben was obviously, um, senior chief mission architect, um, uh, for you as, um ... Has a, has a story, you know, career at- at Ball Aerospace. Um, how, you know, is- is this a- a common theme throughout your career that, um, you've kind of snowballed all the way back from, um, Skybox Imaging, um, you were working there with, uh, my partner, Tom Ingersoll, as well as several other people on your team.

Chad Anderson:

Um, and you've kind of been (laughs), um, uh, assembling them for a long time now. You know, you've kind of been meeting them throughout your career and you've, and you've brought the best to bear, um, at Muon it seems like. Um, this is ... The talent market's in- incredibly tight, particularly over the last couple of years. Yet, you continue to attract some of the best and brightest from some of the world's leading companies. I'm just curious, you know, what's your secret? How- how have you done that?

Jonny Dyer:

Um, I mean, I wish I had a perfect answer to that. I think partially luck (laughs). I mean, I'll be, you know, pretty humble in saying, I think we've been very lucky getting, uh, really awesome people excited. But I do think there's a couple of- of factors. I mean, I think the mission, uh, that we're focused on is extremely compelling to people right now. I think one of the strongest pulls for, um, folks that we're bringing into the company has been this, you know, desire to work on something impactful in the climate arena. And it's actually quite hard to do, um, to find things that, um, are ... You know, you can look at and- and really say, "Oh yeah, I clearly understand how I can have an impact by working on this problem in- in climate." It's just such a big problem. Um, and so, I think that's been a really key aspect of it.

Jonny Dyer:

The other part I think is, you know, I'm- I'm ... I feel very strongly ... Like, my motivation, um, for most of what we do in terms of hiring people and building the team is finding people that like, when I go to the office every day, I just love working with those people and I think that feeds on itself in a very, uh, tangible way that people can sense. In other words, as you add, you know ... You kind of build this momentum. And as you get really great people that are super smart and are kind of in this mission for the right reasons, um, you know, are looking to work with other really motivated smart people, that

feeds on itself in a really exponential way. And even when we have people come in and interview, they comment on this. Just the- the sort of energy, the- the sense of shared mission, the sense of sort of, um, you know, belief in what we're doing.

Jonny Dyer:

But also, kind of, uh, uh, intellectual challenge that we have on the team where it's not, you know, about people's right and wrong ideas, but everybody's really in this to try and come to the best solutions. And I think that- that kind of culture starts to really feed on itself in a way that people can sense and- and really want to be part of. It- it's a really, um, energizing environment to work in. And I think we had that very strongly at Skybox. It was something that I saw kind of grow organically there and- and, you know, I guess, ever since then have been striving to continue finding ways to build those type environments with people that I really want to work with.

Chad Anderson:

So, great people working on big, um, difficult impactful problems. I mean, sounds like a, sounds like a-

Jonny Dyer:

Yeah

Chad Anderson:

... pretty winning formula.

Jonny Dyer:

Yeah. You summarized it much better than I did.

Chad Anderson:

(laughs). Well, so, um, we, uh ... You have a number of open positions. Um, we have a dozen or so of those open on space talent. Um, just curious, you know, for those who are listening who might be, um, interested in- in joining the team, you know, what are your greatest needs as you move into this next phase of your business?

Jonny Dyer:

Yeah. I mean, a lot of the- the build-out we're doing on the team right now is really on kind of core, um, technical teams. So, you can think about like ... Our biggest ... Right now, like just our biggest challenge is electrical engineers. That's, uh, been a really hard role to hire. I think it's generally been a- a tight market for electrical engineers. And I think we have some really compelling, uh, (laughs) interesting problems, uh, for- for folks that are, you know, are electrical engineers to work on. We're- we're actually doing some really interesting and I think pretty cutting edge work on, um, RF remote sensing with software defined radios, which is a- a really, uh, you know, kind of interesting space.

Jonny Dyer:

Um, there's a lot of just core avionics work going on. So, yeah, definitely like just, you know, electrical engineers are a big hard point for us right now. Software engineers are always tough. Um, and I think, you know, software engineer is a very general term. Uh, there's a lot of different flavors of that. Uh, we're hiring for folks that are working on core embedded stuff for our spacecraft, but also things like

data engineering, data science. Um, a lot of the- the, um, you know, more kind of generalist, uh, back and front end stuff. So, uh, those are, those are definitely the- the big ones.

Jonny Dyer:

Um, we also are, you know, hiring, um, for some science positions. One of the key, um ... A- another kind of key portion of our belief in the solution space here is that we're really trying to deeply couple the science with the engineering. Uh, and Dan has already done a great job of building out a small, um, fantastic science team and there's some other roles around science that we're looking to hire. So, those are probably the big ones.

Chad Anderson:

Okay, great. Um, so, we recently published the great climate opportunity with Silicon Valley Bank, and in that report, um, we featured Muon. Um, it really, the idea was to unpack the- the massive climate opportunity, um, uh, for impact and, um, and return of capital and the foundational role that space technology plays in enabling these climate markets. Um, and one of the key points that we were trying to communicate is that, um, satellite data enables us to understand and address some of the most pressing challenges of our time. Uh, like climate. And that, um, this is a massive problem that is effecting, um, uh, basically every business, every major industry is going to need to understand with regards to their business assets, their operations and supply chains going forward. Um, what are the pain points in the market currently and how is Muon helping to solve those? Kind of the problem and solution set.

Jonny Dyer:

Yeah. So, I mean, I think that, um, there's ... I- I like to kind of break this problem apart into two primary categories. Um, one is, um, you know, if you think about the climate problem in general, there's kind of ... There's really three categories. There's mitigation, there's adaptation and then there's control or geo-engineering. I'm going to kind of leave the third one off for now, because I think that's further out in the future and there's a lot of questions about whether that's a good idea or not. But certainly for mitigation and adaptation, um, you know, data is critical to operate on, in both of those areas. So, mitigation is how do we reduce the net carbon in the atmosphere and slow greenhouse, uh, gas genera- accumulation essentially, um, to s- slow warming?

Jonny Dyer:

Um, and adaptation is recognizing that even if we're enormously successful at mitigation, we're still going to end up in a world for the next, you know, 50 to 100 years, um, where the climate has changed and we have to deal with things like, uh, sea level rise and extreme weather and- and- and greater wildfires, et cetera. Um, in- in both of these categories, you know, data's hugely important. Um, on the mitigation side, you know, more and more of the, um, belief about how you solve, uh, for kind of the mitigation problem requires markets to work. Um, and there's, you know, there's, um, there's now some fairly large compulsory carbon markets, uh, in Europe and California. Um, there's very quickly growing voluntary carbon markets. Um, and in both cases, a huge, a huge problem that's widely, uh, recognized is transparency. Mar- markets can't work well without good data and information.

Jonny Dyer:

Um, and today, there's very, very poor information, um, in these markets. And I'll, and I'll give a very s-, I'll give a very specific example that we- we were discussing yesterday. Um, one of the- the- the largest

types of carbon credit's getting traded in voluntary markets today are what are called natural carbon solutions. It's basically, uh, you're buying credits in private forest land that is, um ... You know, that the owner of the forest land, uh, essentially agrees to manage it in certain ways, not cut down the trees, et cetera. Um, that, you know, through sort of an accounting process they can show, uh, will net- net st- ... Save carbon, uh, emissions. Um, or- or es- essentially sequester more carbon over something like a 30 year timeframe. Um, and there's a number of companies that are very actively developing product in this space and doing projects where they work with land owners to- to produce these credits and there's companies starting to buy these credits.

Jonny Dyer:

Companies like Delta Airlines and other ones. Um, but if you really start digging in around the edges, uh, the- there- there's no transparency at all into how these credits are priced, how they're monitored. Um, the data about actually understanding how much carbon is stored in the forests, um, is extremely poor and typically highly tied to things like putting boots on the ground and cutting down sample trees to measure their carbon content. Something that just inherently does not scale, uh, globally. And so, an example of a way that, you know, satellite ... Uh, better satellite data, um, hopefully will be able to help is by providing a much better, um, set of global data around, uh, um, forest biomass. That- that's a huge need. Um, it's something that I think is achievable with some, you know, some development in both technology and science.

Jonny Dyer:

But, um, it, uh, we believe is going to happen. Another example is, um, you know, I think maybe on the adaptation side, um, is the wildfire, you know, issues that we're seeing now. And I think that, um, wildfires, there's- there's a lot of causes of the- the kind of trends in mega fires that we're seeing now. Some of them go back to longstanding forest management practices that are 100 years old. Um, but, a- a nontrivial component is climate change and regardless of whether it's, you know, purely driven by climate change or not, it's widely accepted that wildfires are a large and growing, uh, problem globally and they're going to continue to be so. They also have a- an outsized, um, environmental impact, both in terms of greenhouse gas, uh, kind of, uh, stocks. But also in terms of things like, um, uh, particu-, uh, you know, essentially particulate population in the air that's very, uh, bad for human health.

Jonny Dyer:

And so, um, better management of our forests, uh, and- and dealing with these mega fires in a more, uh, I would say proactive, uh, way rather than the kind of very reactive manner in which we're- we're trying to manage wildfires now is- is clearly crucial for the future.

Chad Anderson:

It makes sense. I mean, we've had carbon markets for quite a while now. But they've been very limited, right? Um, at the same time, we know that financial institutions are beginning to use their influence to drive change. We know that large asset managers, like BlackRock, um, TBG and others are setting aside, you know, large amounts of- of capital, um, to offset, um, and to participate in these, in these carbon markets. Yet, the transparency seems to be a key issue. I mean, it's- it's what's been preventing really serious money from coming in, um, uh, into these markets. So, um, you know, thinking about how, um, your solving for this. So, you're bringing, um, a remote sensing capability to this broad array of organizations and institutions who, like you said in the beginning, um, aren't satellite experts. Their- they don't want to build out a bench of rocket and satellite experts

Chad Anderson:

... it's to do this for them. Um, and so you're, that's where Mission as a Service comes in, right? Where you're kind of providing them a turnkey solution?

Jonny Dyer:

Yep. Yeah. I- that's exactly right. And I think a key, um, kind of, you know, nuance to that is we are very intense on, um, you know, A, building, again, I, I mentioned kind of this technology platform that allows us to deploy sensors very efficiently, um, but also making sure that we're working with c- the ultimate customers of the data deeply, um, such that the right sensors are getting deployed. And I think that's, um, something that's a, a nuance, but it's, it's a little different than a, than the way that a lot of the rest of the kinda new space remote sensing industry has approached these problems. Uh, there's been lot, and, and I'll, I'll be very upfront that I think we were somewhat guilty of this at Skybox even, of much more of a "build it they will come" mentality tow- towards deploying sensors in space.

Jonny Dyer:

What we're doing is essentially engaging with customers in these markets very early, um, you know, long before we, you know, even have the idea of a, of an engineering solution for a sensor, um, and partnering with them to kind of deeply dive into the problem space. Um, you know, going back to some of the science, uh, team stuff that I was mentioning before, bringing our scientists in to look at the problem with them, understand it, and say, you know, "How can we solve this," uh, "with a remote sensing system," um, "in a way that really gets to the bottom of the problem and provides," um, "the, the right type of data?" Um, and we think this is, you know, a, uh, you know, it's more than just a platform to deploy the sensors, it's a platform to deploy the right sensors, and we see this, what we call, formulation, mission formulation, which is the first step to our engagements to customers. It is a really, really crucial and underappreciated component to, um, sort of making that work. Um, and so that, that's, uh, you know, we're doing a lot of that with, uh, early customers right now.

Chad Anderson:

Yeah, and there's clearly money to be made here. I mean, we've seen several companies over the last few years that have raised hundreds of millions of dollars in equity financing. Um, but you seem to be uniquely positioned with regards to assembling, um, some very smart people who understand the sensors and can build the sensors, um, purpose built for customer needs. That seems to be missing from, um, from a lot of the other sort of, or, sort of assembly shops, um, that are putting together commercial, off the shelf type components. Um, would you say that that's your key competitive advantage, is, uh, that capability, plus, plus, obviously, the people?

Jonny Dyer:

Yeah, I mean, I think it's really, uh, again, I, we're trying to orient ourselves to make sure that we're solving the right problem for a customer. And really, um, I think that is, we believe, will be our key differentiator, that we're not trying to sell a dataset that we happen to collect and are hoping that somebody will buy, but we have really collected a dataset that's absolutely crucial to the problem that our customers are trying to solve. And I think the fact that we bring the dept of experience, um, on both the engineering and the, the, the science of remote sensing to bear on that problem puts us in a really unique spot to be able to do that. Um, and I, I do wanna emphasize, I think it's im-, it's also important that that is coupled, uh, very tightly with the ability to, as you mentioned, develop the sensors and deploy them, um, efficiently, because, I think, you know, it's, it's, it's all well and good to, um, you know,

know there's a need, it, it, but being able to actually get that, um, that need fulfilled, and delivering data to a customer in a cost effective and time effective way, um, I think will really substantially open up an entire, you know, new customer base to this type of capability.

Chad Anderson:

Sure. So how are you thinking about the market for muon? You know, how big is it now, how big do you think it could get?

Jonny Dyer:

I mean, we're, we're, you know, obviously, it's always hard to (laughs) estimate exactly how big markets will be in the future. Um, I think if you look at... You, you can slice this a few different ways. I mean, if you look at the, the market today just for getting, sort of, sensors in space, um, you know, it's, it's, it's large, it's in the, in the, you know, lar-, high single digit billions per year, and that, obviously, is spread over a whole bunch of different things like including things like defense intelligence. But that's a very nontrivial market, um, it's, a lot of it is government funding, as we've seen, you know, from some of the recent announcements around, uh, US government acquisitions that are coming out. Um, but we do expect that to grow, uh, tremendously, and we think that's gonna continue to be a big part of our, um, you know, our, our, the markets that we're tapping into longer term.

Jonny Dyer:

Um, I think, we believe that the real huge opportunity is in these, you know, kind of climate-driven markets longer term, and those are largely non-existent today, um, at least for data, and I think that, so it's, it's a little bit challenging to kind of estimate, uh, how big those are, but you can make some course assumptions just based on, um, sort of the things like the, the, um, the assets at risk due to climate impacts, which is in the many trillions of dollars over the ne-, the coming decades. And if you start backing out from that and saying, um, if a, if a dataset can help reduce some of those risks, or mitigate the impacts, um, and you even capture a very, very small portion of the, um, the dollars that would be flowing through things like infrastructure investments, uh, insurance payouts, et cetera, you know, the, the numbers can be very large, in the, you know, certainly tens, and probably hundreds of billions of dollars a, a year, in terms of market size.

Jonny Dyer:

So that's, that's what we're really excited about; we see this, you know, enormous upside potential long-term in some of those types of, uh, of markets.

Chad Anderson:

What would you say are your biggest challenges in working to expand this market and, um, uh, help those, those new expansion markets to, to emerge?

Jonny Dyer:

Yeah, that's a great question. Um, so I think one is just time. Um, you know, it's gonna take time for, uh, all of these things in carbon markets, um, to evolve. You know, a good example is if you think about insurance, that the, and the thing I like to say is, like, you know, you have to think about a world where the next 10 years don't look like the last 100, and if you think about insurance and reinsurance, their whole model, for the most part, is looking at the last 100 years as a, an indicator for what's coming in

the future sort of statistically. And so there's sort of mindset shifts that need to happen when, when that's no longer true, and that's just gonna take time. Um, so that, I think time is a big component.

Jonny Dyer:

Um, I think the other component is, um, sort of the interaction of policy, regulatory r- environments, um, and, and commercial com-, sort of, commercial players. Um, so as you mentioned, a lotta companies are really starting to invest a lot in ESG. Um, this is largely voluntary though; this is largely being driven by things like, you know, pressure from their customers and their employees. And there are some, uh, you know, regulatory changes coming. The SCC has now announced, um, that they're gonna start requiring publicly held companies to disclose things about their climate risk, uh, both their, things like their carbon footprint, but also the, the financial, uh, liabilities they have due to climate impacts. Um, and so I think we're seeing that those, you know, those pressures are coming, but again, that will take time to develop, it's not totally clear, especially country to country, how the regulatory and policy regimes will evolve, and, and where those lines will get drawn. And so I think, um, a lot of this is really kind of, uh, understanding how the interaction of the commercial market forces and things like government policy and regulation are gonna interact, um, and then kind of waiting for those things to play out over time. That, that's gonna be a big part of it.

Chad Anderson:

Got it. Um, so tell us a little bit about your product. What exactly are you, are you selling to customers?

Jonny Dyer:

Yeah, so our product, um, is, as you mentioned, we call it Missions in Service, um, and it basically is, um, you know, a turnkey, uh, solution that allows a cu-, uh, y- again, a- allows us to work with a customer from a very early stage. We like to think of, like, a, you know, an idea of a, a, on a cocktail napkin about how a new dataset could impact their business, um, all the way through, um, kind of architecting, uh, a network of sensors that would, would, um, would actually deliver that data, and then working with them to deploy the sensors into our, uh, essentially, space and ground platform, and operate it on an ongoing basis to deliver data back, uh, to their business. So you can, you can kinda think about it as, like, a, a, an end to end, turnkey, uh, new data development product, where, um, you know, we work with them all the way from an early idea through having, uh, data streaming into a cloud bucket in their organization somewhere.

Chad Anderson:

Okay. And, um, where do you see advances happening that can e- enable new data sources, and where are you seeing, uh, the biggest advances in cost savings?

Jonny Dyer:

So, I think, on the new data sources, um, you know, there's, I think there's a couple of trends that are really interesting. Um, so one is just, you know, as, as has been the trend for a long time, uh, as things like electronics improve, you have higher performance, for instance, um, detectors. We're seeing a lot of improvements in things like infrared detectors, which are, um, you know, a very useful and important, uh, part of the electromagnetic spectrum to be monitoring a lotta climate variables in. Um, also, I think just data, the, the amount of data that can be managed and handled in large scale constellation systems is, is sort of growing, I would say, in a near exponential way right now, for a couple of reasons. One is the ability to get, you know, directly get large quantities of data down from spacecraft into the ground, uh,

ground stations on Earth is improving because of large deployments of commercial ground station services, but also because radio technology is, is very rapidly improving, and allowing for very high bandwidths. Um, so, so just the amount of data that can be usefully collected and, um, and utilized, is growing, uh, pretty quickly, compared with, for instance, like, more traditional, like, NASA-type missions, which are often very bottle, bottle necked by data. And that starts to point to doing sensing entirely new ways. So for instance, rather than trying to architect sensors that are very narrowly focused on a particular part of the EEM spectrum and collecting a very specific type of data, you can start to think about much more flexible broadband sensors, whether it's in the RF, or even in the, the optical spectrum, that are just kind of vacuuming up photons at a lot of different frequencies, um, and then, you know, getting all of that data down and kinda sorting through it, uh, to, to build many, many different applications off, off the common dataset.

Jonny Dyer:

So we think that, you know, there's a number of companies kind of, uh, doing things like hyper-spectral imaging in the space right now, that I think are enabled by, uh, l- larger data pipes, essentially, and compute pipes. Um, we're not sure that, you know, others are exactly getting that right yet, uh, we think it's really interesting. And then there's also a bunch on the RF side, uh, that we are currently actively developing internally, that we think is really unique, uh, from just a multi-data, multi-mission, uh, flexibility perspective. So I think those are, on kind of the sensing side, things we're really excited about.

Um, on the, on the cost side, um, you know, the, the big, I mean, the, the elephant in the room is launch. Launch has, uh, literally gone down, I, I love telling the story, by a factor of 10 since we did Skybox. Um, the same, uh, you know, basic, same launch capability that we paying about \$6 million for when we were launching SkySats is now available through, um, ride share brokers for about, uh, a tenth of that, about \$500,000. So we've seen, in order of magnitude, uh, reduction in sort of the cost of access to space over the last 10 years. If Starship comes online, we expect that, that trend to continue. I mean, that really changes a lotta things about how you think about the whole lifecycle of developing, uh, spacecraft and sensors, it's much less, you know, you can take much larger risks, because the dollars at stake and in getting some things wrong are much lower, um, you start to think about like, do CubeSats really make any sense? Like, we can launch fairly large capable spacecraft today for the cost that it used to be to launch a CubeSat. And then that really opens a lot of doors to much better capabilities in terms of power and data, and other in Aperture and other things.

Jonny Dyer:

Um, so I think Launch is a huge, you know, kind of origin of driving, uh, a lot of cost trends. But I think it- it then catalyzes you to have to think differently about how you do everything else, which we're starting to see the industry start, you know, moving some places there. But I think that our hope is to get, you know, way out ahead of the industry in certain ways, uh, by really looking to a future in which Launch is dramatically cheaper, and really thinking about how you architect spacecraft fundamentally differently in that context.

Chad Anderson:

So interesting how everything that we do in orbit is a function of the launch infrastructure in place at the time. Um, and, you know, things are moving so fast, uh, the best thing you can do right now is surround yourself with really smart people and, and be able to adapt to this changing environment. So it sounds like you are, um, set up for success in that regard. Um, unlike, you know, most startup companies, you

started off with some significant, uh, customer contracts, um, kind of out of the gate. Can you tell us about your traction and your progress with customers, um, to date?

Jonny Dyer:

Sure, um, yeah, I-I, uh, without being super specific, yeah, we've had a couple of engagements we've been working on with customers over the last, you know, year and a half. Um, and very much in line with sort of value proposition I was describing of, you know, having a really strong interest in, uh, kind of unique remote sensing data sets that don't exist today, but not necessarily having the, um, capability or desire to do the reinvent the wheel, uh, all the way from the ground up, um, sort of, you know, execution approach. Um, and then I think the fact that we also had really tremendous, um, you know, the experience of the team has been compelling in working with those customers on, um, not only, you know, building the missions, which we're just starting to get into, um, you know, early stages of now, but really helping them, um, architect the systems and think through, um, what the key, uh, the really key requirements for their products are, and how you optimize a set of sensors to meet those requirements. Um, and that that value proposition, again, I think, has been very strongly, um, uh, sort of seen by the customers we've worked with.

Jonny Dyer:

And just to give a couple of examples, um, you know, we spent a fair amount of time last year working with a company called Tomorrow.io, which is a weather forecasting company, um, interested in deploying sen-, you know, sensors for essentially feeding their weather forecasting products. Um, and, you know, again, when we, when we kind of met up with them, they were in the very early stages of a concept for the types of data they would want. And, I think in working with them over the last year or so, um, there's, you know, the concept has sort of evolved, you know, pretty substantially in a very good way. Um, and I think they're now positioned, um, uh, in a really interesting place to deploy a capability that I think is like, going to be really game changing once, uh, they kind of start talking more about it publicly. Um, and another example is, we-we started working last year, um, early with a team at Google, again, on this Wildfire project, uh, that I was kind of alluding to earlier. That's now transitioned into a larger effort, um, supported by a number of other folks. And again, I think the, um, the-the sort of value proposition of being able to really, uh, go back to first principles and look at, um, what is the problem that needs to be solved? And, um, how do we do that in an elegant way, uh, with kind of a coordinated constellation of sensors, um, has been very powerful in allowing a team at Google, that's essentially a software team to, um, have access to these kind of capabilities. Um, so yeah, I mean, that's kind the short (laughs), shortish version.

Chad Anderson:

Yeah, great. Um, and I'm curious too, you know... What have you, what have you learned about Muon's ability to bring technical advances to the climate and scientist community, as you've now engaged more fully with potential customers?

Jonny Dyer:

Um, so I think, I-I think probably the single most interesting, um, thing that's come up, and this is, and Dan, our chief scientist, is much better at talking about this than I am, but it's really the fact that when you start thinking about remote sensing from a constellation versus a single sensor, so having many sensors, um, that are coordinated in space operating together and-and making coordinated measurements and getting low latency data, for a scientist, it fundamentally shifts the way they think

about solving problems. And-and, you know, Dan, I think has seen this for a long time, and has believed it for a long time, even in his time at JPL. Um, but you really move from a world where you think about, um, "How do I solve this problem with one exquisite, you know, instrument," to, " How can I solve this problem with a large array of sensors that are maybe lower, slightly lower quality on an individual basis, but in in nets, the data they're producing is actually much more useful to the science problem I'm addressing?"

Jonny Dyer:

And I think the most recent example of that that is very interesting, is-is we-we have been, you know, again, on this Wildfire mission, we're looking at, um, you know, without saying too much like a large deployment of sensors that would have very, very, uh, short temporal sampling cadence, something like sub-hourly, I'll just say, uh, measurements of the entire globe. And the, um, you know, we have some science advisors that we've brought in to help with, um, thinking through the climate impacts of this and other things, but several of them, you know, we've really seen a light bulb turn on in their head around things like, "Wow, if you had this capability, even if it was a targeted at a fire problem, it would really trans-, completely transform the way we think about, uh, measuring and monitoring other things in the Earth system, like, you know, ocean, uh, uh, sea surface temperatures, for instance, or, um, plant health and-and global forestry, that, you know, we-we've been thinking about this in a very different way. But when you start to see these large deployments of-of coordinated sensors, there's a mind shift that can be very powerful, uh, that you start to see with scientists.

Chad Anderson:

Got it. Um, okay, so, um, you know, final question, I think. Um, given the macro sort of capital markets, um, environment, fundraising, is obviously much tighter. Uh, but you've just closed around, um, you're well capitalized, and you're in a great position to advance, uh, while you know, the competitive landscape is retrenching. Curious, you know, how are you thinking about that and what's next for Muon.

Jonny Dyer:

Yeah, it's a great question. We just had a big leadership meeting yesterday going over this. Um, so I think that the way we're thinking about it is a, um, looking forward, you know, a lot of the, a lot of the startup world, over I think the last decade, has been built on the back of a lot of capital being available, um, without necessarily, um, you know, having to have real concrete, uh, business proof points. And I don't mean that to sound pejorative, but I just think there's been a lot of optimism around long term business opportunities. I think what we believe we're gonna see is more focus on tangible business metrics, um, in the investment community, uh, at least in the near term. And so we're really, you know, focusing a lot on that, how do we build a business, not just a-a-a big vision, and I think the vision is important, but it has to be supported by a revenue engine. Um, so that that's a big thing that we're focusing a lot on right now.

Jonny Dyer:

Um, and I think also just, you know, very tactically, like, um, we're making sure that we make the cash last that we've raised, so that we can, um, we can weather, you know, weather the storm that's coming. Uh, we don't know how big that storm is going to be. Um, but I think in the same frame, like we're trying, so we're trying to be a little bit conservative, um, and make sure that we don't get too far out ahead of our skis and-and end up in a place where, um, it's gonna be difficult to raise money. But I also think we're, uh, keeping our eyes very open for opportunities, because I think a lot of times, especially in

the position we're in, having, as mentioned, just been recently capitalized, and, um, some other, you know, uh, um, you know companies and, uh, organizations facing headwinds, we anticipate there will be some big opportunities that pop up, and we want to be very well ready to kind of, uh, spring on those opportunities when they arise. So it's kind of a combination, I would say, of conservatism, but also making sure that we're keeping our eyes open and looking for opportunities.

Chad Anderson:

Sounds good. Um, like this is really, uh, important work that you're doing. We're very happy to support. Um, keep it up. I think we're gonna let you get back to it. Um, it's been great to have you on and-and great chatting with you. Thanks for coming on, Johnny.