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Virtual Event Series

Why is Space So F*cking Expensive?

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DiffuseTap: Why is Space So F*cking Expensive?

Last time on DiffuseTap, **Kate Lynch and Mike Scardera, Co-Founders of NeoSpace**, talked to us about the extremely high barrier to entering the space business, the real reason why SpaceX is so successful, and why the costs of space development are slowly but surely coming down.

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DiffuseTap

This networking session is part of our weekly virtual events series. Networking (you'll bump into at least a dozen high caliber fund managers) meets purposeful (you'll tap into brand-new sources of ideas)... straight from your armchair like a boss.

Meet the Speakers

KATE LYNCH is the Co-Founder and CEO of NeoSpace, which builds spacecraft. She is a deep tech entrepreneur focused on the convergence of varying fields of technology, optimization of people and systems, leadership, negotiation, and finance. She is co-organizer of Crypto Mondays LA and co-creator of the FFC.

Linkedin: @kateforspace

MIKE SCARDERA is CTO and Co-Founder of Neospace. As an aerospace engineer and Air Force officer, Mike has helped develop future space system architecture options for the US Air Force. In his career as a space entrepreneur, he has designed, built, and sold over a billion dollars' worth of spacecraft, from launch vehicles to complex satellites.

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KENNY ESTES: Miss Lynch, do you want to tell the good folks a bit about your background and what you're up to over at Neospace? And then, pass the mic.

KATE LYNCH: Thank you so much for having us speak, Kenny and Ayla. I'm Kate, co-founder and CEO of NeoSpace. We build modular multi-role spaceships at 1/5 of the current cost. Since this is largely a crypto crowd, I can appeal to more of the thinking about how the future is in sovereignty in space.

Right now, space is very monopolistic. It's ridiculously expensive. It costs about 50 to 100 million per passenger, 15 to 25k per kilogram. And so, the focus is how do we democratize access to space? How do we let other types of businesses, whether it's fiber optic cables, or if you want to 3D print your heart – which is something you can actually do with your own tissue and bio printing in space – and all of what else microgravity has to offer? Only by dramatically dropping this cost. It also must be done for other nations to be able to have access to space. These are the things that we are really focused on solving.

And so, this talk today will be about why space is so expensive. I have been a deep tech generalist my whole life. I'm very enthusiastic about building technology that enables humans. it's more "pro-human and good vibes", I should say. I met a co-founder several years ago, Gary Hudson, who is not here.

He became my mentor. He actually was one of the inventors of entrepreneurial aerospace before Elon Musk. They were doing reusable launch in the '90s. I met him when I was working on another project. And then a couple years ago, he asked me to take his life's work and be the CEO and co-founder of NeoSpace.

And then, we brought on Mike. I'll turn it over to Mike so he can introduce himself, but he is one of the most incredible engineers who has designed, built, and flown every aspect of spacecraft. And obviously, he had this robust history building stuff in the Air Force, and then with other entrepreneurial aerospace companies. He understands BD in space, the space economy, and building spacecraft in a way just like no other.

MIKE: Nice. Hi, everyone. Mike Scardera. As Kate mentioned, I have spent over 40 years in the space industry. I am NeoSpace's Chief Technology Officer and Jack of all trades, as Kate mentioned. I met Gary Hudson back in the 1990s. We were both doing entrepreneurial space launches before it was fashionable. I was working with a company called Pioneer Rocketplane, which was trying to do a reusable space plane. And Gary was at a company called Rotary Rocket Company, which he started.

We knew each other then, just through being a small community, and running into each other at conferences. We were friendly competitors. But then, when Rotary Rocket closed up shop, we hired Gary for work that we were doing on a DARPA project and other government programs at the time. We got to know each other and work with each other.

I ended up working with him at a program called AirLaunch in the early 2000s, which was launching a 1,000-kilogram payload rocket from a C-17. That was another DARPA program. We got to work with each other and know each other pretty well, and we've always wanted to work together. But that only worked out recently when we founded this company together.

KENNY: Okay, that's great. A lot of experience there. I guess my first question for you, and we'll make it the one that's the topic of the day, why is space so expensive?

MIKE: It's a very long answer. There are lots of reasons, but there are four main ones. The first one is physics. The others are, maybe a little bit of history, and then government and politics, and finally, human nature. I would say those are the major categories of why launch is expensive.

I guess I could start out by talking about a little bit of physics. At a very simple level, it takes a lot of energy to go 100 miles straight up, and then 22,000 miles an hour horizontally. And that's just to get there. Then, you have to use even more energy to do something useful. And then, you have to get rid of that energy coming back, which costs energy.

So basically, it takes a lot of energy, and a lot of energy is expensive. Now, thanks to SpaceX and with the SpaceX Starship, that price is coming down significantly and it will come down even more.

KENNY: Can you expand on that a little bit? Why is SpaceX specifically bringing down those costs?

KATE: Well, if we go back to the history, the other part of why space is so expensive is it has been based on something called Cost-Plus contracts. This means you are incentivized to over-staff, and you can delay your projects as much as possible to charge more. There was something that changed a little bit with this one. Our co-founder helped develop the COTS program which opened the doors for entrepreneurial space.

And then, SpaceX got a fixed-price contract. That way, you can have more affordability in how you're building, and it does not incentivize building out staff so you can get more government money. I think that was a lot of the detriment. And also, the big part of the reason that launches did not succeed before is that you didn't have venture capital money.

Until Elon Musk came in saying "I've got a few hundred million in the bank, let's go", you could not get that extra capital to really take your startup to full success. You could do maybe a little bit of investor money and government contracts. But that was also what prohibited the cost. Since Elon had so much capital to start with, he could really go after all the information that was already out there. He integrated it by his incredible skills and by having that right amount of money.

MIKE: Yeah. Kate was mentioning the business reasons and some of the technical reasons. He did things a little bit cheaper at first, then he brought in reusability, which has always been known to be a big win in terms of lowering cost. And now, he's getting scale with the new Starship, which is a very large launcher, and full reusability as opposed to partial reusability with the Falcon 9. So, there are both good business and technical reasons why SpaceX has been very successful.

KENNY: Gotcha. Barney has a question in the chat here. We're talking about SpaceX a lot, but Blue Origin is also another competitor out there. Are they actually making much of an impact on the industry?

MIKE: The honest answer is no. First of all, I think they have been very slow to develop their products, very slow to bring them to market, and their expenses seem to be pretty high. I think the biggest mistake they made is that they are located in Seattle, and a large part of their management and personnel base came from Boeing aircraft. That's not a low-cost way of building aerospace hardware, following Boeing or traditional aerospace practices.

KATE: The other aspect is that most space companies – and this is also the struggle with a lot of startups – they don't understand how to do rapid prototyping. SpaceX did a form of that which helped bring down the cost dramatically. But as you were talking about, with Boeing, that's really staff bloat.

And when you're thinking about true entrepreneurial aerospace, an example is, what would take a team of 200, the NeoSpace's of the world can do with a team of 20 people. And if 80% of cost in Aerospace is people, then it's really important to understand how to design simple systems, how everything integrates, and how to keep teams small in rapid prototyping and iteration.

KENNY: That makes a lot of sense. We're going to change topics a little bit. Can we talk about the use cases for microgravity? In my mind, people want to get into outer space because we want to mine asteroids, and stuff like that. But clearly, there is some more near term payoff, and it sounds like you've touched on some of them. Can you expand on that? It's interesting.

KATE: Yeah. When we're thinking about space, everything you stream on your phone is because of space. You use about 100 space inventions a day, so you're already connected to space, whether you're up there or not. The thing that is prohibiting in what's considered this huge gold rush, again, is the cost. There are many great things people would like to do, such as mining, which breaks the limited resources paradigm on Earth. We don't have to destroy Earth to get precious resources.

But as I touched on in the beginning, there are things that happen only in microgravity, like how crystalline structures form. For example, a pharmaceutical company did a small test on the ISS. The delivery system is way more potent, and you capture more of the benefit of the drug when you're in microgravity.

There is something called organoids. You can create mini organs to do medical experiments on, but only in microgravity. And it's the same thing, as I had mentioned, if you want to bio-print a replica of your heart with your tissue. It will collapse on Earth, but you can build these in space. Those are more medical, then there are fiber optic cables. Some people are also thinking about semiconductors, like how you

could do the wafers. So, there's tons of applications besides mining. And obviously, tourism would be really fun.

KENNY: Interesting. I actually knew very little about any of that. That's pretty cool. Mike, back over to you. We prepped on this one a little bit, and we talked a lot about SpaceX. Are you going to beat them on pricing?

MIKE: Well, the big problem SpaceX has now is they have grown and grown into a big company. In a lot of ways now, they are still doing a lot of good things. But let's take Starship as an example. I think the NASA SLS program was a $12 billion program last time I recall. Starship is somewhere going to be between a $5 to $10 billion program, if not more. It has better capability in a lot of ways, so it's still good.

It's still going to be a revolution in a lot of ways, but there are very steep development costs. They have large staffs now. They're not doing projects with small numbers of people. Their Dragon team is well over 500 people. We're planning on doing the same kind of capability that has more operational utility for a team of, like Kate mentioned, 20 to 30 people.

That's how we keep the costs lower. I don't think we're smarter. It's just that the natural transition of small companies to large companies, particularly following 20th century models, is to just grow things, specialize more, and do more matrix management. I think the Europeans have a better model, which is more of a network model of business growth. I think that's the approach we would want to take to keep costs low as we grow.

KATE: And the other aspect of the unaffordability is the lack of modularity. For example, Kenny, if you want to go to space, you get a ride for maybe a couple days on Dragon. You might get to hang out in the ISS, if you're lucky. But again, these are very short windows. If you are somebody who wants to stay up in space, if you want to do manufacturing, or you want to do R&D experiments, or tourism, you can't have a long lived on-orbit mission. You can't have space the way you want it.

With our modular vehicles, we are creating the interiors of the spacecraft exactly how you want it, whether it's for your manufacturing, tourism, R&D, etc. And also, our exteriors are modular. That way, you can change out your rendezvous and docking. Right now, you can't have a vehicle specified to your needs.

And our cost is dramatically cheaper because people can buy or lease our vehicles. And also, it's space the way you want it, not like renting a ride on somebody who has a lot of cost to amortize. This is stuff that we know how to build and we know how to do correctly, because it's not just about SpaceX and the low costs.

It's also that we have done these types of very small-team entrepreneurial aerospace companies before. It's just a whole different way of thinking. And so, you do have to train the younger generation on rapid

prototyping and systems engineering. A lot of people don't have the mind of a systems engineer, which is absolutely critical for keeping costs down.

KENNY: That makes a lot of sense. You can't do rapid prototyping as a big company. And there is almost like a “niches to riches” argument there, where here's a very specific use case, we are going to go solve that particular problem and iterate quickly to get there. I guess we'll bring it back to crypto. Jake has a question. You need to raise a lot of money to do this. That’s just a statement. And I know you're not pitching…

KATE: Less than most companies, though.

KENNY: Fair point. Meme coins are pretty hot right now. Raising in crypto seems relatively easy. So, Jake's question is, are you going to do a token launch? Oh, man, that's awesome.

KATE: Well, I know another company has. Meme coins are about riding a specific type of hype. It might be fun in the crypto world, but it might hurt our branding in the more traditional world. If I was going to do a meme coin, let's just say I probably would not attach it to my space company. I would do a lot of analytics and put a team together of what meme coin is going to be hype-y. But usually, meme coins are a pump and dump scheme. It’s more about the basic ethics of crypto. So, I don't know. That's probably not my vibe.

KENNY: You can actually just do security token raises, where you're just using the crypto marketing buzz, whatever the case may be, and it looks just like a regular fundraise. Just FYI.

KATE: I don't know if the audience for space in crypto is big enough yet. Although I do have crypto people interested, it’s more for the blockchain use cases in space. Usually, if you are like a BTC or ETH whale, you might want to fund projects that feed the success of them, and help the ecosystem.

So, I'm not sure it would be as successful. The people that are more interested in our technology tend to be governments or companies that want access to space or hard tech and deep tech investors that are thinking 10 years out.

KENNY: Right. Okay, that makes sense. Back to the questions. Mike, where does nuclear come into this, as far as an energy source for space travel?

MIKE: For space propulsion. It's the only way that you can leapfrog Starship, in my opinion. I think it's essential for interplanetary travel, especially if you want to bring timelines down significantly. And of course, for powering things like Moon bases or Mars bases, or in space platforms.

It's not essential because you do have solar power, but it is enabling in a lot of ways. In any system development, there is always a trade-off of what you want to do that is best for energy sources in space. The trade-off is in favor of solar in many cases, but the trade-off can be in favor of nuclear for power production.

I think it's essential for the future. I think it's going to happen. I think that the DARPA DRACO program, which is a nuclear thermal propulsion system needs to happen. If fusion gets perfected, that's a better approach. It's more efficient, faster, and more energetic.

I think the future is bright for nuclear in space. I do not see it as an Earth-to-orbit launch capability, just because people are afraid of using it. I think it's possible, and I think that could be revolutionary, but I just don't think it's politically viable.

KENNY: Understood. So, it's necessary in some cases just as long as it's away from people.

MIKE: I think nuclear is essential for long term human development in space. I think that's crucial. Is it essential on the ground? I mean, I think as a power generation source, nuclear is important. But I seem to be in the minority, even today.

KATE: I think there is a changing tide with this. I'm going to remain out of this politically, but there is so much development going on that I think, give it a few years and it seems like some people who are very anti-nuclear are going to be switching over to the other side, if there are safer ways to do it. And I know a lot of inventors that are working on some cool stuff, so I think we will see some rollouts of safer technology.

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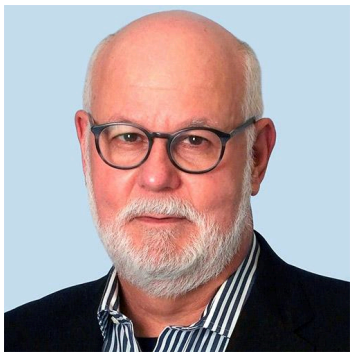

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