The Space Capital Podcast S01E17 - Quantum Security with Chune Yang Lum - Transcript

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Chad:
Welcome to The Space Angels Podcast, episode seventeen: quantum security. I'm your host, Chad Anderson, CEO of Space Angels, the world's leading source of capital for early-stage space companies. You can find us on social media at Space Angels. In this podcast, we explore what's happening at the cutting edge of this new entrepreneurial space age and speak to the founders at the forefront. Today. we're going to be talking about quantum security. You may know that quantum computing is advancing rapidly, and this is creating a problem for secure communications that rely on the supposed mathematical complexity of asymmetric encryption keys. Although these keys are secure against computational hacks today, most are easily cracked with quantum computers. China's leading the world in its own impenetrable quantum secure network with offices in Singapore and Colorado. Speqtral are the only company outside of China that has demonstrated a Quantum Light Source on orbit. The company seeks to leverage quantum technologies to offer secure scalable solutions for distributing symmetric encryption keys using satellites as trusted key exchanging nodes. They're a quantum security company and what they're building has been described as the security layer for the Quantum Internet. That's why I'm so excited about today's guests, Chune Yang Lum whose CEO of Speqtral, a Space Capital and Space Angels portfolio company described as a game-changing startup of 2020 by CB insights. Chune Yang was previously head of strategic development at the center for Quantum Technologies in Singapore. He has over 10 years of Business Development experience. Most notably with SES, a world-leading satellite operator in Luxembourg, where he was a senior manager focused on the Asia-Pacific region. He also has a Master's in physics from Penn State and an MBA from INSEAD. Chune Yang, great to have you on the show. Thanks for taking the time to speak with us.

Chune Yang:
Oh, thanks Chad. It's a pleasure.

Chad:
So, if you were in Singapore it would be very late in the evening, but you happen to be in the Bay area today. So, a little bit more civilized time.

Chune Yang:
Yeah, that's fine. Morning or late at night. That's great for me.

Chad:
I know that from personal experience working with you. Okay, so we have a lot to cover today, and I want to dive in to start us off. Can you tell us a little bit about yourself and how you became involved in Quantum Computing?

Chune Yang:

Sure. So, I kind of- I started physics for my undergrad and, you know, all along in my teenage years has been very interested in physics and quantum physics, in particular. And, you know, in my early career, I did a number of experiments and research in quantum entanglement experiments, and that's how I got involved in, you know, the quantum world. Obviously, that, kind of, in the early 2000 was very early in terms of technology development. But really in the past few years, we've seen tremendous progress in quantum technologies, in general, and particularly so in quantum computing and also quantum communication.

Chad:
Okay, great. And so this is a complex topic. And as you said, things are moving really quickly. So, I'd like to start at the foundational level and just kind of cover some basics. Can you help our listeners? I mean, most people have probably heard of quantum computing and they know that things are developing there, but can you help us understand what it is and how it works?

Chune Yang:
Sure, sure. So, quantum computing is the concept that we are using single particles, either atoms. ions, and in another more complex a superconducting qubit. And I'll try to break it down slowly. So, a qubit in quantum computing speak, is a quantum bit. Essentially, you can map a physical quantity of an atom tool like a 1 and a 0, right. And the special thing about a qubit is that you can prepare that qubit in the state where it's a mix of of zero and one. Which is fundamentally different from what the bit, the ones and zeros, that we're used to right now. So having this ability to control and manipulate that qubit right now, and it enables physicists and a lot of companies right now to do very interesting computations using quantum algorithms. And with this, you know, it opens up a lot of potential for new algorithms to run on applications. People talk about quantum machine learning, you know, breaking encryption codes, and and so on, so forth.

Chad:
And so, classical computers, they crunch a lot of ones and zeros, and they just- we put poor more and more compute power into the computers and they become faster and stronger, and they're able to crunch ones and zeros faster and more efficiently. But what you're saying is a qubit uses superposition. So, it can be a one and a zero at the same time, and this effectively allows multitasking and that's what makes a qubit so powerful. Is that accurate?

Chune Yang:
Yeah, essentially that's accurate. And combined with another wild concept, which is called entanglement, you really want to entangle the individual qubits together. And with those, the concept of superposition and entanglement, you're preparing the whole kind of ensemble of qubits in a state where you can do meaningful computations on it. And that's, you know, drastically different from the sequential ones and zeros, and, you know, processes that a classic computer has.

Chad:

Okay. And so, what would take years for a current computer to do, a quantum computer can achieve in just a few moments? Is that correct? I mean, I've heard, you know, figures like a million times more processing strength than all of the world's computers today combined. Is that real?

Chune Yang:
Yeah. So, there's- there's a caveat to it. So, with a quantum computer you need an associated quantum algorithm that can run a certain task much faster. So not all not all tasks can be run on a quantum computer faster. Like for example, just like a word processing on a laptop in Word, you know, a quantum computer wouldn't have any speed ups or advantage of a classic computer. However, for certain computations, just for example, encryption that we use today is based on a difficult mathematical problem, and apparently so that that mathematical problem has an associated, you know, quantum algorithm called a Shor's algorithm. That quantum computer with the Shor's algorithm would be able to compute much, much faster than the classical computer can.

Chad:
Okay. And then, so labs around the world are racing to develop the first commercially viable quantum computers. We've seen a lot of headlines, I'm sure, I hear that it's likely still years away. But there's some companies that are- are working on this. Who's out there focused on on the race to quantum supremacy?

Chune Yang:
Right. Yeah. So, it's very, very exciting right now in the, kind of, that quantum computing hardware development. You know, the idea has been around for like twenty, thirty years, and literally over the last, you know, four or five years, there has been, you know, essentially exponential or even double exponential, as some people claim, speed ups in kind of the development of quantum hardware. So, some of the major players today are Google, IBM, and there's a number of very well-funded startups in this domain. Like Rigetti, like IonQ, and, you know, Xanadu, and a few other kinds of major companies or startups coming through and having very, very good and concrete progress.

Chad:
But defense contractors and - like Lockheed Martin and others - are really looking at this as well, aren't they?

Chune Yang:
Oh, yeah. That's right. I missed- So, Lockheed Martin. I think they are partnering with D-Wave. They were some years back already. To look at, you know, using a quantum computer for some of the defense applications, which could be simulation, you know, quantum machine learning and a few other things.

Chad:
Okay. So with regards to security, there is a serious threat to current cryptographic systems, right? I mean, you mentioned that, not in all cases, but there's a lot of cases in which current encryption would not be adequate to combat and deter, or fight off, a quantum attack. Can you

help us understand, you know, what types of key infrastructure exist, and relies on the types of secure communications that could be, you know, at risk with the advent of quantum computing.

Chune Yang:
Right. Right. So, right now, I think the current understanding is that there's this, you know, encryption standard that we use is called a public key infrastructure, or public key encryption, which essentially uses a complex mathematical problem, called factorization, that is currently under threat. You know, a quantum computer with Shor's algorithm would be able to crack this PKI. Usually, we use, in most Anglo term, the RSA standard, and also another kind of algorithm, called ECC, elliptical curves. Those two will be vulnerable to a potential quantum computing.

Chad:
Hmm.

Chune Yang:
Yeah. So, and- and that, I think, you know, I think over 90 percent of all the kind of encryption algorithms used today are based on either one of those types RSA or ECC.

Chad:
Okay. Okay. So, this is a really big problem. Potential problem.

Chune Yang:
Yeah. Yeah. It is a huge problem. So, a lot of it depends on the security policy of the entity of that individual on how, you know, you want to think about this. So fundamentally, for those entities that, you know, absolute secure communication is key to the organization, there needs to be kind of a rethink on that infrastructure. That, you know, key exchange infrastructure on how you share secret keys between parties to allow secure communication.

Chad:
Is it fair to say that China is leading the world in this regard, and in regard to creating its own impenetrable quantum secure network?

Chune Yang:
Yeah, I would say that is a very fair statement. There's a lot of developments, especially implementation projects, in China that allows them to have this secure communication network. I'll cite two examples. First, is that, you know, China has essentially now the longest, I would say, longest baseline of a secure network, quantum secure network, between Beijing and Shanghai. That's about a two thousand kilometer, you know, fiber line. You know, and that's being secured by quantum communication, or quantum key distribution for want of the technical term, and they're building more lines to, you know, Chengdu and Chongqing, and also between Shanghai and some of the nearby cities. So I would say they have the big head start in deploying or implementing secure quantum communication network underground in China. The second kind of example or milestone progress they have made, is that they have even done a long-distance quantum communication program or project, called the Micius satellite, that was launched in 2017, that allows quantum secure communication between China and Europe, and also between two cities within China.

Chad:
Right. And so, I've seen video of a video call being transmitted through this- through a satellite developed by this- this is the China Science Agency?

Chune Yang:
China Academy of Science.

Chad:
Academy of Science. And so, they've demonstrated this. And they have a practical implementation where they're actually securing video calls and things right?

Chune Yang:
Yeah. That's right. Yeah. That's right.

Chad:
Yeah. And I saw just last week that they also deployed the first quantum mobile, quantum satellite ground station. So, something that you can put on top of a truck, or in the back of a pickup or something, where they can use it to send and receive secure quantum communications.

Chune Yang:
Yeah. Absolutely. I mean, they are. They are making, kind of, breakthroughs and progress on all fronts. Yeah, that mobile ground station I think is a- is also kind of a landmark development, because I think to enable mass deployment of satellite-based quantum communication, the receiver note, which is telescope on the ground, needs to be kind of manufactured efficiently or cheaply. And they've now come, you know, and developed like this small compact size quantum receiver, which is about, you know, thirty centimeter in diameter, and weighs about 80 kg. That, yeah, that can be deployed on trucks, you know, easily put on rooftops or buildings, and so on, so forth. So, with that kind of technology being developed, you know, it'll be easy to kind of mass manufacturers such quantum receivers on the ground and, you know, deploy anywhere all over the world, as and when the demand occurs.

Chad:
Hmm. Okay. And, I mean, I've heard a crazy statistic also. That- So, China is planning to spend at least 10 billion dollars over the next three years on Quantum technology, which, you know, compare that to what the US is planning to spend, and it's like thirteen times more than the planned US government spending. So, they're very serious about this. They've got a great, you know, they've got a big head start it sounds like. They've proven the ability to intertwine quantum particles from satellite to ground, and now with the portable ground station, they're now able to implement it very efficiently and effectively. Would love to hear a little bit about Speqtral and what you're working on. How it works in in relation to this, and in relation to these Chinese efforts. So can you tell us a little bit about, you know, you and the team and how this all got started?

Chune Yang:

Yeah. Yeah, sure. So, we, at Speqtral, we spun out of a research center called a Center for Quantum Technologies in Singapore. Really, this is, I mean, the concept is about quantum key distribution, quantum communication, and we really want to reach the problem of long-distance key distribution, right? You can distribute quantum keys through fiber optics, but that's really, you know, up to about fifteen hundred kilometers. We are focused on a long-distance, kind of, intercontinental key distribution. So, you know, at CQT, one of my co-founders, Alex Ling and his group has been doing or performing experiments developing technology in quantum communication for the last decade or so. And at CQT, you know, even longer than that. You know, just ground based experiments has gone the past twenty years or so. So, a long history and heritage of- of, you know, such technology development. And specifically, you know, we as a team, kind of the founding team, from Alex's group, a number of key people from the research lab has kind of moved on and formed Speqtral. One of the other co-founders, Robert Bedington, he's a CTO at the company and he's been leading a lot of the satellite QKD effort in his group, now moving on to Speqtral to continue that work. So, what we have done, we have launched, well, together with CQT, launched two successful experiments. Basically, kind of demonstrating quantum entanglement in space as a first step, you know, having a prototype, you know, quantum source, or quantum light source as we call it, in space. And that's been successful. So, the latest one, called SpooQy-1, was launched last year in June from the International Space Station, collecting a bunch of data. And it's been very successful so far. So, as a company, we really want to leverage that base technology to really rethink on how we can put up a system that is commercially viable, and that addresses the requirements of customers for, you know, secure communication or quantum secure communication applications. So by and large, kind of, I would say, very similar domain as what the Chinese is doing on the satellite side. We believe we are, kind of, the only entity outside China that has such technology in space. And really, in the next two years or so, we're looking to deploy our first, kind of, service demonstration mission to realize this in a long-distance quantum communication.

Chad:
Okay. And so, for those who don't know, the- the Center for Quantum Technologies at the National University of Singapore has been involved in leading in the research in quantum technologies for quite a while, is that right? And you were the head of strategy, strategic development for the center.

Chune Yang:
Yeah. That's right. That's right. Well the, kind of the connection between CQT and quantum communication goes back a long way. So, the director of the center, Professor Artur Ekert. He was one of the, you know, the early founders of the field called quantum cryptography of quantum communication, essentially pioneering a concept to use entanglement to do, you know, quantum communication. That was in 1991. And he has a very famous protocol, called Ekert 1991, that, you know, a lot of our work is based out of. You know, we've since kind of moved on to a few modified concepts, but there was a foundation of- in a lot of work that we do. And since the early 2000s, you know, just research and development and technology in ground-based fiber-based QKD, free space QKD across two points, you know, on campus, across two kilometers, and now kind of satellite experiments in space. So, as a group, I mean, CQT has been, you know, caught a number of Wolfers, in terms of the technology development in quantum key distribution. And now, as a phase in the last two, three years, we've seen a lot of that work being

commercialized and, you know, bring out the market. So, my role at CQT, we joined CQT in 2017, to kind of really take a look at what pieces of technology that are right for commercialization, and kind of where CQT should be headed, in terms of industry engagement, industry collaboration with big partners or big companies, and also kind of commercialization, and using of the- using the IPs for potential applications. So yeah, working very closely with the team there at CQT, and kind of essentially jumping into one of the startups, called Speqtral, to really bring that technology to the next step.

Chad:
Got it. And so, you had been with the center for a while and were a pretty integral figure there, and then you decided to take this technology and spin it out into a business. What was it that compelled you to- to do that? Having, you know, spent some time there and, obviously, you probably have- you were probably working on a lot of really interesting things. What was it about this that convinced you that this was the thing to drop everything and pursue?

Chune Yang:
Yeah. Fundamentally, I think the biggest, kind of, compelling reason is that the landscape for quantum communication, you know, secure- secure quantum communications, secure communication, has to change. This can be, kind of, a paradigm shift in how we distribute keys or how we use encryption going forward. So- And that's kind of the underlying reason that compelled me to jump on this exciting program or startup. But- and then also, kind of, there's a confluence of two trending topics that I can see, kind of, make this a viable business. Again, you know, technology is great, but without a market for it, without demand for it, it can't stand on its own two feet, right? So, on the technology front, I think we've come to a point where it's mature enough to kind of take that next step into developing it into a usable product. And on the market demand side, some say, you know, we may be a bit too early and so on, but I don't I really don't think so. And, you know, that we have been hearing a lot from the- the customers, be it the government defense sector, telecommunications sector, and also private enterprises, you know getting worried about the security of their communication infrastructure. And more so, I think the market potential is much bigger because those people, like you mentioned earlier, that, you know, many people are still unfamiliar with quantum technologies, the threats that quantum computing can bring, and, you know, quantum communication, what it's all about. So, we've been doing a lot of, kind of, educational workshops to bring people up to speed, and I think the crucial task for us is community. Is to bring that- that awareness and education to the broader industry and community. So the market potential, I think, is huge. And even, I mean, kind of beyond secure communication, using entanglement, you know, as a fundamental property, there's a lot of other interesting applications that we can build using our technology.

Chad:
So, this is definitely something that you don't want to be, as a CEO of a big, you know, of a company, that relies on encryption, and- and secure communications. You don't want to wake up one day and realize that you missed the boat here and find yourself unprepared. You would probably be in a pretty tough situation. It sounds like one of those things where, you know, this technology is developing and if you're not prepared, like we're going to hit a tipping point at some point in the future, and it sounds like in the very near future, and if you're not prepared for that, you know, you're wide open.

Chune Yang:
Yeah. Yeah, exactly. I mean, as a security kind of product or implementation- Kind of step back, right. Today's communication. So, any emails or any communication you send out there, even if they're encrypted today, you know, there has been reports that there are widespread wiretapping on, you know, communication infrastructure. It's so easy to steal data from a fiber line, right, that's, you know, a hundred-dollar device you can buy on eBay. That, you know, you can splice that fiber and you get a copy of the data that's going through the fiber. You know, essentially, I think the current concept of understanding is any communication you send out today is being wiretapped or stored somewhere by someone. So that's the concept of this, you know, store now and decrypt later attack. Where, you know, bad actors, they're storing your data and as and when technology comes, or becomes mature, that they can decrypt that information. Your information, that sensitive information, would become already vulnerable. So, the idea that you need to really prepare now to protect your communication for the longer term. It's really urgent, right? If you are- if you are an organization that needs to keep your data secure for ten, twenty years, that piece of information that you sent out could already be compro- compromised by this store and decrypt later attack.

Chad:
Yeah, makes sense. Okay. So, you've mentioned quantum key distribution, QKD, a few times already. Can you help us understand exactly what that is, and why it's more safe or secure than what we're using currently?

Chune Yang:
Yeah. So, I mean the threat now is, essentially, the whole kind of encryption concept is based on the sharing of a secret key. How do you share a secret key, right? So right now, the way we do it is through a difficult math problem. We just encode that key in a difficult mathematical problem. But again, so I mentioned before, that it's not safe right now. So, what we plan to do is, essentially, physically deliver those keys, and using, well, individual particles of light, called photons, to deliver those keys. So, you know, essentially encoding the ones and zeros in quantum states of a photon, a single particle of light. In a qubit. And sending those photons from the spacecraft, from the satellite, to ground. So, we have a device on the satellite, called a quantum light source, that will be able to generate, you know, very secure keys, and we deliver those keys from the spacecraft to, you know, ground stations all over the world. And doing it this way has a few key features. Which is if somebody tries to steal your keys, your photons, while it's on the way to the ground, you would know it, or we will know it, because it you destroy the quantum state, so to say. So, this is essentially, you know, tamper proof or unhackable, uncrackable, you know, as somebody mentioned. So, you know, having- using this kind of method of key distribution would enable entities to have forced security. Meaning, you know, no process in classical computing, or quantum computing, would be able to break your encryption if you get keys this way, because there's fundamentally no way to steal your keys.

Chad:
And how would you know?

Chune Yang:

Yeah. So- so it boils down to the quantum property. So, when we prepare an entangled pair of photons, right, in a quantum state. There's- there's a concept in quantum physics where, if you observe a quantum state, it we assume a definite state of ones and zeros. So, before you observe it, before you measure it, it can be in a superposition of zeros or one, but once you observe it, you know, it adopts either a zero or a one. So, with this concept, we will know for sure- I mean, that's the set of post processing methods we can- we can use to see whether- And if robbers try to steal the keys, and it would turn up as errors in communication- in a quantum communication. There's- there's, you know, a lot of ways to do that.

Chad:
How interesting. Okay. And then, so why satellites? I mean, you mentioned earlier, that fiber is vulnerable, but why use satellites and why are they more secure?

Chune Yang:
Yeah. So, satellite, they are kind of your most secure, in the sense that, well, hacking a satellite is fundamentally more difficult than, you know, splicing a fiber line on the ground. But really, I think the use of satellite is for the long distance, you know, there's no way to relay quantum signals over a long distance. We use satellite to relay those signals across large distances. And I think, you know, technology has come to a stage, you know, the new, Chad, you've been in kind of new space for a long time, and the technology's really matured that we can put, you know, small, kind of, size cube sets in space at a cost-effective manner and propagate that, you know, worldwide. Right? Using a quantum device on the spacecraft.

Chad:
So, space gives you a unique vantage point, it's scalable, and you're able to transmit the signals across very long distances.

Chune Yang:
Yes. That's correct.

Chad:
Got it. Okay. So, this is all been super fascinating, and the tech is incredible. Super interesting. But this is a startup, as you said, and you've gone from working at the center and doing research, now to running this startup. What is the business model here? How are you planning on making money with this tech?

Chune Yang:
Yeah. So, we- we have a couple of, kind of, business models, well, two distinct ones. The first is, again, I think we can deliver, or we're kind of offering, a dedicated mission of companies or entities that needs it. So, we call it a bespoke mission. Essentially, we'll build the satellite and, with partners, but we'll build the quantum hardware ourselves, integrate it, and launch a mission for our customer. And they can use it anywhere they want or anyhow they want. Right? And we have, you know, as a company, we wouldn't have that control. So, it's good for companies or entities that want that extra security, and also that confidentiality, in terms of how they want to operate the quantum satellite. So that's one model that we'll kind of deliver a full mission to them. Really, in the long-term, you know, we are thinking of essentially distributing encryption

keys as a service, right? So, some of the enterprise customers, like a bank, data centers, and so on they would not own and operate a satellite. For those customers, they would essentially want to know that they have secure, you know, quantum encrypted communication. With that, you know, we plan to partner with some of the Telcos, a communication provider, to provide a quantum encrypted link, essentially quantum encrypted communication. So, we plan to offer that as a service for potential customers in a future.

Chad:
Okay. And then, in terms of market traction, I was curious to hear, you know, who is first to adopt this new technology. You mentioned banks. What other types of- of customers are you talking to?

Chune Yang:
Yeah. So, unfortunately, I can't name names right now. But we're working with a number of defense groups to do, you know, trials and proof of concept for this technology.

Chad:
Makes sense.

Chune Yang:
Yeah. We also have now applications that once do- Or we can also deploy, kind of, ground-based or fiber-based QKD. And there are more trials there in, you know, the computing kind of world, or secure computing world, they would like to try out these things. And a lot of, kind of, early compositions of [Telcos?? 00:30:16], I was early [mumbles] number of MOU signed with major Telcos around the world. They are eager to- Because you know from a Telcos perspective, you're providing communication as your core product or infrastructure, right? An infrastructure product. You need to ensure that those communication infrastructures is safe for your customers. So, a lot of these Telco groups are coming forward and thinking about how to make their communication network quantum secure. And- and there's a number of banks and financial institutions that have, you know, taken interest as well. We're doing, kind of, early phases of potential proof of concept with them.

Chad:
Interesting. And then, so who else is doing this? I mean, we've talked a little bit about China and the Chinese Academy of Science. Are there other commercial entities that are looking at this, and how is Speqtral in relation to these other efforts?

Chune Yang:
Yeah. So- so I'll kind of lump the QKD. You know, that there are a number of companies providing fiber-based QKD, and only, you know, a select two or three companies providing the space-based for long distance AQKD. We've seen a number of startups coming through to say that they are in the landscape for space based QKD. But none of them, that I know, have demonstrated a quantum payload in space. There are also a couple of major satellite operators that have announced plans to provide, you know, quantum key distribution products or services in future. But we understand that they are in kind of planning phase or proof of concept phase right now, or design phase right now. But, you know, and kind of more so for the fiber-based

QKD, there's been much, much more activities there. Just because I think the technology is a little bit more accessible, but the- the ecosystem is very rich There's quite a number of players here already, but I think looking at us as company versus the- the other companies planning to do space-based QKD, I think we have a good head start in terms of Technology. You know, having demonstrated that in space, and we are really putting that framework around providing a turnkey solution, you know, an easy to deploy turnkey solution for customers.

Chad:
And so, you're really the leader in this from a commercial perspective. I mean you were founded in 2017, but you have years of technology development while at the center.

Chune Yang:
Yes. Yeah. That's right.

Chad:
Yeah.

Chune Yang:
Well everything's very, very, you know, mature and rich technology here.

Chad:
Okay. And then, so something that I meant to ask you a little bit earlier when we were talking about the technology, but this will kind of help me get my head around, you know, where you are in relation to others. Can you walk us through the- the tech demo and when you demonstrated the QKD in space? Can you walk us through what Speqtral did?

Chune Yang:
Oh, right. Yeah. So, the- the team at Speqtral, kind of, while there at CQT, um, together. We essentially have miniaturized desktop-size experiment into literally a 20cm by 10cm quantum payload that can fit on a CubeSat form factor. So that quantum payload is flying in space right now, we've done, you know, all those associated space qualifications. It is flying space right now on Spooqy-1, you know, collecting a lot of data, as mentioned earlier. It's very successful. That quantum payload itself. I would say, is our core technology. Kind of the miniaturization process is- is difficult. Making it a rugged enough in a space environment, you know, carefully selecting components that are, you know, space qualified, and really keeping the stability of the quantum signals. Because, as I mentioned earlier, so quantum signals are very, very finicky.
So, maintaining that alignment, I call it, is very crucial while flying. So, all of that kind of technology has gone into the payload. We make it very rugged, very stable in space, and- and that's kind of essentially the landmark that will come out, major milestones that we have, as a company, together with CQT. And then, really, I think the next step, we have plans for a intermission, a service demonstration mission, that essentially can provide early service for potential customers in about the two year time frame.

Chad:

Okay. Yeah. That was my next question, is what's next for Speqtral? Is it taking that signal now and bringing it to the ground to and from the ground, and essentially closing the circuit here?

Chune Yang:
Yeah, exactly. So, just be fair, so the- the Spooqy-1 satellite, we didn't implement the link from the spacecraft to ground. It was a demonstration of the quantum payload in space. And that, again, I think is a milestone because it's very, very challenging to do that. Our next step- Yeah, you're right. So, we'll, in our next situation, we call it Speqtral-1, that's going to be our next satellite. We will have a link from the spacecraft to ground using telescopes, and, you know, essentially also thinking about how to make it, again, a turnkey solution. So, devices on the ground interfaces with the current communication devices. Essentially, you know, doing an end-to-end encryption, a secure- quantum secure encryption for customers.

Chad:
And that's all you need to do to close the gap between where you are right now and where China's world leading efforts are. Is that right?

Chune Yang:
Yeah, absolutely. So just to close the link. And we don't really see that as any kind of technology showstoppers, you know, laser comms, as you might know is pretty mature already right now, kind of, you know, beaming, well, laser communication from spacecraft to ground. So we're going to work with a couple of key partners there that has very mature technology, to bring that to- to breach that link, while we provide a quantum device. So we really don't see that as a technology showstopper, it's more like a more engineering task to put the two systems together. And we, you know, we're very kind of optimistic about that that mission coming.

Chad:
Great to hear. Very exciting.

Chune Yang:
Yeah. Yeah.

Chad:
So, on the show, we like to say that there's never been a better time to get involved in space investing. Can you give us your personal perspective on that, and which areas are most exciting for you?

Chune Yang:
Yeah. I mean, I've been in space, kind of, working in the space industry for some time now, and actually came from the, well to quote unquote, the old space sector, right? I've been watching the evolution of using smaller size satellites, CubeSats. The launch, again, a lot of launch providers coming through. So, for our company, Speqtral, we're really leveraging this technology base that's really built up, you know, by a lot of other pioneering companies in the industry. The access of space, having small spacecraft in space, and then opening up in other applications to serve the community on earth, right? So for us, it's cybersecurity or secure comms application, and I think that, you know, just as a general theme, having space-based assets, you know, really

opens up multiple new applications going forward. You know, people are doing Imaging for sure. You know, they have sa- constellations programs coming up. And really, I think, that's in a lot of- I mean, you know better than I do, Chad, a lot of innovative companies opening up new application, new industry, and new markets by just Innovative thoughts and innovation technology. Putting, you know, that technology on the space platform and then, you know, commercializing that. So yeah, I'm very, very kind of bullish on just, in general, the space industry, right, going forward.

Chad:
And it's great to hear, you know, that you can build this type of application and you don't have to build the entire supply or value chain yourself. You know, that there's other companies and partners you could work with.

Chune Yang:
Yeah. Yeah, exactly. I mean, if us, as a company, we're going to do the whole, kind of, chain. Including all the supply chain of launch and satellite manufacturing, this is going to be a daunting task, Right? Like ten years ago, you know, I would never imagine being able to do that. But now, you know, with in the kind of ecosystem in place, it makes it so much easier. And we concentrate on, you know, what we do best, which is kind of the quantum stuff, and a lot of the, you know, the space, you know, hardware and services, you know, there's a lot of great partners out there.

Chad:
Okay. And if listeners would like to learn more about Speqtral, what's the best way for them to go about doing that?

Chune Yang:
Well, you can visit us on the website. You can contact me; I think that the information is on the website as well.

Chad:
At Speqtral with- At Speqtral with a Q. Speqtral dot space.

Chune Yang:
That's correct. Yeah.

Chad:
Okay. And we'll put a link to that in the show notes as well. Sorry.

Chune Yang:
Yeah. Yes, please.

Chad:
Great. Chune Yang, it was great talking to you. Thank you very much for your time today. Certainly, very interesting conversation.

Chune Yang:
Really. Thanks a lot, Chad, for- for the invitation. Happy to share, you know, what we have and what I know. And, you know, best of luck for your- for the podcast.

Chad:
Thanks for tuning into The Space Angels Podcast. If you enjoyed this episode, please leave us a review on Apple Podcasts or wherever you get your podcasts. And subscribe to make sure you never miss an episode. If you're interested in learning more about investing in space startups. I invite you to visit our website Space Angels dot com, where you can learn all about how you can invest in this exciting new innovation economy.