

Space Capital Podcast S01E03 - The Year of Small Launch with Jim Cantrell Transcript

Right now, over a thousand satellites are waiting to be flown, and they're waiting years on backlog of secondary rides. If we look forward in to five years from today, we see something on the order of seven hundred or eight hundred satellites being launched every year in the Microsat category.

Welcome to The Space Angels Podcast, episode three. I'm your host, Chad Anderson, CEO of Space Angels - the world's leading source of capital for early stage space ventures. The purpose of this podcast is to provide investors with the context and information necessary to understand the real risks and opportunities in this dynamic new space age. In 2009, a little-known rocket company launched their first successful commercial satellite. And in doing so, ushered in what we like to call the entrepreneurial space age. This fundamentally changed the way we do business in space, and enabled hundreds of would-be space entrepreneurs to enter the space sector for the very first time. And with the backing of Angels and VCs from 2011 onwards, the number of small satellites that were launched grew significantly, from twenty to a hundred to a hundred and sixty. Before falling off in 2015 and '16. Not because there were fewer satellites in the queue, but because they couldn't get a ride to orbit. Now, companies like Vector Space Systems are further enabling the entrepreneurial space age by providing increased access to space, addressing the bottleneck for small satellite launch and catering specifically to these customers. Vector's on track to begin commercial flights with their Vector-R vehicle next year. And in this episode, we'll be interviewing Jim Cantrell, the company's CEO, and we'll be asking him about his plans to provide affordable and reliable access to space through their family of small launch vehicles Jim, welcome to the podcast.

Jim:

Thank you, Chad. Glad to be here.

Chad:

So, what is it that Vector does, and what's your value proposition?

Jim:

Yeah. So, Vector is a space access company, and we are trying to lower the barriers to entry for space entrepreneurs or anyone else who needs to put some physical asset or idea in space. So, what that means in real language is we've got a two-part business strategy. The first is to build a set of rockets that are small in price and small in size, and that can be flown at a high rate. And then the second part of our business proposition is developing what we call software-defined satellites. That we launch, that we put up. That users, instead of having to develop their own satellite constellation, can essentially, for a fraction of the cost and a fraction of the time, get their applications or their ideas on orbit quickly. So right now, we're primarily focused on the launch vehicles themselves. Our Vector-R is the first one we're building and flying. And it puts about sixty kilograms into orbit. And its attribute is such that the very simple design, it's the Model T of the rocket business, so if it doesn't need to be on there, we don't put it one there. It's also the racecar mentality. If it weighs something, get rid of it if you don't need it. Yeah, and so we keep our parts count way down. We're about a thousand parts on this vehicle, and compare with, say, ten thousand on something like a Falcon-9. So, this allows us to manufacture a lot of

them like sausages, as Khrushchev used to say, and fly a lot of them. And one of the issues with flying a lot of rockets, you know, we're talking hundreds a year. One of the issues of flying hundreds of rockets a year is the issue of range. And most of these big rockets have to be assembled on the range and they sit there, and the day of the launch, you have to evacuate a good portion of the range. Ours is about as small as a tanker truck of fuel going down the freeway, and about the same explosive potential. We bring our own launchpad with us. We have what we call a mobile tail that we take out the rocket out onto the range, and we erect it, fuel the rocket, and launch it. And our first two launches, we've been able to do in about three hours from the time we arrived in the morning to the time it left the pad. We think we practice we can get that down. So, what we're talking about, if we can actually manage to sell this many in the market, is showing us that it's supportive of this and actually prove a reliable service and can fly often. We think that this has tremendous cost benefits. Plus, value proposition for satellite designers and constellation operators that they never had before. You can go ride share on a bigger vehicle, but you can't choose where you want to go, you can't choose when you want to go, and you can't do certain things like timing of the launch very, very specifically for certain physical things. So we think that this will completely broaden the utility of these microsattellites with have a limited utility, but one of the limitations is that they're launched as secondary payloads along with the bigger master payload. So, by owning their own rocket and the Vector-R is a million and a half dollars, and that's a real price, that's not something we'll sell and then jack it up to four by the time we get them first flying. Our initial costs are vindicating our pricing. You know, because John had done so much work on it, we had a lot of detail knowledge of the costing of this thing. We can honestly sell these flight services at a million and a half a flight. That means more people can afford a rocket. And so, again, you're talking about broadening the access to space and lowering the barriers. That's the first one you have to do. And the second one is this business of the.... the software-based satellites. And there's gonna come a time in the not too far future, I believe, where people are not gonna even want to build the satellites. Right now, they clearly don't want to build the launch vehicle. We think that extends to the satellites. And that won't cover a hundred percent of the market. It might cover twenty or thirty percent of use cases. And so, we have about forty patents on this technology because we brought in as one of our early investors, and later an employee and executive, somebody from the Silicon Valley software industry who was familiar with networking and virtual machines. And this whole other world of technology normally doesn't get associated with aerospace. So, as a culture in Vector, we're trying to bring together a lot of DNA influences from other industries. Automotive, you know, we're working with folks from Tesla, we're working with folks from other automotive groups. We're bringing it in from networking and software development out of Silicon Valley, and so forth. So, we see ourselves as really fundamentally changing, as well, the way that this whole business is gonna be conducted.

Chad:

Yeah. That's great. And so, how much time do you think that's going to save somebody, versus somebody who wants to get some data from space today versus the future that you're envisioning?

Jim:

Good question. Yeah. So, the launch itself, right now, people are typically waiting two and three years for a launch slot that makes sense. So, by doing the frequent launch, once we're at full...

production capacity in flight manifest, you know, we can really accommodate people in a walk-up situation. When they're ready to launch, they go launch. So we can literally take those years of wait off the table, or in the case where they have to pay for that launch two years in advance, you're no longer gonna have to pay that money out of your very early funds that you've raised and very expensive equity finance funds. It just makes no sense to take a million dollars of your investors' money that will sit in a launch vehicle company's bank account. That's usually offensive to most investors. So, we're looking to end that way of doing business for these guys. And when you then add on top of it, the time you've reduced to build the satellite, you know, you're talking about taking another year or maybe two off of that, depending on what people are doing. If it's a complicated constellation, for example, it could be two years. And I think more importantly though, is it's gonna open up the kind of innovative thinking to a broader number of people in the world. Right now, there aren't that many space geeks. And so, given a certain population of space geeks, they're only gonna have so many good ideas. So, there's a lot of people with good ideas that know how to do software that aren't space geeks. So, what we're hoping is that not only will this shorten all the timelines and make it cheaper for investors to, you know, roll the dice on some, maybe, risky idea, but do it with a broader DNA that comes into the business.

Chad:

So, a couple weeks ago, there was a CNBC headline that said, this founder split from Elon Musk and is now launching rockets for one twentieth the cost of SpaceX. Can you talk a little bit about your background, how you came to be involved with SpaceX early on, and why you decided to start Vector?

Jim:

Yeah. So I started off in engineering like most of these entrepreneurs in the space business, working for government programs, and one of the things I ended up doing that was unusual was I worked with the Russians, former Soviets, during the '90s to- prevented a lot of proliferation of missiles and technologies you're starting to see show up in North Korea. That started back then. And part of the activity that we did was to work with the Russians to convert some of their ICBMs that had been treated out into satellite launch vehicles. And never thought that would lead to a phone call that I got in 2001 from Elon Musk. And at the time, he was a PayPal guy. I didn't even know what PayPal was. And he called me out of the blue on Friday afternoon and said, "Hey, I'm this guy with all this money. Internet millionaire. And I want to start my own space program. And I need Russian rockets because American rockets are too expensive. And somebody told me to call you." So, it was a long story, you can read it if you like in Ashlee Vance's book. But the result of the phone call from Elon, we put together a mission to Mars that he thought he could afford and went over to buy the Russian rockets. And the long story is that the Russians wouldn't sell us the rocket. And we, on the way back to the US, Elon announced to Mike Griffin and me that he was gonna build the rocket himself, rather than buy it from the Russians. And that's how SpaceX got starts. So, as it turns out, one of the people that we brought in early on to help with this Mars mission was John Garvey. And John was building rockets in his garage instead of doing something with cars in his garage, like most people would do. And when Elon had seen this, he decided that this proved an idea that if we had the adequate amount of money, and talent, and management that we could indeed build a rocket of the scale to go to Mars ourselves. So that became the inspiration for SpaceX. And I stayed with SpaceX for about

a year after that. And John never joined up. He tried to convince Elon to build these tiny little vehicles for Microsats. We saw Microsats coming along in the marketplace. They were very new back then. But John really saw the bright future for them. Elon, rightly so, said there's no market for it, so we can't really start there. And John went on his way to build that- that rocket. I left. Started working with a lot of the entrepreneurial space startups that started coming about, like Skybox. I helped them. I helped a number of others, Rocket Labs, included. And a number of other of these Silicon Valley startups. And the thing I always saw, that was the same story over and over, is the primary risk became launch as the number of these satellites were being produced in larger and larger numbers, the availability of launch was just not there. So that led me to go back to John, about two years ago, after I'd sold my SpaceX stock to acquire John's company. He perfected a lot of this small launch vehicle that, back in 2002, he proposed Elon to do. So now the market was there for it. So that's how Vector got started.

Chad:

That's great. Yeah. And I particularly like that story, because at Space Angels, we looked at a number of different new launch companies, but we didn't invest in any of them until we came across you guys at Vector. And one of the many reasons that we- that we did choose to invest was because your background and Garvey's, and your relationship, right? So, as you mentioned, since your time at SpaceX, you went off and you were working with all of these companies. Garvey went off and was developing the rocket technology, and then you brought the band back together. And when you did that, you had technology that was years ahead of the competition, and you had been out talking to your customers the entire time. So, it seems like, you know, a match made in heaven. And can you talk a little bit about that, and your relationship with Garvey and how that's allowed you to really leapfrog everyone else?

Jim:

Yeah. No, that's a big part of the story. You know, if you look at we've done in the last year and half since we've been in play, you know, we've raised close to thirty million dollars and we've launched two full-scale Vector-Rs, which is our minimum viable product. That's our smallest vehicle. We've launched two full-scale versions of that. We call them block zeroes. And we've also, as of right now, have parts coming in for the orbital flight vehicles of next years. Our schedule of mid-2018 of going to orbit is holding. And the real reason of that is that all the homework that John had done over the fifteen years after he didn't sign up with SpaceX. And so, John and his crew, he lost a lot of his crew to SpaceX. A lot of the early founders were John's guys, and he reconstituted his team. And over the years, with some SBIR money, some zone money, some DoD money, he perfected the engines, for example, in... and the fuel as well. So those engines and fuel are really kind of the heart of the rocket. And, you know, he had the basic design for the rocket, as well. But that gave us such a solid starting point. We've been able to bring my side of the equation in, which was, as you mentioned, knowledge of the market, knowledge of the customers. Plus, I had an automotive engineering group that I essentially merged into Vector. We had been building and designing racecars for a number of years. And so, we had, you know, about a million and a half dollars of CapEx equipment already there, a facility that was ready to go on day one. So, we didn't waste a minute getting started. And, you know, we view first to market as being very important here. And so, we've really been working hard to make that schedule stick. And so far, we're good. So, it's pretty critical having, you know, the experience of the crew, and the first time we went out and launched something, you know,

my guys from the automotive side saw it. You know, they said, "Hey, these guys really know what they're doing when it comes to launching rockets." And that kind of maturity takes a decade to develop. And you see that, not to pick on anybody, but Rocket Lab and all these other startups, are gonna have to go through the same teething problems. And it's a team experience, more than just an individual's experience, as well. You know, John and I are a little bit on the older side for being in startups, but that gives us a perspective knowing where a lot of the potholes are. And we've seen enough of what's worked and what hasn't worked. At least, we hope we can avoid those same mistakes people made in the past.

Chad:

Beautiful. I want to talk to you a little bit about competition. So, after years of promises, we've got three small satellite rocket companies that are close to launch, right? We've got Vector, you guys are talking about launching next year. Rocket Lab, who had a test flight earlier this year. Virgin Orbit, out of Long Beach, California, part of the Virgin Galactic group. And there's others, right? Firefly, Generation Orbit, PLD Space in Spain. How does Vector fit into this landscape, and how do you differentiate?

Jim:

We're the smallest vehicle that's out there. We're looking at sixty kilograms to orbit, we're a million and a half. Rocket Labs, you know, about two to three times that size. It's about two hundred and fifty kilograms to orbit, so that's closer to four. And to some satellites, Rocket Labs, for example, still looks like ride share. If you're a three-use satellite, so you've got three or four of them to launch, you know, you're still gonna have to share that manifest with other people. So, for a certain class in the market, that doesn't even solve the problem. So, we've got our second vehicle called the Vector-H, stands for heavy, because every launch vehicle company has to have a heavy vehicle, right? So, um, that's very tongue and cheek, by the way. So, our heavy vehicle puts about a hundred and fifty kilograms to orbit. It's closer to the Rocket Lab throw weight, and then Virgin Orbit's about three hundred and fifty kilograms to orbit. So, they're a bit bigger. So, one of the things that Vector has that nobody else has is an ability to dynamically allocate production and flight operations between two different sized vehicles. And our H is built on the same components as the R, and so they can use similar factory space and all the same basic components, like General Motors uses the same engines across all the lines of their cars. And so, we just don't know what the market is gonna pan out to be. And we can adjust our production and our flights accordingly. One of the- one of the things I've seen since I've been in the business, is that the market preference changes with time. And we may have a batch of imaging satellites that prefer the H for a period of time, and then that may go away. And then there's a lot more of the Rs that are gonna be needed. So, we don't have to lock ourselves into fixed production schedules and fixed production timelines like a lot of the others go. So, our- One of our key ideas is just to maintain flexibility in our business plan, in terms of our technology. Then I'd say the last thing that we have that nobody else has, is an electric thruster, auxiliary propulsion system that essentially acts as a third stage. And that allows whatever mass we put into orbit to go to much higher altitudes with almost no mass penalty at all. So, we have patented electric thruster technology that we licensed from George Washington University. It's flown. It's been proven. And that'll be an add-on ability, but it essentially makes our vehicle much larger if you're going to high altitudes. So, for the equivalent set of mass, let's say eight hundred

kilometers, our Vector-R with the auxiliary propulsion can put that same amount of mass as an Electron costing four times more into the same orbit.

Chad:

And the Electron being Rocket Labs vehicle.

Jim:

Correct.

Chad:

But I thought batteries were heavy. So does the electric propulsion have a penalty, as well?

Jim:

It has mainly a penalty, in terms of the time it takes you to get there. That's the bigger downside. There is a mass penalty, but we use solar power for that. And these thrusters are fairly low power, that's one of the aspects of them that's very attractive. And you can take upwards of a month or two to get where you need to go and save all of that money along the way. So, if time is not critical, this is definitely a better situation.

Chad:

Wow. That... that really is innovative. On Cheddar, a few months ago, you said, "We will launch more rockets than anyone else in the world combined." The headline was, Why Vector CEO, Jim Cantrell, Says A Hundred Launches A Year Is Modest. Can you just talk about the market as a whole, and how it can support that many launches?

Jim:

Sure. So just standing here today, based on our market model, which is probably one of the most comprehensive models out there, we count actual satellites that have been either built or funded, or in the process of getting funding. And it doesn't count ones that we don't know about that are probably gonna come on next year, things that people are working on that aren't public. And right now, over a thousand satellites are waiting to be flown, and they're waiting years on backlog of secondary rides. So that, in and of itself, gives us an opportunity to fly off many of these. In fact, our early customers are doing just that. They're flying off many of these backlogs that they can't get anybody else to fly. So, we're already stealing manifest from the secondary providers. So, the reason we think that we can launch so many of these, we believe the market is going to support it. If we look forward into five years from today, we see, you know, something on the order of seven hundred or eight hundred satellites being launched every year in the Microsat category. The demand has been growing pretty dramatically. Just this year, we expect something on the order of four hundred being launched of the smaller ones. And these are being done mainly by secondary rides on larger vehicles. So, what we're finding is there's a lot of imaging satellites, whether they're... radar satellites or optical imaging satellites that are going up. And all these constellations have the plan to reconstitute the constellations with time. So not only are they fulfilling their initial constellation, but they're also relaunching. And the other thing that we're seeing is that there's a lot of these smaller three- use side satellites that are gonna go up in large numbers and constellations. So, our analysis shows three and four hundred launches of our Vector-R and H, some distribution between the two of those, is possible a year.

Chad:

So, Jim, that's really helpful to understand the market opportunity from Vector's perspective. How does that translate to returns for the investor in your company?

Jim:

Good question. So, we think that the investor returns long-term are extraordinary. And there's several reasons why. One, we think that this is a once in a lifetime opportunity for this particular technology that's similar to the opportunity we saw with microcomputers back in the 1980s, where they began to displace mainframes. And there's a lot of people who will tell you they don't think, you know, mainframes would ever be displaced. And they were right. But they were mostly displaced. The same is true of the satellites. So we see a continuing and ongoing shift, based on cost pressures, on other reasons why microsattellites will continue to displace the effective utility of the bigger part of the market, and that we will create a preference, if we're successful, to our particular service, which will have even a stronger draw out of the larger markets. It's, therefore, a long-term market penetration is very large, and we think that we could become one of the more significant space access providers out there. We see ourselves as more of a, not a rocket company, but a manufacturing a flight operations company. I see that focus on manufacturing and flight operations as being where most of the money is made, and if we can take early command of the market share, we'll be in a very dominant position for decades to come.

Chad:

Okay. And then from the investor perspective, they would get a return by someone buying Vector? Maybe one of these larger launch providers that don't have a smaller rocket family of vehicles?

Jim:

That's a possible exit. We're really looking at a number of different exits out of - I hate to use the word exit - ways to, you know, have the investors get their returns liquid. One is to go public. And we think that we're actually a good candidate to go public. I know everybody says that, we really mean that. We've got a very strong brand. And just this conference I'm at here today, these are not space people, these are people that think about other aspects of technology that are excited about what we're doing at Vector, because it makes space relevant to the average person. And they're excited by that. And I'm surprised at that reaction, to be honest with you. But we're seen as that company that's going to make that happen. The same as the PC became a part of every household. And that would make a great... a branding for a IPO. And we believe, based on our own financial models, that we're in a very good position for an IPO. Again, if we can hold our schedules and get our initial operations capability going.

Chad:

In terms of the IPO, what do you think the timelines for that would be?

Jim:

Yeah. It looks like it's probably a two to three year away timeline on an IPO. It's on the early side. We think that's the right combination of revenue growth and operational capability, based on our initial analysis.

Chad:

For me, this is blowing right through the common misconceptions about space companies. Especially, when you talk about launch as a market segment. We invested in the seed round late last year. You're launching the full Vector-R next year, and you're talking about an IPO in a couple of years. This all seems a little too good to be true.

Jim:

I'm a man on a mission, and I'm in a hurry to make this happen because I think there's great opportunity. And I see- I see opportunity costs if we don't choose to move quickly. And I want to move quickly because I see the demand there today. I see the opportunity; I see people willing to finance us with equity financing that is truly mind-blowing. It's an honor to have so much support. And it seems to me like this is one of those rare places in my life where we're all at the right place in the right time. And I definitely want to take advantage of it.

Chad:

I couldn't agree more. We're very excited to be one this journey with you as investor. And so, we were involved in the seed round, and you just recently closed the Series A that was led by a tier one VC. I wanna, I guess, understand from your perspective, how that's helped you. How that influx of capital, obviously, makes life a little bit easier. But particularly from the quality of investor that you've received the capital from, how that's helped the brand and what it is you're trying to do. And also, what closing that round has done for the company.

Jim:

Yeah. So, we closed a twenty-one million dollar round with Sequoia leading, and we had Shasta and Lightspeed as participants. None of the three are considered slackers in the VC world, they're all really top tier VCs. And what's even better than just the reputation alone is the kind of assistance they've been giving to us. At a operations level, they've been very, very helpful. Each and every one of them made an investment in Vector because, A, they believed in the team, B, they believed in us, but, C, they thought they could help us.

Chad:

A big headline from the World Satellite Conference in Paris last week was, uh, you're laughing already. Big Launch Companies Predict Doom for Upcoming Small Sat Launchers. And in quotes, at SpaceX, "We started with a small launch vehicle," This is President of SpaceX said, "We really wanted to make a business out of the Falcon-1." Which was their original small launch vehicle that you mentioned. "But we just couldn't make it work." And I just wanted to get your reaction to that and what you think about the incumbents telling you to not even try.

Jim:

Yeah. So, the first thing I thought of was the quote from the founder of the Digital Equipment Corporation when he said, "We see no reason why anybody would ever want to have a computer in their home." So, it's just a lack of vision. Gwynne Shotwell, who made that comment, I knew

her before she replaced me at SpaceX, but we've kept in contact over the years. And she was always a big fan of small launch vehicles. I think her comment is disingenuous. I would never call her a liar. But I actually did the market assessments for the Falcon 1, 5, and the Falcon 9 in the beginning days of SpaceX. I was quite aware of what the markets were at that time. In fact, I'd even negotiated a couple of launches on behalf of Skybox for the Falcon 1. The truth is, they had a large number of them sold. So, the demand for the Falcon 1 really wasn't the issue. The issue was that the business case really didn't close on the Falcon 1 alone. And that was primarily due to the fact that they could really never build more than ten or twenty a year and fly them. And she's quite right. That doesn't make sense. That's why we have a high flight rate, and we waited until the market was really ready. John Garvey could have never sold this business case ten years ago. So, the market has come to us. They're technology has moved on. And in reality, I think what Elon is looking to do is to not only service the large geomarket, but to service colonizing Mars, and he sees that as the way forward for SpaceX. And that's great. It's just different than microsattellites. Having these large launch providers say that we're doomed, gives us more credibility now than what he had before they said it.

Chad:

I wanted to touch on something that's, you know, really good news for you guys, and I think that a lot of people probably saw your recent launch. You've done a really good job of getting video and doing webinars, and streaming your launches live. And so, I think probably a lot of our listeners have seen the video of your latest test launch. I'd like to talk a little bit about that. You had paying customers onboard this test flight. And, yeah, and you launched from Georgia, which I don't think a lot of people associate with space flight. So curious to hear a little bit more about that.

Jim:

So, let's start with the launch site first. Georgia, that was Camden Space Port. And it's a space port that's not yet approved, but they're in the process of getting that done. It's a pretty basic site. For us that worked, for some of the other providers it probably wouldn't work. We don't need anything more than a concrete pad to launch from. In fact, we didn't even have that either in Mojave when we did our first one. We launched a block zero vehicle, that's a suborbital vehicle. The block one is the orbital vehicle. And our block zero is full-scale, but it has not all the parts to go to orbit. We had two paying customers. One was a prototype imaging satellite. The second one was a biological experiment that we recovered from the landed rocket, and I personally recovered that and returned it to its rightful owner.

Chad:

So, Jim, it sounds like your vehicle is very versatile. You put it on the back of a tractor trailer, you can take it around with a truck, you can pull up to a slab of concrete and, you know, light the end, and smoke and fire, and you've got something in space. I think our listeners would be interested to hear a little bit about what goes into a launch. What do you need to do to coordinate that? How do you make sure that the airspace is clear? How do you talk to the ground? This data, how do you get it back down to the ground? Who's controlling the thing? Just, you know, in a nutshell, how does- how does launch operations work?

Jim:

Yeah. So, you know, physically, we could launch these rockets from the middle of Tuscon, from downtown, if we wanted to and we could make orbit. We would not be permitted to do that for many reasons. Mostly safety, being that. So, by FAA rules, who is the regulatory body that we have to deal with in the United States, we have to launch from a launch range that's been certified. That's what Georgia's waiting to do. Cape Kennedy is certified, Wallops is certified, Alaska, and so forth. So, we have relationships and, actually, leases with several of these ranges already to use them. So, we're not waiting on Georgia. But the second thing we have to do is we have to have approval from the FAA or some other government regulatory agency, like NASA, that has the ability to approve the flight safety of the vehicle. And so, there's a lot of complicated things that go into the flight safety approval. One of them being an ability to... to destroy the rocket in flight or to terminate it, as we say. And since we're pressure-fed, that's one of the things that's really easy. We just vent the tanks and the engines quit operating. So, we don't have to blow it up as it is, it would fall back into the water, and it would be done. So, the rest of the qualification of the vehicle, or flight safety of all the avionics and the guidance, and so on, would be done by the FAA and or NASA, who spent a lot of time looking over our design details and worked very collaboratively with us. We're in the middle of that process right now. It's typically a long process, about a year.

Chad:

Is the truck that pulls the trailer, is that a little mission control? Does it fold out into a camper van, or how does that work?

Jim:

Yeah. So, we typically use a, you know, a one-ton truck, and we have a specially constructed tail. Which is a, in our case, it's a Big Tex Trailer that we converted to take the launch vehicle from horizontal position to a vertical position and mount it on the launch stand. And so that stand is bolted to the ground, and we have flame deflectors below it. That's all we really need for launch infrastructure. Then what we have is a portable fueling systems that pull up, again, with other trucks. We fuel it. And we're not talking about a lot of fuel here and liquid oxidizer. And then, once that's done, we have a control trailer, typically onsite or if we're gonna operate in some place permanently, we'll have a permanent block house kind of thing. We don't have all of our operations folks on the launch area. They will be operating out of Orange County. That's where our design and engineering group is. And they tend to be guys on the count- consoles that know all the little things about the vehicle, it's sort of unique behaviors, and so on. And they would be the ones running the auto sequence on the launch. So the job of the people at the- at the launch site is to, you know, mount the vehicles together, prior to the launch day, bring the vehicles out on the day of the launch, and to fuel them, and to make sure that they're ready for launch. This is the way we can launch so many of these. We have one team that sits in one place. They're not on airplanes all over the place. We don't have to have five different launch teams all over the world. We have a few people at each launch site that tend to be more technician-level types and maybe some ops managers there. But they live there. They're the ones that spend the good part of the week getting the vehicles prepped, and then actually flying them on, say, a Monday in Georgia, maybe Tuesday in Cape Canaveral, maybe Wednesday out of Alaska, Thursday out of Hawaii, and Friday in some other place. And then take Saturday and Sunday off. So that's the kind of- that's the kind of tempo, and that's different from the way other people do it. Very, very different. But again, when I say we're a manufacturing and flight operations

company, this is what I'm talking about. Vehicles get made; we don't change them. We're not going to upgrade every tenth vehicle. They're the same vehicle we're making over and over and over. And the more we do the same thing over and over and over, the better we get at it.

Chad:

So, once you light the stick and the rocket goes up, how do you communicate with it and how do you track where it's going?

Jim:

So, in the initial year of operation, we'll be using all ground tracking assets to track the vehicles at live, telemeters all the data back from the vehicle. We don't know if we'll have a command capability to the vehicle yet. We are thinking it's gonna be an autonomous flight termination system, which, essentially, the vehicle itself has a cone in which it's gotta fly and if it ends up outside that cone, it shuts itself off and self-terminates. So, we probably don't need a commanding capability is what it's looking like. So, as the vehicle ascends in altitude, and it goes down range, we'll have to have down range assets out on an island, for example, if we're on the East Coast. Or on a ship, potentially, if we're in a place like Alaska. So, what we're eventually going to be doing, and this will be one of the functions of Galactic Sky, is to have an orbital receive capability on the satellites and that comes down in real time through the constellation, which has the inner satellite link. We call this the Ring. That'll be our initial deployment of the Galactic Sky constellation.

Chad:

We'd like to ask you a little bit about how you work with your customers. How does that process work? How do you fit what they're doing into your vehicle? And then how does the process work, in terms of when you launch it, when you get them to where they want to go, how do you release them out into the wild, and at what point does your responsibility, as a service provider, end and they take over?

Jim:

Sure. So, once the- once we've signed a customer on, we send an integration kit out to the factory when they're ready to integrate their satellite into what we call the head module. And so, this box gets FedExed to the customer's factory, and it contains the payload shroud, it contained all the structures that the payload mounts to. And then this, in entirety, gets mounted at the top of the rocket. It's sort of the pointy end of the rocket. So, what our concept is, is that that, rather than having the customer bring all his stuff to the launch site and do the integration there, we do that in their factory where they already have their tools, where they already have their test equipment. We integrate it there. One of our technicians is there to do the final integration, final closeout on the head module. We seal it up in this box, which is environmentally controlled, and we ship that out to either our launch site or our factory. So, on launch day, we take the launch vehicle out to the pad, lift it, fuel it, and once ignition occurs, that's when our formal responsibility, from a contractual point of view, ends, the rockets on its own trajectory at that point. So that's generally surprising to people. That they think that we should be responsible all the way to the top, there's an argument for that, but traditionally that not what rocket contracts do. Most rocket manufacturers, once you light it, it's down. It's insurance after that.

Chad:

Just a couple of questions on... returns. The first is, speaking about the IPO and getting there in a couple of years, what type of multiples do you think that investors can receive from investing in a launch company? Because I think, you know, people have some preconceived notions.

Jim:

Yeah. So, let's start with comparable events, because we really don't know what the return's gonna be on this one, but let's assume we're comparable with other companies of similar nature. The most well-known one's gonna be SpaceX, and I think they're valuation on the last private financing was somewhere in the order of eighteen billion, judging just by the outstanding share numbers and the price of the shares are being paid for. I think I've seen some press on that. So, you know, you can look at how much revenue they're running through is about a billion dollars a year, and they're getting eighteen billion in value. So that one's been a pretty good investment for most people that's been in there, that they're looking at probably forty or fifty X returns. If you look at Rocket Lab, there's a sum total of about two hundred million that's been put in over various phases, and they're claiming a valuation of over a billion on their last round. So, you're looking at, you know, early stage guys getting probably a hundred X returns on that one, and maybe ten X on some of the later ones. We don't know what future valuation will be but, you know, if we're the least bit successful of what we're trying to do, we'll be multi-billion dollar kind of valuation, as well. I don't think that's out of hand. You know, we're still in the earlier stages. I don't think we're up with Rocket Lab's valuation. I think that was a little high, to be honest. But if they can get it, more power to them. So, we hope to, you know, give our early investors at least twenty X return. I'd be thrilled to death if I gave them a hundred.

Chad:

So, we've got one last question. Our thesis at Space Angels is that there has never been a better time to invest in early stage space companies. What I'd like to ask you, and I ask all of our guests, is do you believe that? And why?

Jim:

Yeah. I'm definitely a firm believer it's a good time to invest in space businesses. Because, number one, I see this is the next trillion-dollar industry. And, to me, it's exactly in the early stages of the Internet when I sort of turned my back on that, didn't think anybody would make money on it, and also PCs. You know, I've seen this- seen this band play twice already, and I'm seeing this again. So, I'm very bullish on the space industry from that point of view. It's an economy that's already about four hundred billion. But I can see it being a multi-trillion dollar economy in a very short period of time. I want to see more investment in it, because I think the promise that comes from the commercial exploitation of space is so much more exciting than what we're seeing out of the government exploitation of space. I think it tends to build upon itself. And so, there's a lot of momentum that's going on right now. And it's a little bit like cryptocurrency, probably, is in the same position right now. A very, very good time to get in. So, space has been slow, it's been around for a long time, but the fundamental change that investors need to understand is it has gone from a government dominated industry to a private dominated industry.

Chad:

Jim, I just want to say thanks for your time today and for coming out and talking to us. Is there anything that we didn't cover that should have?

Jim:

Well, I'm gonna put a plug for Space Angels. You guys were great to work with from a... from a startup side. And I really liked your process. I think out of all the various investors we worked with, you guys were probably the most professional and well-organized. So, I was- I was very pleased with what we saw.

Chad:

Thanks very much, Jim. Happy to be on this journey with you.

Jim:

Yes. And we're happy to have you.

Thanks for tuning in to The Space Angels Podcast. After that interview with Jim, I'm sure you're going to want to learn more about becoming an investor in early stage space ventures. So I want to invite you to visit our website, Space Angels dot com, where you can learn all about Space Angels membership and how you can get involved in this exciting new sector. And before I sign off, I just want to put in a plug for our next episode, where we'll be interviewing Chris Lewicki, CEO of Planetary Resources. You're not gonna want to miss this one.