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Josh Giegel is the co-founder of Virgin Hyperloop, a company dedicated to making hyperloop transportation a reality. Giegel founded the company in 2014, when hyperloop was an idea on a whiteboard in a garage. A little over two years later, Virgin Hyperloop built a full-scale prototype. Previously, at SpaceX, Giegel led the successful testing of six different rocket engines. He then shifted to leading research activities at Echogen Power Systems. In this conversation with Stanford adjunct lecturer Emily Ma, Giegel shares his entrepreneurial story and explains how his personal mission statement shaped each step of the journey.



Transcript

(uptempo music) - Well, hello everyone. 00:00:08,090 My name is Emily Ma and I'd like to welcome you to another Entrepreneurial Thought Leaders series lecture presented by STVP, the Entrepreneurship Center in Stanford School of Engineering and BASES, The Business Association of Stanford Entrepreneurial Students. I am so excited to introduce Josh Giegel to all of you today. Josh is the co-founder of Virgin Hyperloop, a company dedicated to making Hyperloop transportation a reality. Josh founded the company in 2014 when Hyperloop was an idea on a whiteboard in a garage, that's kinda how all good stuff starts. And a little over two years later, Virgin Hyperloop had built a full-scale prototype. Then in November 2020, Josh became famous in history because he was one of Hyperloop's first passengers. Previously prior to that he was at SpaceX. He developed the world's first reusable rockets and led successful testing of six different rocket engines that are now used. He then shifted his focus to powering the earth with revolutionary waste heat to power energy technology, leading research activities that Echogen Power Systems.

Welcome, Josh. Super excited to hear about your journey. I know you've done a lot of thinking around vision, mission, and purpose. So handing it over to you for a presentation I can't wait to hear. - Excellent. Thank you, Emily. 00:01:28,800 Thanks everybody for having me here. It's excited to talk about the journey of entrepreneurship. So I thought I would try it a little bit different 'cause so often we hear about the professional side of entrepreneurship and the things you do within the company, but there's so many things from the personal side and the experiences you draw on before you actually start the company that make you who you are, that have you wired the way you are. And ultimately you lean on as you go forward.

So I'm hopeful it'll be insightful. You're definitely probably gonna laugh at some mistakes and maybe a tire as we go through at my expense, but at the very least hope you enjoy. And these little moments and I've got little quotes from people I've encountered or things that have impacted me on the way. They might seem inconsequential to you at the time but at the end, they're actually some of the most important things in my life, and ultimately what shaped me to be the way I am. So with that, I'm gonna dive in. So, little bit about me. My background is an engineer. So my parents are engineers, my mom, my dad, my sister, my wife, my sister's husband. And with that, I always remember at a young age is working on cars or building home improvement projects with my dad. And there was this kind of magical moment when I was a kid, we were working on a car, I was maybe 10 or 11 years old, and there's something wrong with the car.

And I watched my dad go through the symptom diagnosis, what was the tree of all the things that could be wrong. And I was pretty amazed. I was like, this guy must be the smartest guy on the face of the earth. And when I was asking him about it, he said, it's not. It's because I'm an engineer, I know how to solve problems, I know how to diagnose things. And if you would be interested in doing that, then engineering is something that you should consider. So I kinda knew that that was gonna be what I wanted to be but exactly what kind I didn't know until I really went off to Penn State where I did my undergrad and it was gonna be a mechanical engineer. After about two years inside of that program, I really began to fall in love with the applications of software to predicting physics models or doing systems analysis or whatever it might be. And pretty much ever since then the software component of engineering has been a big part of everything that I've developed and everything that I've worked on. And largely speaking most people who've started their own companies have some degree of entrepreneurship in their background and my parents were slightly similar to that.

They definitely encourage intellectual risk, being unafraid to be the stupidest kid in the room or being all right with failure. And my dad had actually spawned his own business out of a division inside of a company. And it wasn't quite the same as starting your own thing, it was part of a larger company but the things that went into that, that went into doing something for the first time, the excitement that came was really during my high school years and I got to see that and the excitement you had with blazing a trail. So that also got me pretty excited about wanting to be an engineer. So during my undergrad, I did, I was very interested in projects more than just kind of the academic side. And so I spent a lot of time interning and co-oping in companies. And during the fall of my junior year, I got a great offer from GE Aviation in Cincinnati, Ohio. And it was a great opportunity, it was gonna be great experience. I would have learned a ton. They were actually paying interns really well and they were gonna pay for an apartments.

And I was like, all right, I'm in, I accepted it. I went out to Cincinnati, found an apartment in the fall of that year and like, everything was good to go. But then in the early, I'll say early spring, late winter, I got a call from NASA in Cleveland, Ohio, not NASA in Florida or Houston but in Cleveland, Ohio for an eight month co-op. But NASA was like the dream I ever had is being a kid. That's like why I wanted to become an engineer and I ended up calling my parents and telling them like, hey, this is exciting. And I was telling them about the offer. And it was quite frankly, one of the worst offers I've ever seen ever. I think they were gonna give me about \$15 an hour, I had to pay for my own apartment. It was also gonna force me to graduate in one more semester instead of two, and it was gonna last through the whole fall. That ended up being a lot of fun to try to cram all that in one semester but it was NASA.

It was like what I was excited about ever since I was a little kid. And when I was talking to my parents they could see this excitement. They could see me getting up on this, the financial aspect of this. And they had the means to help but it was really unspoken that they wouldn't and that I wouldn't ask for help either. It was just kind of the way that we're wired a bit. And then my dad told me something that profoundly changed the course of my life in that moment. And that was quite simply that, "Josh, if all you do is chase money, you're never going to have enough. And as an engineer, you might never be rich, but you'll never be poor." And my dad's not that deep of a guy but I really think that he didn't appreciate like the literal but also kind of the physical, metaphysical of what he was after. And yeah, he's been right, like, well, there's been times we've had no money, the stuff we were working on and so inspiring, so exciting. Yeah, he was right, I've never been poor and that's been I think one of the more exciting things.

So I called GE and told them I accepted the offer in Cleveland and told them I wasn't coming which was awkward as you can imagine. I found some apartment, cheapest one that you could find. It's actually smaller than a studio, it's called an efficiency. It's like 200 square feet where the bed folds into the wall, you get a single burner stove. I was lucky actually had a toilet in mine. So, it was about as horrible as you can get and you got that for the great low price about \$800 a month. And I hated that place so intensely that I joined every activity that NASA had to offer for for interns. So volleyball, hockey, flag football, you name it, I did it. I even joined a softball week and I absolutely hate softball. But during one of those softball games, I ended up running into a very pretty girl and she was also an intern.

Her name is Stephanie. Six years of dating later, a couple cross-country moves and long distance relationships, we got married and we're coming up on our 10-year anniversary. We've got an awesome 3 1/2 year old and she's been my rock. And whenever I start to lose my way, whenever I forget what's important or need someone to set me straight she's there. And I can't stress how important that has been during this entrepreneurial journey and during my career. That person who knows you, that person who doesn't know you as the persona of founder, CEO, or engineer but you, but you as a human being. You've got to have one of those. And someone who will be there if it all goes wrong and someone said like really sharing success if it all goes right. It's been anything but easy but the one thing is she has been there throughout to keep me grounded. And I don't care if it's a spouse, it's a family member, if it's a friend, it is so critical to have that rock wherever they might be in your journey that I would highly, highly recommend.

So working at NASA, well, it taught me that I didn't want to work at NASA. It was slow, it was bureaucratic. It was aimless. Just the glory days were long gone. There was a woman who stood out beyond just the one that I met in my wife and her name was Ruth and she worked at NASA Langley. She's also a Stanford grad and she was sharp, loved working with her. She could see how angsty I was about the environment that was going on there. And between her and her undergrad thesis advisor, she really pushed me to go to grad school. But interestingly enough, Ruth also said, if you wanna go build actual rockets, you should hear about this company called SpaceX and this was back in 2007 when really nobody knew about SpaceX. So I'll come

back to that in a little bit but first it was off to grad school.

So during a couple of recruiting trips, I went out to MIT, Caltech, and Stanford. Very different visits, very different schools and MIT and Caltech really focused on this student to professor relationship. But the thing that was different about Stanford was they, when we got there they kind of locked us in a room with all the other kids they were trying to recruit. And it was very fascinating and I pulled aside one of the professors and asked like why they did it this way. And he told me that, "You're not gonna change the world with your professors, you're gonna change them with your peers." And so they really focus on the student to student interaction. And I couldn't agree with him more. Like when you look at the room that we were sitting, you saw these groups, like if the president of the United States came in and said there's an asteroid coming to the earth and only this team can solve it. 100% that group would have been able to do it. These photos from building a ton of these robots on the quad, this was probably like three a.m. Like it really reaffirmed it was the right place for me, it was the right kind of spirit that like I wanted to have, and that excitement was really there.

And I thought I was gonna do a PhD. I thought I was gonna stay all the way through but after really discussing that, I just could not get excited about it. It was too specialized and I wanted to get greater breadth and just be able to execute on things quite a bit faster. So I ended up applying to SpaceX. Ruth really was pushing me to go there and I interviewed the week between, two weeks between flight three and flight four of Falcon 1 which is the very baby rocket that they did. And this was make or break for the company. And you could feel that energy, the same thing I'd experienced going to Stanford. You could feel this energy, it was palpable. People were excited. Some of these people were the smartest people I've ever worked with.

And you could feel that just passion for what was going on. One of the guys that started it with Elon was a guy named Tom Mueller who happened to be my boss head of Propulsion. And when I turned in my acceptance letter, he was there. It was like nine p.m. on a Friday night and he took me around, he showed me all around the machine shop. He showed me everything that we were gonna be working on and it was awesome. I'll never forget that just how excited he was and he'd been there for six or seven years at that point. But the responsibilities were amazing for a 24-year-old coming out of school. We got to develop these rocket engines, the Merlin engines that you see flying on Falcon 1 today, SuperDracos, all kinds of different ones, we had to design them all and basically be responsible for them working. Microgravity fluids for spacecraft, all of these things, responsibility was absolutely crazy.

And I got to learn the joy of doing things hard and doing them really, really fast. One of the other key things that I learned there was first principles analysis. So Elon has this view of what is the raw material cost of what you're doing and what is the cost that you're paying for? And that multiple is really the measure of how good of an engineer you are. And that thought of whether it's first principle cost or first principle physics that is so critical to evaluating your next business venture, whatever it might be. And then one of my mentors there was a guy named Dave Calta and Dave gave me this other line. So we were working on this problem. Software couldn't do what we needed to do and I just remember him looking at me and saying, "Don't be a slave to your tools." And he walked away. And like, that was like a magic statement, right? That was like a profoundly magic statement. It was liberating. And from that moment on, I've never been a slave to my tools again and it's been really exciting.

But about 3 1/2 years of SpaceX and I was starting to get an itch to wanna do something a little bit different. I was really interested in sustainable power generation so I decided to take a new job. But as we were leaving the very first night of my honeymoon with Steph, we were sitting on the bed like most couples on a first night of a honeymoon except we had the laptop up and we're watching Dragon dock with the Space Station for the first time. And I was wondering, I was like, hmm, was this the right decision to leave? It's just starting to get interesting at SpaceX. But I decided to go. I went to a company called Echogen. So Echogen, really what we do is take anything hot and we'd make more power from it. And that's not particularly novel but the way we did it was. So we use super critical carbon dioxide to actually make these power cycles. And why that's special is about a 10 megawatt steam turbine's about the size of Volkswagen Beetle, but a 10-megawatt CO2 turbine's about the size of your chest.

So it's much more power dense, it's more efficient. But this role, I was kind of like a mini CTO, it's about 40, 50 people. It was in Ohio so it was shift from California and it was just really influenced me and pushed me in ways I never, never, ever imagined. So I was no longer a slave to my tools. I had to build new software products to optimize the system, to run the system. But I had to learn about company economics and partnerships and how to develop the technology, and the way to sell the technology to other people. But most importantly, after the first time I spoke to an external vendor, the CEO of the company, Phil, pulled me aside and he told me something that also just changed my way. He goes, "Unless you can explain what it is we do to anyone on the face of this planet, engineer or not, five minutes or five hours, you're no good to me and you're no good to the company." And he knew me. He knew he was gonna get a rise out of me. It cut deep.

And so it was practiced but he was right because so often I see engineers trying to project intelligence at the expense of understanding that people aren't really hearing. And all that matters is what the person you're speaking to actually hears. How are they connecting with you? How are they connecting with the idea? And that was the lesson that was so powerful for the next journey of entrepreneurship for me and it was something I was absolutely terrible at and needed to get infinitely better. So I was looking for ways to figure out how to get better at things and ways to recognize patterns, ways to actually be, just get better at something. How do you get better at something? So one of the things I discovered was this concept of really

like flow states. If you're not familiar with the flow state, I'll have some resources at the end, you should check it out. It's very, very interesting. But to give you a thing have you ever done something where you've kind of lost the perception of time or everything else falls away and you're just intensely focused on what you're doing? Like that is a flow state. So in short it's really the ability to concentrate, to make connections that your brain otherwise might not make. Think about a surfer riding a wave bigger than they've ever ridden before or a skier going down a hill that's just outside of their comfort zone.

So you're kind of blending mastery expertise, other types of things to really generate and do something that you didn't think you were possible of. So for me, music is one of my flow states and I can just get lost in it for hours, I've done it for over 30 years. But the music process to the entrepreneurial process, to the engineering process is so interesting because it allows you to practice skills in a way that are indirectly the same skills you need to learn for other aspects of your business. So at example, a musician has to create sound from silence. An engineer creates something from nothing. A musician uses scales, chords, music theory, intuition to create the music while an engineer might use physics or math or computer software and intuition to create something new. You also use each other to bounce ideas off. And by being able to practice these things indirectly, like at Echogen teaching somebody, what it is I do is like teaching someone to play a song that I wrote. And so it was a very interesting piece seeing them get excited about it. And later the act of improvising with other musicians is actually exactly what happens when you're answering questions with the media, with investors, with other partners, whatever it might be.

You have to refer them, you have to make them excited and respond to kind of an ever-changing dynamic. It's really just kind of like jamming with a new group. So it was a way to take this other experience that I had and relate it into a completely different area, and it's still teaching me things. So it was allowing me, at one point we had to do a lot of scripted things whether it was like recording a video or whatever it might be. It's just something I'm not particularly great at. And so what I decided to do is record more and try to play parts note for note which is the same type of syntax as memorization for words, except this was a heck lot more enjoyable for me than it was going there. So finding something, a flow activity that kind of allows you to unlock these pieces was really there. And the music studio to me and this is kind of mine at the house right now is that's my view on life is that you got to find people that are better than you. You walk in with your ideas and you walk out with better ones. And that is a music studio where you walk in and you're walking out with something better and that's the way I like to approach work, I'd like to approach life.

And then at Echogen the other thing I was really on a path to was the personal mission statement. So I will tell you right now that I think this is one of the most important things you can have as a human is what it is that you want to do on your limited time on this rock. And so I went out with a few buddies and I can assure you, as tough as we are trying to look in these pictures, we are anything but that. So we went out, we found enlightenment, I'll leave that to the reader but after a few days, I kind of arrived at mine and it has been my guiding path for really the last nine years. So I'll kind of walk you through what it is. So I will change the world through the technology I've built. Each part was intimately crafted. It has specific reasons for that. And so I used the word will because it's like will versus want. I believe that I will be able to do it.

I don't want to, I believe I can do it. And I talk about change the world. It's a used, a commonly overused phrase especially in entrepreneurs but for this it's actually appropriate because it's the scale of the problem I wanna solve. I don't wanna solve something at local or national scales. I wanna solve something of global scales. Through the technology. I'm a technologist, I'm an engineer. I'm not a politician, a banker, or an artist. Like this is what I do. This is how I intend to change what I, change the world is through the technology I have.

And then that last word is the critical word in my life which is build. I need to do this through action, through building, through creating a physical thing. And this is nine years old. It's evolved. I've become a manager. I came to lead teams. I've actually thought a lot about taking the I's and replacing with we's because we's can do so much more than I's. And that's profound kind of shift. One of the things it doesn't explicitly say is for good. Change the world for good.

And when I presented this to the whole company a couple of years ago, that was some of the feedback I got. And I asked myself, I said, why doesn't it say that? And now you can think what you want about what I'm about to say but ultimately I like doing really hard things. If they happen to be for building weapons, I'd actually be okay with that. But that's kind of the hallmark of a personal mission statement is that it's authentic to you. And if it's authentic to you, not to what everybody else thinks, then it's your true kind of guideposts, your true kind of guiding light. And the last one that was a profound shift is when I became a dad. What if I can't do this but my son can? Is that good enough? That's putting a lot of pressure on somebody else to maybe copping it out for me but what if I create the environment for him to be able to do it? Or as a manager, as a leader of a team, what if I create the environment for my team? And that's where it becomes particularly interesting. So that's the background. So with all that support system, the beliefs, everything that I've got, that was really what was going into the spot that decided to go after Hyperloop. So what is a Hyperloop? So for those of you who haven't heard of it, it is a high-speed transportation system.

The one that we created was inside of a vacuum tube where you take most of the air out but not all of it, be like flying at about 200,000 feet of altitude. So you got the speed of an aircraft for a fraction of the energy consumption. It uses electromagnetic propulsion and levitation. It takes you directly to your destination that stop everywhere and there's very, very limited wait stop. So why was I excited about this? Well, it was gonna be hard enough to be fun. No one had ever built

anything like it. It was sustainable from a technology, from an energy consumption point of view. And then ultimately it was a legacy project. I knew if we were successful this, it would be around long after I leave this earth and there's something really exciting about that. So we went into it.

So in November of 2014, the three founders and I, Shervin who is in the middle picture here on the left, Brogan who's in the top left picture here and myself. I'm gonna just do a quick note here, I apparently only had one shirt in 2014 because all the pictures seem to have the same shirt on even though they were taken on different days, even this and the next slide. So it's okay to only have limited amounts of clothing. So Shervin actually pushed me on to release the white paper in 2013. Shervin went to look for a founding team. He found Brogan at SpaceX. I had worked at SpaceX for quite some time with Brogan so we were very close. And after that Brogan called me, he asked if I wanted to meet. So we went out and he said, "What do you think about Hyperloop?" And I scoffed. I was like, nah, I don't know about this.

And he said, and I told him, I said, "The concept of the paper won't work." And he said, "Would you think you could build one that would?" And just like Phil saying I couldn't talk to anybody on the face of the earth, I was like I think I could. I think I could try something. And a couple days later we met Shervin. We drew the infinity logo that you see kind of everywhere now, we drew that on a napkin at a bar and we really off and running. But I was still kind of deciding, do I wanna quit my job? Do I not? And so I came home and asked my rock about it. Her initial reaction was, hell no. You're not doing this at any point which is a strong reaction that you want from your significant other, your support system. She happened to do it in the middle of an intersection so I asked her to kind of come back to the sidewalk with me while we talked it out. And so I talked it with her, talked about why we would do it. And eventually over couple days it was like, all right, this was an opportunity that was gonna be if it worked, great, if it didn't I was gonna learn a lot about ultimately starting a company.

And so, I said let's give it a try. So I quit my job. We didn't have any funding at the company yet. We were relying on my wife for support system and luckily we did have that kind of support with her. But it was gonna be really, really interesting and that garage that you see here is the garage that we went to to kick it all off. So when I look back at those times, they were exciting, they were amazing, they were scary, they were all of the above. But when I look back and I say, man, I wish we were better communicators with each other. The three of us were not good at communicating with each other especially about tough topics like roles, responsibilities, rewards, equity structure breakdowns. And if you call to mind, if you're thinking about starting a company with somebody, like what is the most awkward conversation that you possibly can have? It's probably the only one that you should have and we just weren't doing that. We were avoiding that elephant in the room, that proverbial elephant.

Since then it would be cover it up, hide it. Since then it's been get on it, ride it because the only way out is through. And the unwillingness to have these conversations was a real big problem what came pretty quickly after. We also were not spending enough time on product market evaluation and ensuring that our product was the right fit. We're kind of just going after a technology and not ensuring that it was gonna fit the market we we're trying to serve. And then ultimately after about a year and a half in 2016 what I call the Summer of Love, about a year and a half of that kind of tension it blew up publicly, acrimoniously, lawsuits, salacious media, you name it, we had it all. It's like everything from, every worst part of a Silicon Valley episode was in this particular company. And when you look back in hindsight, it seemed really obvious that this was gonna happen. It was super painful, it was uber stressful during this time, the fractured relationships all around. But since then, Shervin and I have worked really hard.

We've come back together stronger than ever but Brogan and I, the relationship was severed. Probably will never work together or most likely kind of never speak ever again which is the downsides of these things and discussions not had. So have those tough conversations early and often. Be prepared to move on if things aren't working out for you or for whomever it might be. So after the dust settled, I had a really tough job ahead. So the goal was... Brogan left, sued the company. He ended up gonna start his own competing company which eventually folded. So we had that I'll say competition going. Our investors backed us and me to keep the team going.

There was a pretty tall task at hand, one where I had to show that I could lead, show that I could build the technology, build the company, build that prototype. But on the other hand, I knew we needed to better define the market and the product. We had learned so much and there was going to be a lot of changes to the product that we ultimately need to build to meet some of these market demands. But the challenge of both of these endeavors was that you could really only pick one because each would fully consume the resources of the company. So we had a narrow way to actually make this work. So I had to scale back the ambitions of dev loop which you see here which is what we built in the desert which are prototypes. So we took an idea and actually brought it together from nothing in the desert. Everything that you see here occurred in about an eight month period. And so it was building, we were working two shifts, six days a week, 12 hours per shift. Everybody was going out the site, everybody was pitching in, people were turning wrenches, you name it.

It was absolutely incredible. It was trying, it was successful but we were kind of making progress on both sides. And back in LA I was actually working with Tiger team to get those next generation products going through. It was glorious, it's chaotic, it was all the things that we wanted but we ultimately were able to do it. And in a short period of time really from concept to the prototype, we're able to get a Hyperloop system working. Now, the system is gonna have to undergo quite a few changes. And in that short period of building and learning, we learned a lot of ways to make a Hyperloop and even more

ways to not make a Hyperloop which is kind of key on that product innovation side of the fence. So what we did was awesome. The team, I can't even describe to you what the team ever did. But that feeling that I had at Stanford, the feeling at SpaceX, we had created, we had created like lightning in a bottle and like the world was kind of responding to it.

So at that point, Virgin came in as an investor. We were, Shervin and I recalled down to the White House to talk to the government about how the government could play a role in creating homegrown, sustainable transportation technology development. And everything we had built at that incredible speed had a dark side. We burnt out a lot of really awesome team members. We didn't spend enough time on the alternative ideas and the market analysis. That next set of investors was doing a level of due diligence that we just weren't prepared for yet. So we had to go back and dig deeper and then I ended up creating a bit of a lull in the company and that can be really, really tough for us as we move forward. So one of the things that we did as we were building all of that was to create what is this new product? And I sometimes when I get stressed that I go on long bike rides and I was on a bike ride in Santa Monica Mountains on my favorite hill which is called Latigo Canyon. If you ever find yourself out there maybe you'll see me on it. I was full out on this climb and a 1933 Ford Roadster came around the bend followed by a Tesla Model S.

And those cars are like 80 years apart but they're driving on that same passive road. And somewhere deep in my brain, where was the exhaustion? Fired some synapse. And I was like, that's what we need to do. We need to have a smart car, smart car, dumb road or an archaic smart pod, dumb tube. So we had to create that and build a brand new system and that's what we went after to do. So I'll kind of show you what that system look like once we did it. Narrator After building and testing 00:31:37,630 the world's first Hyperloop system, we are now focused on our commercial product. The key to our product is guided by a design that is elegant through its simplicity, future-proof due to its modularity, and guided by the principles of this century, not the last. To do this, we've moved levitation, power, and propulsion onto the pod. Our proprietary levitation engines make Hyperloop 10 times more efficient than the world's fastest Maglev trains today.

The engines contain a raise of electromagnets which lift and guide the pod within the track. Hyperloop also supports on-demand service and high throughput by having pods travel in convoys. Unlike train cars, pods are not physically connected which allows for individual pods to have different destinations. Just like a car taking an off-ramp, pods can split off while the rest of the convoy continues on. The absence of moving parts on the track and the advantage of levitation and guidance on top of the pod allows for high speed switching and conveying to take place seamlessly. These next generation innovations not only enable ultra-fast speeds, but provide on demand direct to destination service carrying tens of thousands of passengers per hour per direction at airplane speeds with zero direct emissions. Fast effortless journeys that expand possibilities. This is Virgin Hyperloop. - So the big thing that we were doing at this time, 00:33:07,420 we had to go out and create essentially the airplane, the airport, the air traffic control and sky at the same time. So we had to go back to the drawing board, back to create these fundamental designs because our economics weren't good enough.

And so this nuance, this new testing, everything that we did showed that we could actually get there. And then the investment community were seeing this possibility but there was one question that was really outstanding for them is that, is it safe? So, if you're building a passenger transportation company, how do you actually prove that something is safe? How do you prove that what you're doing is going to be safe? How do you prove that you could develop a safe system as a company? Because it's not trivial to build something that is, I'll say never been done before. People don't wanna walk up to it, people don't wanna get into it. They're scared of it. If it wasn't gonna be safe enough for me, how is it gonna be safe enough for anyone else? And that was gonna be really important. That's why I believe so hard that I ultimately needed to be- Team Member All right, team. 00:34:16,342 Please confirm you're ready. Team Member Ready. 00:34:18,367 - Ready. 00:34:33,500 seven, six, five, four, three, two, one.

Launch. (upbeat music) - So how do you lead? 00:34:53,410 And for me, it's pretty easy. I'm not gonna ask someone to do something I'm not willing to do myself and that's why it was so important for me to be in it, to be the ultimate accountable person if things went wrong. If it failed, my life was on the line. But I believe in the team, I believe in what they were doing the way we have done it. And as I was sitting in there with Sarah, my co-passenger, it was just a emotional rollercoaster. Like sitting in there, when I watch the video everyday it gives me goosebumps and it's incredible that we were able to do that. And the team that we had put together was able to keep me safe, keep us safe and do something, basically build a spacecraft in a year and a half that was designed for passengers to get in out and do that very, very safely. But all good things don't last. And I'm no longer at the company as of a couple of months ago and it's been quite a journey.

And over this proceeding years, we became majority owned by a cargo company. They had a very different view about what the product needs to be than I did. Ultimately, they were the majority investor. They control the board, they have the ability to set the direction. And I decided the new direction, we debated intensely about the direction. It was just something I didn't wanna be a part of. And ultimately we parted ways. It's sad. It would have been very easy to stay, it would have been very comfortable. The best things in my life had come when I've been uncomfortable, when I've taken that risk.

And I knew this one was gonna be as well. It's sad to see what you put your heart and your soul into but the one thing I've told myself since the very beginning is if I don't 100% believe in something like GE a long time ago, if I don't 100% believe in it, it's time to get out. And as I mentioned, knowing what you don't wanna do is as important as knowing what you do wanna do. And so for me the journey has been every facet of your being, every belief that you had, every principle you stand for or

don't stand for is tested. Do you have limits? Are there limits in what you are willing to do or not do for the company? Is there a direction you just don't believe in regardless of how optimistic it might be? It's not the vision that you have for this. And are you willing to die on that hill? It's easy to talk about principles until the moment of falling off the cliff occurs and that's where I think it's really important for you to kind of set those things, your guideposts whatever they might be. And for me I went back to that mission statement. I said is this new direction going to get me to that mission statement? And the answer is no. And so it was time for me to go do something else but it can be really painful. And sometimes not all stories have a happy ending but I'm forever grateful for the experience I had.

I learned more things than I could've ever imagined. I've made more mistakes than I could probably count. I've had some pretty incredible successes as well. I've made some lifelong friends. I've also lost friends. People I've lost, people that have come to work for me. But we set out to show something as possible and we did that. And a lot of times people ask me, would I do anything different? It's like of course I would do things differently but I don't have any regrets. So it's like, I wasn't smart enough at the time, I wasn't wise enough at the time to make the decisions I had but that's actually what makes the next chapter really exciting because now I don't have to make this mistakes again, I can do something different. And that next thing I'm hopeful it's gonna be even bigger than what I was trying to achieve before.

And so when you're kind of looking at what's next, there's kind of two components like what excites me from large-scale market, world changing again back to that mission statement, the sustainable side of the fence, decarbonization, power gen, transportation, the automation, the AI algorithms that are coming in to change the way that we actually be engineers and do engineering. But the other thing is like, what is the role? What are the responsibilities that worked for me? And I'm curious, I'm passionate, I'm excitable. I like having a big purpose. I need to have a degree of autonomy to be able to execute. And then I like learning things and becoming an expert at them. It's really one of the things that drives me. And I'll kinda come back to what my dad said at the beginning is as an engineer I'm still not rich, I can tell you that. But I can tell you I've never been entrepreneurially poor. And I think that statement that my dad said probably 20, 25 years ago is as apt today as it was then, is that this experience has made me so much of like a environmentally richer person. I wanna say monetarily richer but this enjoyment of life, the enjoyment of going after something big and grand, and sometimes I fail and sometimes we don't, and sometimes we're able to do things that people think impossible just really drove me and I'm addicted to it.

So I'm looking forward to what's next but Emily, thanks. Thanks for having me. I appreciate it. I've got a couple of links here at the end from some of the books that I found really, really helpful, kind of especially when you're at the beginning stages of your journeys. I wish I had some of these at the time and then some that are just like really good reads, philosophical reads about life but I appreciate it. - Josh, this whole entire talk you just did 00:40:20,320 just made my spine tingle. Incredible nuggets. Such incredible gifts for the students here. And for me, the headline is that you're a lifelong learner. It's not about the content that you learn, it's really about your process of learning and your belief that you continue to evolve and you become a more perfect version of yourself over time.

And it's in the moments when you've let go that you've forged that conviction and chiseled away to even more authentic version of yourself. And I was just really, really touched that you were willing to be so open and transparent about your experiences, especially the hard ones. We talk about the celebrations all the time but what a gift you gave us. I know we have about 15 minutes left, so I'm gonna hand it right over to the students right away because I knew they're brimming with questions. So what I'll do is I'll take a look at the questions here and read them out for you. - All right. 00:41:18,620 - Let's start with the first question 00:41:20,213 which has the most votes. How do you think about the balance between not moving around too much or leaving a project too early while also not getting stuck in a position in which you can no longer grow? So you've done a great sort of going through the thought process. Maybe you could give us a little bit more color there. - Yeah.

00:41:43,453 I think, that's a great question. It's a really personal question the way that, like, what feels like stagnant, right? So in some ways throughout the evolution of the company, I started out as kind of like head of design. I moved through head of engineering then I moved into the CTO role, then I moved into the CEO role. And each point along the way there are aspects of things I really liked and aspects of things that I didn't but it was never dull. There was always something that was really exciting and even at times when things were like really tough or really whatever, I would look and say like, is there some other places where I'm going to learn at the rate that I'm learning here? And for me, you said it Emily, like, that's what drives me and it was actually a conversation I had with my dad at one point a couple of months ago. And he goes, "Well, you know, you're not getting paid very well." And like all of a sudden he changes, right? Now it's been like 20 years and he changes. He goes, "Maybe you should go look at something else but kinda keep this on the side." And I was like, "Dad, like, I'm learning more here than I would learn anywhere else, right?" And I'm learning how to be a CEO. I'm learning, sometimes it's trial by fire and you make mistakes, especially hard during COVID. We kind of work with different demographics and at the end of the day, I would say like, you kind of know. You kind of know when you're not happy anymore and it's not, there's things that make you unhappy but there's also things that make you say, like you're not aspiring to anything.

And as soon as you see like it's time to go is like, is this actually getting me back to that personal mission statement? It's like am I gonna be better off? Is this gonna drive me all the way back? And that's why I think it's so far, so important to have is because without that north star, I think companies will fail, I think individuals will fail. And in one of these books, "The Art of The Impossible," Stephen calls it the massive transformative purpose is what he calls his personal mission statement. And at the end of the day like if you think of yourself as like an explorer like Magellan, if he couldn't see the stars he probably

couldn't navigate. And you can always kind of chart how you're doing. You come back, you reevaluate, you do everything that you need to do, and you just kinda know. Each one of those places I've kind of known that like I've gotten bored and when I get bored I start to look at other things. I look outward instead of inward. That's my view. As soon as I start looking outward and not inward, it's like, okay, I'm getting restless, I'm getting bored and that's kind of the sign for me. - You know, I loved that you shared 00:44:26,220 your personal mission statement and also you shared your stories about visiting it and really stress testing it along the way.

And you hold it actually quite lightly in the sense that you're open to evolving it as your life changes, right? With your son should we change it to we? Is it about me helping my son achieve this or is it helping my team achieve this? But ultimately you have it as a starting point. And there's this great quote by John Mellencamp that resonates for me and what you said, it's "If you stand for nothing, you'll fall for everything." And so, having a point of view for ourselves and our lives is super important as a guidepost to our entrepreneurial journey. So, really appreciate it. - Yeah, someone would describe me, 00:45:13,870 one of the things I've been described is I can be disagreeable. I can be disagreeable because I have opinions and I have a vision for something. It's okay to be disagreeable as long as you're working towards solutions. But like, if you have an opinion and you're actually, again, like the musicians, like, I don't think it should be in this key. And they're kind of stuck. You kinda go back and forth and one knife sharpens another well. - Yeah.

00:45:43,070 Yeah, I think, I do wanna take another question from the students but just reflecting what you just said, I think in various cultures being disagreeable is seen as a bad thing but it's actually a really important aspect of being an entrepreneur, right? You cannot have everyone like you. To your point with Brogan, you may end up having friendships that break and not ever be reconnected. And being likable is not the way to success, right? We have to be willing to sacrifice along the way, really stand up for the things we care about. So thank you for that. All right. Next question from James. What are your greatest lessons from effectively leading and inspiring teams? Oh my goodness. So, focus on maybe the last chapter when you were a manager of individuals and then a manager of managers, what were some key lessons from that? - There's actually a sticky note that fell off my computer 00:46:46,380 that says, do the right thing, you're gonna be criticized anyway. (laughs) Use it. I'm a person who really likes to get to know people.

I really like to understand where their concerns are, what their opportunities to engage in a human to human level. But at the end one of the things that I think is really, really important is just like what makes people tick? And the things that I learned, I'll say very painfully at times especially over the last year has been communication is paramount. If you're tired of speaking, if you're tired of communicating it, your people are probably starting to hear it. And you might be in, I'm a guy who likes to make a decision and go but you've got kind of the group. You've got the inertia of the group and you have to bring them along. It doesn't mean you need to, you have a consensus. I don't believe in consensus, I believe in discussion and then single points of decision-making and empowerment. But you've got to kind of listen to feedback. Feedback will come in. You understand and feedback helps you craft the story about the direction that you're going, right? It's like, if everybody's telling you it's the wrong idea.

So when we made, to give you an example, we made this shift to putting everything on the pod. My whole team was telling me this is a bad idea, it's never gonna work. I said, okay, let's let the math prove it. And by the end it was like, okay, this is the only way that we can see it working now. But like, if you're reasonable in a sense that like, you're not just making buying decisions but you're explaining why you're making the decisions. And sometimes people, that still won't be enough for people but if you're sticking to kind of your guns, you're working through, you're communicating, you're getting the feedback, you're adjusting because inside of feedback is people's fears, it's their concerns. It's what they, their hopes, it's their dreams. It's all of those things that they want. And so if you're not listening to it, if you're not including it in your thought process, then I think you're destined to just be kind of removed in an ivory tower somewhere from that. And so it's engagement, it's getting to know people, getting to know them, their families, their lives, whatever it might be.

That's hard to scale but at the end of the day people are like Josh cares about the company. He knows about the company, cares about me even if he makes a decision that I don't agree with. I understand his principles. I understand where he comes from and I have to trust that he's gonna be in the right way. And they only get to know that if they understand you as man or a woman as a leader. And if you're not willing to open up and be candid about that, then people aren't gonna really know who you are in the first place. - That's fantastic. 00:49:30,030 I think sometimes we forget in a work setting that we are not all just little gears and cogs in a machine, but first and foremost, we are humans to each other and how do we be human with each other. And that actually lays the groundwork for disagreement and respect, and making progress even though not everyone might fully agree with the decisions. So thank you for that.

All right. Next one. What were the most challenging questions you faced from outside the company investors, news, the public during your time building it? So this goes back to your quote, do the right thing 'cause you're gonna get criticized anyways. I'm curious what led to the post-it note that's sitting on your wall. - There's all kinds of post-it notes on here. 00:50:15,658 (laughs) It's really about, there was questions about safety, questions about technology possible. And then there was questions about kind of the economic feasibility, is there something that you can do. I think the most cutting questions, the ones that really get in kind of underneath your skin are the ones that question why are you even bothering to do this? Can't we just build a faster train? Can't we just use more cars? Can't we just use airports or something else like that? And a lot of times the questions are rooted in either ignorance or bias or whatever it might be but other times they're rooted in like

some of the areas where the business model is not completely sound. And those are probably the most uncomfortable ones. Like, for example, tell me how you're gonna get government approval to actually put this on a highway corridor in somebody's backyard? Okay, well, I can tell you through all the processes, through all the conversations I've had, and I can tell you all the steps.

And someone's like, yeah, yeah, you can tell me all the steps but why is someone gonna do it? And those ones that are a bit, I'll say existential that are really like, yeah, it's gonna be really hard. I know that. Like, those ones are pretty tough. I think from an investor side of the fence, one of the things that was really challenging of what we were doing is that we were building a big physical product, something that really only nation states or large organizations have ever done. Think Japanese or Chinese high speed rail. Think about Siemens building something. This has venture capital money. They're not patient. They want faster timelines, they want larger deployments. You could kind of look at the economics and it's a tough economic problem and we had to reinvent, I mean, we reinvented the technology probably four or five times to get there.

We had to continually reinvent the business model 'cause the economics are good probably 10, 15, 20 times to get to something that provided economic returns. And the part that was the most difficult that we had is my money as an investor is fungible. I can put in a Hyperloop, I could put it in a software company. I could put it in the stock market, whatever. Why should I take your bet that's gonna be three, four, five, six years with potentially really large returns when I could take two or three other bets and potentially have better returns in a shorter period of time risk adjusted? And that's a really tough place to be is that like, yeah, we're not a software company. And in a way you almost felt like you're apologizing for the type of company that you were. It's like, we're a big hardware company. You look at SpaceX, you look at Tesla, you look at some of these companies really taken 10, 15, 20 years to get to where they are today. We are trying to go from a garage to grandma's in 10 years. (laughs) And that's challenging but that's still farther than just about 95% of the investment opportunities that are out there.

And so, that's hard, it's like how do you get people on board with that? - I am very, very, very happy you talked about 00:53:26,500 just the long-term patient capital that is needed to build this sort of breakthrough tech infrastructure. Having spent a lot of time in my life thinking about this, the types of investors have to be right, right? 'Cause this is not a sure thing. It's extremely long-term, right? It's like, you got to put your money in and lots of it but for possibly more than a decade, right, to see any returns. But yet if it works it's enormous and it's very radical in its nature. It can't be for venture capitalists who want incremental returns, it's not a sure thing. And I'm glad to hear that you have investors who can think that way 'cause I feel like those types of investors are far and few between. So taking the moonshot, different sort of mindset. - For every 10 investors that exist, 00:54:17,581 actually for every hundred investors exist there might be two or three that have the patience and the pocket books willing to do this type of timeline. - Amazing. 00:54:29,800 All right, maybe one or two more questions if we can fit them in.

So the next one is about being an engineer versus being a manager. It's interesting. Which one do you think creates more impact and how would you suggest students to start their careers? Should they start as an engineer or a PM, a product manager? - I really believe that 00:54:55,510 I drew a lot of self-confidence and a lot of abilities because I was a good engineer before I was a manager. And so when people, investors would ask questions, I would watch different people of other types of companies, they'd ask a CEO a question, he had to defer to someone because he didn't know the product. And I don't, like being a sole engineer, knowing the product, knowing intimately what works, what doesn't work, what's hard, what's not hard I think it makes you a better manager. I also think it makes you a better leader is because you know what people are facing, you know what you're asking others to do because you yourself have experienced that in some way, shape, or form. So if you're doing tech company like ours, I wouldn't maybe necessarily have this be a blanket statement but for us really understanding of engineering component allows you to be a better manager. And quite frankly, us engineers are a bit arrogant and I'll include myself in there is that if you have a manager who's not really a good engineer, really hard for a good engineer to work under a mediocre engineering manager. And I think that gives you a basis, gives you a sound understanding of what you're asking people. You don't ask people to do outrageous things because you know what you're actually asking them.

- I love that. 00:56:08,150 I also believe that your ability to recruit is much higher if you're a great engineer because engineers follow great engineers, and without the ability to really empathize with what an engineer does and that experience, the emotional one, the intellectual one, it's hard to recruit incredible talent and you have an A team. So, it's really great that you shared that perspective. Maybe we can try to fit in one more. You're open to it? Okay, last one. - Yep. 00:56:39,130 - Okay, what specifically about 00:56:42,330 the stepping stone of transporting cargo for Hyperloop appeared so far from your vision for you? - Good question. 00:56:48,286 - Yeah. 00:56:52,570 - There's some nuances I won't be able to answer 00:56:55,133 just because it's a little bit more proprietary. At a high level it was a lot of the different, I'll say adjectives that we used to describe Hyperloop were just different.

But I think at its core is that we had spent the last four or five years since we did that pivot after the split building a product that was capable of doing passengers and doing like air cargo, high-speed cargo. The analogy I'd give you is if you're gonna go, if you're designing a Ferrari and then someone asks you to go transport bulk corn, you wouldn't use the Ferrari to do it. And unfortunately, like we had spent a lot of time developing that tech and it was gonna be difficult to repurpose it, right, like to move it in a completely different direction. Out on the surface, on the surface that's not, I'll say completely

untenable. It's just that like you're gonna have to stop going after the ultimate vision till this other one could be realized and that could take one, two, three, four, five weeks depending upon what you're actually trying creating. So that ultimate vision that you had, competitors are catching up. It's getting pushed further away and you're saying, do you wanna work on this other piece the next three to four years to maybe, and I say that word like maybe back to where you want it be and maybe you're working now? And so, ultimately it was just like you couldn't leverage all the things that you felt and you're gonna do a pretty hard pivot into this other area. And so on the surface, it seems like it's supposed but when you really got in and it's like not leveraging a lot of things, and it was kind of undoing some decisions that you made a long time ago that we didn't have any new information. And that's kind of why I was just like, nah, I think I'm not gonna do this anymore. It was a good question.

A good question. - It goes back to something that 00:58:50,350 really came through multiple times in your presentation which is you know when you're not excited about something and you know that that's time to step away whether it's with GE and NASA or other points in time at SpaceX going to Echogen. I feel you have a really deep sense of when it's time for you to step away. It's when you don't feel the excitement anymore, the fire you're building. - Because if at the end of the day 00:59:11,230 as the board of directors, if you don't have a CEO who is absolutely 100% on board, it's not gonna work. (upbeat music)..