Stanford eCorner

The Case for Convergence [Entire Talk]

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Joe DeSimone is the founder and executive chairman of Carbon, a global company that is driving the evolution of 3D printing from a prototyping tool into a scalable manufacturing technology. As a professor at the University of North Carolina, DeSimone made scientific breakthroughs in areas including green chemistry, medical devices, and nanotechnology, also co-founding several companies based on his research. In 2016 President Obama awarded him the National Medal of Technology and Innovation, the highest honor in the U.S. for achievement and leadership in advancing technological progress. In this talk, he explores how diverse teams, perspectives and specialties can drive innovations in both technologies and business models.

Transcript

Presenter Who you are, defines how you built.. 00:00:08,890 - We're welcoming back, Joe.. 00:00:13,330 Who was here, of just, almost four years ago in 2016.. He co-founded Carbon three years before that.. Previously, he was professor at university of North Carolina, but while you were there, you were also, you do these scientific breakthroughs like I mentioned, in co-founding several companies, all before launching Carbon.. So can you share a little bit more about that path and how you balance those two? - Well, sure.. 00:00:40,840 It's great to connect with a Dukie here, as a Tar Heel but, in fact my first PhD student, Valerie Ashby is now Dean of Trinity college at Duke university.. So I'm much more tolerate, my Duke colleagues there but, yeah, Carolina hired me when I was 25 to help start a polymer program and, I brought, a utilitarian-like perspective from Virginia tech and liberal arts education from Ursinus College and tried to meld all that together and, launch my program.. It was our center base for search.. Had great students..

We're really focused on, fundamentals that would have an impact in the real world.. I call it translational research.. But, I taught entrepreneurship, we had a entrepreneurship minor in the College of Arts and Sciences at Carolina.. And I started several companies but, I was never on the field, with any of the companies.. And, as you know, you learn so much more by doing and when Jim gets in the team at Sequoia he asked me to, I had already hired a CEO for Carbon.. If they asked me to lead it, I thought, boy, now that would be a real opportunity to learn from the inside and be on the field, and it's been an incredible run six years as CEO.. That's a 24/7 job and, for six years, it's very intense.. But, there's nothing like that in academia.. When I walk in the parking lot at the company, all I see are car payments and mortgage payments and people that left great companies to come work for our company.. There's an immense amount of responsibility that you have as a, founder CEO that is, really nothing quite equivalent to that in the academy..

- Yeah, well, college has been quite a ride, 00:02:30,040 so let's talk a little bit about what's going on from since, four years ago.. Let's do it in this context, and this has been our format this summer, as you heard about, and we're gonna keep rocking and rolling.. Let's take some of the clips from that period, and then, fast forward to now and talk about what's happened.. And then, we'll make sure for sure to talk about the future.. So let's take this first one and it's, has to do with a model that we, well, frankly, it's one of the mainstays of entrepreneurship education.. That's crossing the chasm.. So let's play clip number one, that you showed back four years ago.. - And a chasm, is in this technology adoption curve, 00:03:12,560 where in the beginning of all new technology introductions, the techies drive adoption.. Techies, love products.. In fact, label up products that are not complete..

They like to cobble together a partial solution and that's part of what they love to do, but, to really get to the early majority or the large volume of revenue.. You need an economically viable solution.. People don't care about technology on the other side of the chasm.. They want a solution that's economically viable.. - You look exactly the same as you did four years ago.. 00:03:44,530 (laughs) - I'm glad I didn't wear that.. 00:03:46,495 I took that sport coat off but, (laughs) - So, this is a very important concept, 00:03:53,490 as I mentioned in entrepreneurship education.. So where is 3D now? In the adoption curve.. - So, up to this point, 00:04:05,750 up to the point when Carbon launched, 3D printing has been mostly a prototyping industry.. That includes hardware, software materials, even the parts..

That's about an $8 billion marketplace.. I also had some dental in there.. Dental has been part of this sector.. So that's probably the more, most commercial of the traditional 3D printing.. When we figured out how to take 3D printing and go

faster, and make real parts, that was the beginning to go into the $300 billion manufacturing world of injection molding.. So I think, what's crossing the chasm for us is what are the use cases? What are the killer apps, if you will, that draw high volume manufacturing and, Adidas, I don't know if I mentioned Adidas back then, but Adidas is our partner.. That said, we always saw, boy, if we could scale up, like a consumer running shoe, the world would be our oyster.. Because we would have figured out a lot of stuff, advanced materials, global scale manufacturing and, we figured that out.. And, now you go at adidas.com buy the, AlphaEdges and the 4D and lots of great running shoes and over a million pair already, with that.. We also have liners for Riddell, football helmets, personalized helmets, over 1000 NFL D1 athletes and many other sports coming along..

Those high volume consumer, including, specialized bike seats, they've all happened.. We've crossed the chasm.. And now it's scaling to replace foam more broadly.. We also have the very first parts on production vehicles had in Detroit.. New cars, Ford Mustangs, F-150 trucks, the very first parts on 3D printed polymeric parts on those cars and trucks.. And so that sets the stage.. It took us two years to get through for quality standards to make that happen.. But now that opens up many billions of opportunity in electrical connectors and other sort of applications in the automotive space, and then, in the healthcare space for us, not only dental and dental models, but, we have now the first FDA approved 3D printed dentures.. You could argue that we should do nothing else but dentures right now.. It's a $14 billion marketplace..

We have over 5,000 people now wearing the first 3D printed dentures.. So there are great examples of crossing the chasm, but they are the killer apps and we need thousands of those.. We are expecting to do thousands of those applications because that's what manufacturing is all about and that's what we're focused on.. - So was shoes the, lead? 00:06:54,330 Geoffrey Moore, who developed that model as you know.. He talked about bowling alley, where you knock over the first pen and it, so what was the first pen? Was it the shoe? - It's the shoes and the bowling alley for us, 00:07:06,650 there are several bowling alleys.. So we try to be disciplined but, foam replacement, using elastomer lattices to replace foam from Adidas running shoes, specialized bike seats, Riddell football helmets, all those kinds of all those kinds of advanced applications.. Another bowling alley for us would have been industrials.. Electrical connectors, Vitamix, Lamborghini parts, NASA parts.. We have parts on the, circulating the space station on the first autonomous untethered vehicles circulating the space station, back in Dickinson.. So they're bowling alleys, but for us, it's really a platform, to make parts..

Resins are the enabler of the TAM.. Every resin opens up new TAM, new capabilities, new properties, and that's how we think about it.. - My niece went bezerk when she heard, I was talking to you.. 00:08:04,060 She's a teenager back in Minnesota and a big Adidas fan.. So, that's all it took.. - I used to, 00:08:09,150 it's neat to be a chemistry professor and be the cool kid on the block with sneakers.. So it's unusual for me.. - Well, also back then, you talked about, 00:08:20,130 four years ago, talked about future proofing.. Which I really love that term.. I've not heard that before and future proofing your customers through an innovative business model, which I heard those about that..

In other words, innovate not only in technology, which clearly was a no-brainer for you, but also the great companies also innovate in business models.. So let's play that clip number two.. Future-proofing customers.. - And again, as I mentioned to you 00:08:45,000 that we're coming out with this printer as a subscription model.. It's a rental.. What this really does is, it aligns us with our customers' printing.. This is not a transactional sale, it's a partnership.. Most importantly, this future proofs our customers.. I know the product roadmap.. I know when this product is gonna be obsolete..

Our customers don't have to worry about that.. They're not locked in, they're future proofed.. Especially for a company like us that's just coming out with a brand new technology, I don't have the heart to have people buy stuff that I know is gonna be obsolete.. So the subscription model for lots of reasons becomes an important way to move a new product into the marketplace.. - So how's this business model working? 00:09:35,113 - It's been the key to the whole business.. 00:09:38,990 In fact, I looked at the slide and I forgot to appreciate.. So that was our first printer, the M1.. We only built about a hundred of those.. Now the commercial product at that scale is called the M2, and just as a great example, it's got twice the build area, so it went up, 2X and the price went up 25% to $50,000 a year instead of 40 and so, that's an example of, you got twice the build air, you can have twice as throughput and you didn't have to be, throw away the other printer.. People can upgrade and we actually have a customer that, took back all the 100s, and are using them in other markets, or they're continuing to be used beyond their three years..

And so, that's a great example, but the key is, it's 100% smart hardware, that takes over the air software upgrades, and that process is intrinsically digital.. We think of as a software control chemical reaction to grow parts.. What's key is, we've been able to do software upgrades every six to eight weeks and, the process is getting better and better.. So in many ways it's like a network effect.. The more people use it, the better the products getting and the ability of rolling out new resins.. So now, in sort of hindsight, I don't know how you introduce a new physical product without doing, a subscription model with it, which intrinsically future proofs customers It gives us really close relationships with our customers.. So we're their partnerships.. We get to know who we're doing business with and, 35% of our sales or so goes to existing customers.. So it's really a land and expand marketplace, and it's an install base that's growing and growing and the subscription model really helps us with that.. - Wow, that is, well, again, 00:11:31,130 another big, important, takeaway that we stress in all our entrepreneurship courses is, and it's, especially for our STEM students, is it lightens them that, innovation is not just, relegated to being a technology breakthrough..

It can also be a business model breakthrough.. - Totally right Tom, I think, 00:11:52,410 the board, the company,

everybody believes that the breakthrough and the business model, is as significant as the technology and it's built relationships.. It's kind of what Alan Mulally did when he was at Boeing and had power by the hour for the GE jet engines.. So it's really been a key part of who we are.. - I want to talk to you about COVID 00:12:14,160 'cause I realize, you're over at the School of Medicine here at Stanford right now.. I am not on campus.. I think you might be one of the very few people on campus but I want to talk about COVID and what's you've been doing on that.. But before we do that, let's talk about sustainability.. I know that's been a core value for the companies since the get go.. So, how do you, emphasize that in both the technology and the business model? - They actually have to be done hand in hand..

00:12:45,450 We now believe we know the 3D printing is gonna be big and so many businesses don't think ahead about the implications of their technology.. When you look about, think about Uber and it was gonna be a company that, was gonna eliminate congestion in cities, and now it's causing a lot of congestion or, Juul was gonna help people stop smoking and it started vaping and, encryption was going to protect our privacy and it's now the domain of criminals.. I mean, just, you have to think of the broad implications that for Carbon, 3D printing is gonna be big.. We have to think ahead of schedule, ahead of time, about environmental stewardship.. So we've been able to now take that as an initiative out of the gates and think about our largest volume resins, Adidas running shoes, dental models, and what can we do to make those recyclable? You think about Invisalign-like products.. We'd make a model of teeth and you thermoform a sheet of plastic on it to make an aligner, and the 3D printed model is a single-use plastic.. It's used for 30 minutes and it's gonna be land-filled for hundreds of years.. Because it's a thermostat.. Why our technical team has designed a resin that can turn that back to liquid.. A reversible thermostat..

We think we can do that for, elastomer lattices too.. If you can do that and you have a business model, that collects those and doesn't rely on the municipal waste stream, but you have a business model that, you bring those models back, you chemically digest it, turn it back to liquid and reuse it.. So that's where we're going.. That's a higher calling.. When every part has got a barcode on there, you can actually quantify maybe for the first time, somebody's environmental footprint or recycling, data-driven.. But you also get into, lightweight parts, biobased feedstocks, local for local production, and ultimately avoiding inventory.. Inventory ties up a lot of capital.. A lot of parts are sitting in air conditioned buildings, just waiting to be used.. So you think about on-demand inventory, and there's a lot of things on the environmental side, that are really enabled by having a digital manufacturing platform.. - Well..

00:15:08,700 - A lot to unpack there.. 00:15:15,390 - It sounds like science fiction, but it's not.. 00:15:16,930 - I still get goosebumps so, 00:15:19,150 as a polymer person, I remember in grad school, just making a, test specimen that looked like a dog bone was hard, and now we just print, thousands of them.. It's, the team's been amazing.. It's really been pretty remarkable.. - Well, sustainability and climate is, a big deal.. 00:15:35,780 It's a big issue for the planet.. It wasn't 2016.. It is in 2020, and we've been faced with some other big deals have come along this year.. So, let's talk about COVID..

The reason you're on campus this afternoon, I'm assuming is from what you said this morning was you were, meeting with the Dean of our School of Medicine and the CEO of Stanford hospital.. So, a few weeks ago, and it was back in May, we had Andy Karsner of X, as an ETL speaker and he, about, for everybody's watching, if you'd go back to the ETL in May with Andy Karsner, it's a fantastic ETL, about speaking of climate and sustainability, that's his expertise.. But about 20 minutes in, around the 20-minute mark, he goes off on you in a big way.. He's talking about this COVID thing that you did.. So, can you, before we play the clip, can you tell us a little bit what's going on? - Well, I mean the context.. 00:16:46,340 I was moving into my governance role at the company.. Ellen and I had just traded places and, in COVID hit and all of a sudden we're getting inundated with, knowledge about supply chain disruption.. We've been talking about from the very beginning, what digital manufacturing can do.. We are mostly thinking about earthquakes and storms, things that could disrupt the supply chain.. Then you get this pandemic..

All of a sudden, very simple things like face shields are in massive short supply.. The hospitals, they only stack a couple of weeks of supplies on these things.. Now all of a sudden they're just inundated.. Then COVID testing swabs, the biggest factory for making these testing swabs was in Lombardy, Italy.. They got hammered with the Coronavirus.. So, here is the disruption that is actually the irony.. It's disrupting the things that allow us to test for the disruption.. So there was this massive shortage.. The Air Force flew in the last million swabs and everybody was panicked and I didn't know what a nasal pharyngeal swab was when I started.. But we looked into it and we could walk you through..

- Yeah, let's play the clip and talk some more about it.. 00:18:07,250 Announcer At Carbon, our purpose is to improve lives 00:18:10,410 with science, technology and creativity.. When COVID-19 hit and we saw a world confronted by medical supply shortages, we knew we needed to do something.. We brought together our employees, partners, and customers to address two needs.. First, protect health care workers.. Second, increased testing capacity for COVID-19.. Digital light synthesis, our 3D printing technology, is enabling the protection of those on the front lines by making up to 50,000 face shields a week and more accessible testing, thanks to Resolution Medical lattice swabs, crafted with Carbon technology.. Together, we're making what the world needs now.. - So I just want us all take a minute here or a second, 00:19:04,313 and just, recall the compressed time, we're talking about.. We're in June, we're still in the pandemic, but this was about four months ago..

You're having an incredible run with, what? Huge deals with Adidas and the other major companies you talked about.. You could have just sat back and, rode that momentum, but then you got inspired.. So, how about this? What were some of the,

tell us a story about some of the, I hate to put it in the negative but what were some of the roadblocks you went through to make it happen in such a fast time? - Well, as you know, everything was happening so fast 00:19:58,010 and then, the other thing to realize is that a good chunk of Carbon's business is in dental and dental was shutting down.. So there's this capacity sitting there.. A lot of our partners are sitting there.. So we had, Ellen Kullman called, a town hall meeting and Phillip and I, my son, we hosted over 300 of our, partners and team members and, we said, look, we have a lot of resin and we have a tool that doesn't need molds to make things.. It's using light.. Remember how people make things physically, typically, by injection molding is you have to, invest a lot of time and energy to have a mold.. Then you heat a plastic up you fill the molds, with a part, let it cool down, open up the mold and take the part out.. We do things without molds..

It's mold-less.. We use light to craft things.. So what we did is, we pivoted our capability, our machines, our team, and we said, look, we'll push face shields' designs and we'll design two different ones to meet the properties of two different high volume residents that were sitting there available.. Our dental model resin and our Adidas running shoe resin.. So working with the Adidas, and, working with all our dental customers, we pushed, designs out into the field and right, we're approaching a thousand printers globally and, we're at 17 different countries and we gave people that had capacity and interest.. The capability of keeping and not only keeping our employees going and keeping their businesses going, but to help out in the local communities.. So I think we're did over 350,000 face shields, 50,000 shields a week.. Still counting and people are renewing, and now they're going into grocery stores and dentist offices and all sorts of things.. So that's pretty cool.. The testing swab, we literally, learned about what the conventional swab look like, and we printed new varieties the next day..

One day.. - You're kidding.. 00:22:11,390 - No, it was amazing.. 00:22:12,910 Our team heartache and our team and Murray and Steve Pollack.. We figured out, some early designs went through a couple dozen different designs.. Then we worked with a medical device partner, Resolution Medical, who is an FDA registered medical company, 'cause we're not and stood up a supply chain that leveraged the dental labs.. Remember there's, 7,000 dental labs to support over 100,000 dentists.. Those labs are our customers and have our printers.. They're the ones that make the physical things that dentists use.. We pivoted one of our dental resins that was used for making night guards..

It was already FDA approved for night guards.. It's approved for mucosal contact.. It's a soft plastic.. We created a very soft lattice structure.. We brought a medical device to life and Resolution Medical launched the device in 20 days.. Class one exempt device, and then 50 days later, that's why I'm over here at Stanford, 50 days later, we completed over a 400-patient clinical evaluation of two different lattice designs and compare them to a standard swab, for performance.. Performance on comfort, collection efficiency, the PCR compatibility.. It was a non-inferiority trial.. It's more than equivalent and there actually is a hand, that we have a lower false negative rate for low viral loads.. So we need to go study and quantify that but, it's pretty remarkable that in 20 days you could bring a medical device product to life and complete a 400-patient trial 50 days later..

- Well, you are, helping, the heroes 00:23:59,650 and you're helping us just, humans that, as well, I think you are way up, you're up the supply chain of heroes as well, you and your company, and, hats off to you.. I wanna talk more about that and maybe we'll do that during Q&A.. I just don't wanna miss this opportunity to play a couple more clips having to do with another phrase that I remember well, from four years ago, the drivers of innovation.. And you're talking about this notion of convergence.. So can we play a couple of clips? First clip is, about connecting with the humanities, which is another big theme of ours nowadays at Stanford and the entrepreneurship center.. So let's play clip number four.. - Historically, the word convergence and its meaning, 00:24:46,850 has often implied the convergence of the physical sciences, engineering and medicine.. In fact, that's the way MIT has classically referred to convergence.. But I think, what it really means is bringing together disciplines and maybe not so obvious ways and thinking about what emerges from that.. But I think more broadly, and what Apple has done is I think you have to think about extending this to the social sciences, the humanities, and perhaps even the performing arts..

Thinking about tech and the humanities and the liberal arts as an important aspect.. As part of that, I think a lot of people believe that convergence itself is actually a blueprint, for innovation.. If one can get convergence right, I can be real driver for new ideas.. - Can you give us some 00:25:33,643 interesting examples, of our convergence? - Well, I think in the beginning, 00:25:39,703 especially back then, I was, building upon what we were talking about with hardware, software and chemistry all coming together.. Those are disciplines that are spread out and, there's a lot of good stuff in between those disciplines.. So there's that level that is very tangible.. I think it's easy for people to understand a software control chemical reaction to grow parts.. That is very tangible and that's a foundation, but then you think about, that in context of, business approach.. The idea of rolling in a subscription model.. Which has never been done in a physical world..

Seriously, this is the very first piece of manufacturing hardware, ever to go out with a subscription model.. Then a 100% hardware and what that means from a context of inventory replacement and the like, and so, now you roll it up and you think about, again back to the liberal arts, you think about, everything in context.. You think about what it takes to make an impact.. What are the economics, what do they, the history of all that and, understanding all the business aspects and supply chain dynamics.. And to me, it's all the convergence coming together, that you have to think about the business model, societal implications, helping our customers, where to make impact.. To think about, recycling now, as opposed to waiting after the fact and realize you've caused a problem like I alluded to with, Juul and other companies.. It's really that contextualization of what it is you're doing, that really brings all that together.. We're now working on, meeting folks here in

pediatrics.. We're working with folks, neonatal babies that have cleft palates and, they're too young to have surgery and working with amazing doctors here to seal the pallet and maybe work with palette expanders as the babies grow.. It's having, the wherewithal, the understanding of context and impact and be an open..

It's a big part of that.. - Where I was interested in yesterday 00:27:56,500 I had the opportunity to attend, an urgent or important academic council meeting.. In other words, it's just gathering all, the number of professors at Stanford.. It was a mix of humanities' professors and engineering and physical sciences' professors.. There was an issue on the table.. That's not so as important as it was, I heard over and over how the engineering professors love to being part of a liberal arts university.. I know that, that's the way, professors feel at UNC and Duke.. That's why it's very comfortable for me to be a visitor, especially since I'm an entrepreneurship professor, my counterparts at UNC and Duke feel the same way that, engineers all learned about the humanities and of course, humanities majors all learn, enough to, about technology to be Renaissance people.. Everybody can learn to be a Renaissance person.. It's not something you're necessarily born with..

Let's play another clip that, 'cause this is also very, very important topic this year.. This is the advantage of diversity.. Let's play clip number five.. - Recognizing early on, 00:29:12,610 that we learned the most, from those that we have the least in common with.. You think about that, If you're a part, if you're getting part of a design team and you're fortunate to be part of a design team, you recognize, that these different experiences drive the innovation process.. I can tell you, more times than not, at different design teams I've been associated with, which if somebody grew up with not much money, they think about problem solving fundamentally different than somebody that grew up with a lot of money.. Not that one is better than the other, they're just different.. If your goal was to broaden the perspectives around the table, then you have to think about this diversity, this element of diversity that drive innovation.. - That was four years ago.. 00:29:54,123 - Yeah..

00:29:56,830 - How about four weeks ago? 00:30:00,630 So, how do you think about diversity now and what's going on in America in particular and, what does that have to do with Carbon? - It's, 00:30:11,443 not a lot to change, frankly.. When you look back, I remember in the late 1990s, my group, a very diverse group at Carolina.. Graduated with over 80 PhD students and half were women and others underrepresented in sciences and I had a large number of, African Americans in my group.. I was giving a talk in South Carolina in 1990s and the NAACP had a boycott on the state of South Carolina because of the Confederate flag.. I was the keynote lecturer and we decided we weren't gonna go, as a group.. What happened was they ended up moving the meeting to another state.. And now we hear about NASCAR finally addressing the Confederate flag.. I mean, it's just, a lot has happened, but a lot hasn't changed.. Our faculties don't represent the diversity of our student population.. There's so many things that we need to keep working on..

And again, back to the importance of this, this is where the richness of innovation is.. The diversity of perspectives.. The thinking and cultural values, all that comes together.. If we don't get this right, we're holding back innovation and it takes a relentless, unfortunately, it takes relentless leadership to keep making this front and center because I tell you, I see it so many times that if you don't keep it front and center, it's easy not to do.. It's gotta be relentless and people fall back to not thinking about it.. It's uncomfortable being with people that are different than you.. That uncomfort is gotta be harnessed.. That's where all the richness is.. It's and early in my academic career, I got invited to a, innovation group and not only was it all white guys around the table, but they all graduated from the same research group and they all knew the same stuff.. They were at a structural disadvantage, for driving innovation..

Your community is, you've got to think about your community, your groups, at the onset, or you're not gonna be as innovative as you possibly could be.. That's something you've gotta be relentless, it's great.. Ellen Kullman, this has been a big passion of hers too.. One of the great reasons why she's part of the team at Carbon, and she's been a strong advocate, and it's a really important thing for us.. - Take a moment to talk a little bit about other employees.. 00:32:46,413 I wanted to do that earlier as well.. I think this is important 'cause, she has a great reputation in terms of the DEI.. - Yeah, no, Ellen is amazing.. 00:32:59,160 So we've got Alan Mulally on our board at Carbon.. He was the iconic CEO of Ford Motor Company and, we needed chemical acumen on our board and I asked if anybody knew Ellen, she just stepped down as CEO at DuPont..

I didn't think I could get to her, but Alan could get to her.. I may have invited her play golf somewhere or something, but she came and she checked us out and I knew their technical team at DuPont.. They knew me.. I think she did a little due diligence there and she joined our board, about four years ago and brought a lot of perspective.. She'd been my partner in crime as I've been leading the company as CEO, for four years.. She then became our lead director.. And lo and behold, she's having a great life.. I thought being a board member, she's a board of Goldman Sachs and Amgen, United Technologies, Dell and Carbon, and she's fairly young and wanted to get at it and to be CEO somewhere.. I had been CEO for six years and, my heart and soul is in academia and, been doing that for 24/7 and we ended up switching roles.. So, she's CEO..

She switched in November.. Her timing is not great, right before COVID.. When she joined DuPont, it was right before the financial crisis.. So, other than that, it's been really great.. What great leadership is, we scale our business.. She really understands global dynamics and how to build businesses and scale them overseas.. We're in 17 countries now, and she just brings, that kind of scalability, the processes and as Carbon continues its trajectory, having that kind of leadership has been awesome.. - Thanks, Joe, for that whirlwind.. 00:34:48,060 We can come back to some of the important topics that we were covering just then.. DEI, for example..

Some of the future proofing, convergence, anything's game, but I wanna give our students and others, a chance to participate.. Now I see a question here.. It's a little bit long but, lemme do the punchline and backup.. How does Carbon select its clients and does the company take into account the longterm impacts of the client's company? This has to do with, itself may allow waste reduction and capital optimization for its clients.. Client's activities may still be significantly contributing to climate change and speedy 3D printing may just accelerate their activities.. So how do you balance that, sort of competing values, I guess? - Well, a subscription model, 00:35:41,640 is a partnership and it allows you to assess your customers and also allows you to understand your values, is if you're value aligned, with a subscription model, because we technically own the hardware, we have terms and conditions for its use.. So along those lines, we actually say not for weapons.. Because we have advanced materials and we don't want to usher in a new era of security issues.. So we get to say those things and that, allows us to work with the kinds of customers we want.. This is the environmental stewardship opportunities allow us to hear the feedback from customers and understand the technological challenges to enable their aspirations..

So designing new resins and new business models to help drive their aspiration.. So that's how we think about that.. - Here's another one, and is related.. 00:36:30,080 So maybe building on that, when would you suggest as a subscription model? Many people complain about software subscription models because costs add up.. - Well, I think the compelling reason 00:36:44,260 for us is this future-proofing.. I actually think a subscription model is more compelling in the physical world than it is in its, I was gonna say more occupied.. It's as compelling as you can get, because the last thing you want is to have legacy hardware and a transactional sale where your provider is not aligned with your business goals.. We get telemetry from the printers, they have 80% use time.. Many are working, over a hundred hours per week.. We could watch a dip on the Coronavirus..

We watched a comeback.. All those things allow us to work closely with our customers.. I think if you've got a hardware business, you've got to think about this.. Unless it's a hardware business, that's one and done.. When you launch a platform and we're staring at 30 years of innovation, I cannot imagine, a more compelling reason to not have a subscription model.. It's really enables one, to work closely with their customers and really drive innovation.. Imagine if you, were inhibited to innovate, because customers would get mad at you 'cause they just bought your hardware.. This now like, gets rid of that hesitation.. You're just driving innovation the whole time.. - We've got another question here, 00:38:03,050 and I'm really glad to see this one because I wanted to come back to this topic..

This is around DEI, it says, how do you track and measure your efforts on diversity of inclusion? How do you make this a relentless pursuit? Where are the pitfalls? How do you go beyond just the optics? This is something that's going on in the leadership of pretty much every enterprise you can think of.. Whether it's a startup, whether it's a rocket ship like yours, or whether it's an established company.. - Yeah, no, that's a great question.. 00:38:37,690 Something that I think I learned, early on, is that, you've gotta be clear about your values.. Early in my academic career, and this, boycott, is one example.. If you're clear about your values on your website, in your promotional materials, what happens is, you become a destination for excellence.. Wherever it's at.. People wanna align themselves with who you are, because you're purpose-driven many times.. If you're also clear about your values, it's almost self-fulfilling because, there are some people that realize, yeah, maybe they shouldn't be part of your organization.. So, it can be really self-fulfilling about that..

Being clear about what's important to you, becoming a destination for excellence, is a key part of that and then it's actually, measuring and quantifying that.. You look at, Carbon as we get ready for the next phase of Carbon, we've been very intentional about our hiring and, you know our, General Counsel, Meg Nibbi.. Our CFO, Elisa de Martel.. Our CHRO, Barb Cadigan.. Our CMO, Dara Treseder, now our CEO.. I mean, this is a manufacturing company.. It's led mostly by women.. And a great team, but it's not, at a board level.. We've got two women on our board.. I really like the new laws in California..

About the number of women on board because it gives us, it allows us to go back to the investors and say, look guys, and I meant guys, and it wasn't the Philadelphia guys.. It was the literal guys.. It's like, look, we need to be compliant and there's too many people occupying precious seats.. So the investors who were often not very diverse have got to give us latitude at companies to be able to allow our companies' boards to be reflective of our values.. So it takes the leadership of the investors to realize that we've gotta create up, we've gotta create seats and even if those regulations help drive it, I'm really grateful for that because it gives us a strong argument, to have the boards reflective of our company's values.. - There's a question here about the COVID work.. 00:41:04,620 I'd like to share that with you.. After COVID has waned and we don't know when that will be, could be this year, could be next year, it could be a while.. - It could be a while.. 00:41:13,130 - Yeah, I think so..

00:41:16,863 Do you see Carbon continuing to make medical devices? You are in the digital market already, but is this going to, is this a big bowling alley for you? - Yeah, I think it's TBD.. 00:41:26,410 There's over 100, the nasal pharyngeal swab was invented in like 1922.. Right after the Spanish flu.. There's over a hundred different swabs out there.. It's gonna be performance driven, as a mid turbinate swab for the nares and an oral swab and, we were just on a great call with the Chan Zuckerberg center here with Steve Quake and his team and, there's a need to integrate, designs, for high throughput analysis instead of humans breaking off the current stem of the swab.. So to me, I think there's actually gonna be, multiple products in this space, that are gonna be new products that, no one's ever redesigned a swab in a hundred years.. There was no reason to, and so now all of a sudden you realize that there's capabilities to improve performance, improve function, improve comfort, opening up new high throughput opportunities for sequencing or testing.. So, I think it's here to stay and what's

gonna be interesting too, there's some really important dialogues out there now about supply chain disruption, for our nation.. I think I would rank order things like, pharmaceuticals and biologics and making sure that we're able to have these available, in the country.. You see a lot of work on integrated circuits and chips on-shoring of that capability and then physical goods, what we do and, in the injection molded world and having, reassuring manufacturing and having the flexibility of pushing files in different directions, in different locations, in order to have agility in the supply chain..

Those things are here to stay and the COVID was our, moment to shine, on what digital transformation, digital manufacturing, enables.. - Joe we've got more questions here 00:43:23,310 but, I'm watching the time and I'm realizing that, this is a special moment.. You're a special, person.. I mean, just what you've accomplished in your contributions to the planet and its wellbeing, so far in your life but, put yourself back in, being, an undergrad.. That's our sweet spot with this, Speaker Series.. It was in 2016, it was 10 years before that and it still is.. This is an amazing time to be a college student.. - Wow.. 00:44:01,590 - If you stop for a moment, and think about all, 00:44:02,970 the same goes with me.. So, what do you say to, this current, generation of college students and how they might be feeling this summer with all these things that firing at one time? - Yeah, that's a great question..

00:44:25,780 But, these are gonna be badges of honor this time.. I mean, it was in 9/11.. It was in, the financial crisis.. This is gonna be a time that, it's gonna be, remembered.. The stories are gonna be told and what's, I think really magical about this time.. That's a word I'm gonna use, magical, is there's so many things happening now.. It's not just the Coronavirus, it's the economic impact from the Coronavirus and it's the racial disparities all coming together.. This apparent chaos, this is the moment to fix a lot of stuff that needs fixing.. That has been taking too long.. In my lifetime, it's taken too long on a lot of racial diversity inclusive issues..

And all of a sudden now, it's time.. And you can do it through the cover of chaos.. I had heard someone explain it the other way, the other day that way, and, may have been at a coach Kay leadership thing that I was on.. I hate to admit that, but it may have been an app, but nonetheless, it's, this is the moment.. I think everyone is gonna be able to reflect back on this moment, what they did to help make a difference, because this is a tipping point on so many really important things.. To me, this is an inspirational time, especially we make at this moment to fix stuff that's taken decades and hasn't been fixed.. They're gonna be able to tell these stories.. This is gonna be their badge of honor.. This is gonna be their moment and, when they deal with other issues in the future, they're gonna be, we're gonna be okay 'cause we lived through this time and we came out better for it.. That's what I would tell the undergrads..

(upbeat music)..