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Aurora: on the road to autonomous trucks

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Tom Slater (TS): Creating an autonomous driving system is a hugely challenging task.

CU: Can we make it safe enough? At this point, I'm certain on that.

TS: It's all very well having this exciting technology, but what's really important is industrialising it and making it safe.

CU: I have more conviction now than I've ever had on this is going to happen and it's going to be huge.

Claire Shaw (CS): Hello and welcome to Season Two of Invest in Progress, brought to you by Scottish Mortgage. I'm Claire Shaw, an investment specialist in the team. In this podcast, we take you behind the scenes to hear the conversations that take place between the Scottish Mortgage managers and leaders of some of the world's most exceptional growth companies.

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Wherever you're listening from, look around you. And the chances are that the majority of the objects and products you see will have at one point been transported by truck. At all hours of the day and night, drivers take the roads, delivering goods to supermarkets and shops, materials and equipment to construction sites and healthcare products to hospitals. Without the trucking industry, life as we know it would literally grind to a halt.

Yet this is an industry with numerous pain points. There are significant driver shortages, high fuel and insurance costs and restrictions on how many hours you can drive. In short, it is an industry ripe for disruption. Three bright minds from Google, Tesla and Uber realised this and came together to form Aurora, the autonomous trucking company and the focus of today's episode.

And today, we welcome CEO and co-founder, Chris Urmson. He is a respected thought leader in this space and has been referred to by some in the industry as the Henry Ford of autonomous vehicles. But before we welcome Chris, I'm joined by Portfolio Manager Tom Slater who can tell us more.

CS: Hi, Tom.

TS: Hi.

CS: Scottish Mortgage has for a long time had an interest in the automotive industry. And primarily, it's because we think it's an industry poised for vertical transformation on a massive scale. And I think when we talk about this and we look across the industry, we see these three seismic shifts happening at the same time. The shift from traditional engines to electric. The switch from owning your own car to ride-sharing. And then the transition from human-operated vehicles to autonomous vehicles or self-driving ones.

And of the three, I think that transition to autonomous vehicles might be the most revolutionary. Would you agree with that statement?

TS: Yes, absolutely. I think if that happens, it will have really profound impact. It promises to significantly reduce the cost of transportation, massively improve road safety, save lives. And I think it will affect every industry that is depending on transport.

CS: And Aurora, who we have coming on, have an interesting set-up. A lot of other companies focused on autonomy are focused on building the vehicle. But Aurora are focused on just building the driver. They're just focused on the software. How do you think that's a benefit for the company and being set up in that way?

TS: I think they have a singular focus. Creating an autonomous driving system is a hugely challenging task. And having that focus, but also understanding what you're not good at and actually the skill of bringing the industry along with you, with partnering with companies that have the expertise to turn this vision into a reality, is one of their superpowers, I think.

CS: I'm actually really looking forward to this one. I'm interested to hear what Chris has to say. Let's just go over to it now. I'll hand over to yourself and Chris.

TS: Hi, Chris. Great to see you. Thanks so much for doing this.

CU: Hey, Tom. Awesome to see you. Thanks for having me.

TS: It's been a while since we were sat out in the Utah sunshine in July, but it's not quite as auspicious surroundings. But nevertheless, fun to be here.

CU: It's awesome to see you again. Always great to chat.

TS: We start by asking all our guests the same opening question. What is Aurora and what is the problem that you're trying to solve?

CU: At Aurora, we're a company on the mission to deliver the benefits of self-driving technology safely, quickly and broadly. And we're building a driver. And that driver can go out and move vehicles on the road safely, helping people get where they need to go more efficiently. Doing that in a way that improves safety on the world's roads.

And we think it's an incredible opportunity to help bring all of these incredible advancements in artificial intelligence and sensor technology, to bear on such a fundamental problem for people.

TS: And it's a problem that you've been working on for a long time, I think reaching right back to when you were studying at Carnegie Mellon. Could you just talk us through that journey and how you managed to keep conviction, if you like, that you would get to the end point over all that time?

CU: For me, it started because I thought it was cool. I had been working on a robot that moved, basically, at 30cm a second. If you imagine a person with a walker, that's about how fast they moved. And the Defence Department had this competition to have vehicles drive from Los Angeles to Las Vegas. And the idea was, you're driving 50 miles an hour across the desert. And as a young, actually, at that point, a relatively old graduate student, but as a young person, I was like, that sounds awesome. Let's go do that.

And at the time, it was really about getting young men and women out of harm's way in the military. That in Iraq, the US lost more people on the supply line than they did on the frontline. And if we could help there, that would be meaningful. And then that morphed into a series of challenges that, eventually, we were driving on roads and had to be on our side of the road, not just on the road. And there, I started to work with General Motors and really began to appreciate the impact that this could have for everyday people, not just for folks in the military.

And then over the last, I guess it's been 20 years or so I've been working on it now, the opportunity to work on something that has a profound impact that if you look around the room you're in or I'm in, there's nothing here that didn't move on a truck at some point. That's just fundamental to our existence in society today. And working on something where I've got a chance to work with amazing people, where the technology is fascinating and interesting and where the problem is so important, that trifecta has kept me motivated over the years.

TS: From Carnegie Mellon, you then went to Google. Tell us about your time there. And was it difficult to leave?

CU: It was amazing. After Carnegie Mellon, after these challenges, Larry and Sergey had this idea of investing in automated vehicles. And they recruited me to come

help found what's now Waymo. And I had the privilege of leading that, I think, for seven and a half years. And Google, it was an awesome company to work for. I worked with amazing people. We had an opportunity to do incredible things. And honestly, I don't think the automated vehicle industry, such that it is today, would exist without their foresight and investment.

It was difficult to leave. But I love the people. I love the technology. And I was incredibly grateful for the chance they gave me to work on it there. But ultimately, it was time to go figure out what was next.

TS: And that next was Aurora. And if I look at some of the leadership team and the people that joined you in the early days on that mission, you had Sterling Anderson who'd led the team that launched Tesla's autopilot and Drew Bagnell who'd worked on the Uber self-driving team. A really impressive and quite diverse set of résumés. How did the three of you come together to form Aurora?

CU: It's a small community, at least it certainly was at the time. Drew and I had known each other since graduate school. He is one of the world's leading experts in machine learning and applied robotics. Sterling was at MIT a little bit later than we started. And I'd followed some of his work as a graduate student and we talked to him about potentially joining us at Google. And he ended up going to McKinsey. Everyone makes mistakes!

And then went to Tesla. And again, we'd stayed in touch over the years. We, together, thought there was a real opportunity to build something special in this space. And I feel incredibly privileged to have a chance to build company with the two of them. And they're still fully committed. We're all here together and making it work.

We've seen lots of interesting technology development, lots of effort that's gone into what I would think it was the first wave of deploying this technology and making it real.

And we thought, how do we take the wisdom from that and build the right company? We knew that this was a hard problem, but it's also really hard to make vehicles. And it's really hard to build Uber or build FedEx.

And let's be a one-miracle start-up, instead of trying to be a three-miracle start-up. And that led us down to focus on what we can do best and go and work with amazing companies that share our vision.

And that philosophy of partnership has been baked in from the beginning and has led to what I think are some really strong and certainly industry-leading partnerships in the space.

TS: These partnerships that you have with the likes of PACCAR or FedEx, why are they so important for cracking this industry? And how did they come about?

CU: And this comes back to this philosophy we have of, be confident in our ability, but also be humble enough to understand that other people know what they're doing. And my mental model is if you're a company, you've been around for 80 years, 100 years, you've got really good at doing that. And for me to come in and say, 'Hey, I'm a software robot guy from Silicon Valley and I'm going to figure out how to build trucks better than you', that seems egotistical.

Let's go find great partners who share the vision, who see the opportunity to transform logistics and make it safer, better, more convenient for everyone. And we reached out to companies. We reached out to PACCAR. We reached out to Volvo. We engaged with them at the team level and at the very top of the companies. And talked to them about our vision. What was exciting was they shared that vision and saw the opportunity.

And then today, we work with these companies day in and day out. Our engineering teams are in constant sync where they're working to build what you think of as the truck so that it's capable of talking to the Aurora Driver. And we're building the driver in a way that's capable of talking to those trucks. And then when we talk to companies like the FedEx and the Hirschbachs and the Schneiders and the Werners of the world, these are the customers that use the truck and the driver to do something useful.

And again, as we talk to them about the benefit of how we see this helping their top line and their bottom line of their business, we've been building pilot programmes with them so that they can experience the new technology, build trust in it, understand how it can impact their business. So that ultimately, they'll be excited and confident to run this and incorporate it into their operations.

TS: And the software itself, could you give a non-technical explanation of how it is that you do this really quite amazing thing?

CU: Yes, and I'm happy to geek out on this for as long as you want! We use a combination of different types of sensors to see the world around the vehicle. And that's really where it starts. We use camera, we use radar, we use lidar and we use our proprietary FirstLight Lidar, which is this special form of lidar that can see farther and also see how fast things are moving. All of that information allows us to build a model of what's happening around the vehicle in the moment like where the cars are, where the road is.

We then take that model, and we have what we call a motion planning system, which is figuring out, given what we're trying to get, how should the vehicle move over the next few moments? And it's also one of the really interesting things, thinking about, if I move in this way, that's going to influence the behaviour of the other drivers on the road or the other people on the road in how they react.

And it incorporates that into its plan as it's... And you could think about this when you're merging, for example, if I go a little bit faster, you slot in behind me. If I go a little bit slower, you slot in front of me. It's important for it to understand that dynamic and that interaction is part of how its behaviour influences others. Once it figures out the optimal thing to do, then it hands that off to a little computer that then controls the brake and the throttle and the steering wheel. And then we repeat that many times a second for the thing to drive down the road.

TS: I suppose the first point to make is it's staggering when you realise just how big an industry trucking is. I think something like $800bn industry. Why did you focus on trucks?

CU: And it's important to know that that $800bn is just the US market. If you look globally, it's somewhere between three and five times that. Why trucks? We have this mission to deliver the benefits of self-driving technology safely, quickly and broadly. And as we think about, how do we make that happen? We need to have a business because we need to be self-sustaining. Of course, you're an investor, you'd like us to make some money. That would be great.

And as we looked at the confluence of the technology and the business models, it was clear that trucking was the right place. The market is gigantic. If you compare it to ride-hailing, I think that's somewhere in a $65bn market, whereas trucking in the US, $800bn. It's ten times a bigger market. If you think about the unit economics, we value the movement of goods more than we value the movement of people in terms of how much we pay for the driver. And the unit economics is about three times bigger.

If you think about the emotion of the decision-maker, if I'm riding in a taxi or an Uber and the driver goes down a different route than I would have, I get frustrated. The driver doesn't make the turn that I would, I get frustrated. In contrast, if I'm a shipper and I'm shipping toilet paper between Dallas and Houston, if it gets there safely and it gets there on time and it's at a reasonable cost, I'm happy. And that confluence, that's the business argument.

And then if we look at the technology, we thought with the investments we've made and particularly our FirstLight Lidar technology, we had a unique technical advantage. And then the ability to scale this business because the freeways look much more self-similar than, say, urban driving, made us have even more conviction that this was not just the right market to enter, but the right combination of market and technology.

And then we could use the business we built on that market to drive down the cost of delivering product. And that would then allow us to go in and compete and serve customers in other markets as well.

TS: And I think there's an interesting cultural aspect at play here. The trucker is one of America's folk heroes, this solitary entrepreneur that braves the weather, fatigue, to get their deliveries to their destination on time. How has that trucking industry responded to your business? Is there a resentment among truckers that feel their jobs may be at risk?

CU: I think, first, it's super important what you said. It's not just folk hero status. This is a noble profession. All of us rely on goods getting where it needs to go. And today, that's all done by people driving trucks. And my hat is off to them because it is a really difficult and dangerous job. Many of these drivers are on the road for days or weeks at a time, which means they don't see their family. In the US, if you're driving a truck, you're ten times more likely to die on the job than the average American.

You have a bunch of health challenges that come with the fact that you're stuck in a truck, sat there most of the day behind the wheel. And it's noble, but it's really difficult. As we talk with the companies and we talk with truckers, of course, it's something new and you have a spectrum of responses. What I can tell you is that we employ a number of truck drivers. And they are excited about the opportunity to take logistics and advance it.

The opportunity to see safer roads, the opportunity to create new job types for folks that are interested in logistics and can then play a new, interesting role in that. And, yes, we have folks who have concerns, of course, and that's rational. But we all see an immense amount of enthusiasm for the opportunity here as well.

TS: And I guess thinking of another stakeholder, the end consumer, how do they benefit from Aurora's technology versus that conventional truck and driver combination?

CU: Again, if you think about the constraints that are in freight today, as an operator, you're only allowed to drive a truck for 11 hours a day. And a trip between Houston and LA, let's say, is about 24 hours of driving time, which means that it's three days of travel. In contrast, if the Aurora Driver is operating that trip, because it's not limited by those 11 hours of service a day, it can do that in a day. And as a consumer, you're going to have better reach to goods.

If you're a small farmer, your berries, your fresh fruit, you're going to be able to serve a larger market, which is going to allow you to be more selective about where you sell. Allow you to be more successful and more competitive. When you're driving on the road, in the US, there's over a half million collisions a year that involve trucks. And if we can make that incrementally safer, then we all benefit from that.

And then as this technology rolls out more broadly to light vehicles, the whole transportation ecosystem will get safer as well.

TS: And if you think about the future of the trucking industry, it's been going through a challenging time in recent months. But the growth in trucking, is it ecommerce and next-day delivery or are there other factors at play for the outlook for the industry as a whole?

CU: It's been going through a difficult time for decades. And we've seen it particularly acutely over the last 18, 24 months during the supply chain crisis. But we've had a systemic shortage of drivers in the US, and we see that in other countries. In Japan, it's almost same quantitatively, but even more significant in terms of proportion of population. In the US, we're about 80,000 drivers short right now to serve needs.

And the American Trucking Associations is estimating that we're going to have to have 1.2 million new drivers over the next decade come into this space. What's driving that? Part of it is ecommerce. Part of it is just the growth of the economy. As we make more stuff, we need to move that stuff. And as you pointed out, 80% of goods are moved on trucks. It's overall progress, but certainly fuelled by consumers' expectation of rapid delivery as well.

TS: When I was preparing for the podcast, I looked back to some of my notes I've made through the years when we've chatted. And I think it's probably nearly ten years since we first met. And there's something that I wrote down from one of those early meetings. Which is you said, "the only thing that matters about self-driving cars is the last 0.001 of accuracy. Up until then, you have a really nice demo."

There's lots of scepticism around the concept of autonomous driving. And that is mainly about safety. Can you talk about how you approach that at Aurora?

CU: Self-driving is one of these gee-whiz technologies. It's just mind-blowing. You get in a vehicle, and it drives itself because it's a new concept. But making it work on a truck and doing all the little demos is actually relatively straightforward today. Industrialising, like any other technology, is where the hard part is. And that's what we've really been focused on. And for us, we didn't want to just have some demoware that we could put on the freeway, hope it works and get some press.

We really wanted to have a safe, deployable product. And we've thought about, how do we do this in a way that is holistic? And we've developed what we call a safety case. And this is really, you can think of it as a way of thinking from the technology through the company, how do we convince ourselves that we're operating in a way that will result in safety? And it has really five pillars.

The first is that it is proficient. You'd expect that when the truck is on the road, that it drives well and everything's working. But then it also has to be failsafe because the one thing you know is at some point, something's going to break, despite how well you engineer it. And in that situation, you can't just throw up your arms and hope. You have to actually have a plan on how you mitigate that and continue to result in a safe outcome.

We need to be continuously improving. As we look at our process, as we look at our technology, we learn from the lessons of the past and we incorporate that into how we develop and deliver the product going forward. We need to be resilient. If someone attacks us with a cyber-attack or misuses the technology in some way, that that doesn't cause a brittle response.

And then finally, that we need to be trustworthy. Again, because if I tell you all the other stuff, and you can't trust me, then it doesn't really matter. And that involves the way we have a just culture internally, where we encourage people to speak up if they see something they're concerned about. And that we respond to that in a way that is appropriate. That we engage with regulators and policymakers to educate them. And we've been tracking the work we're doing across that and one of the things we share publicly is our progress in, what we call, closing that, which means doing all of the 460-some things that are in there that ultimately result in us having conviction that this thing will be safe on the road.

TS: I think one way I may have thought about Aurora in the past is having a very methodical, prudent approach to autonomy. Quite different from, say, the "move fast and break things" philosophy that was articulated for Facebook. And could you just reflect on whether you feel that's been the correct approach? Anything you would have done differently in hindsight?

CU: Yes, I feel pretty good about it. Right now, I would characterise it as the "move fast and don't break things" approach. There's a reason why quickly is that second word in our mission. Safety first, quickly and then broadly in the scale. Part of what we were fortunate to have as we founded the company was folks who had deep experience and understood just how hard this problem was. Because as we talked about earlier, it's mind-blowing when you get a vehicle that just drives a bit.

But it is easy to underestimate how hard it is to get from... I'd trust it with my wife and kids on the road next to it. And the only way you get there, there aren't corners to cut, is you have to do really good engineering. You have to be methodical about it. You have to put the hard work in to actually close the safety case. And we think about, where can we work incrementally smarter rather than harder, of course, all the time? But you still need to do all the work.

TS: In the last 18 months, two years, many of the competitors and the start-ups in this area have either been acquired or run out of capital. Why have you been successful when lots of those around you have been falling down?

CU: I think as one of our fantastic capital partners, you may be better served to answer this than I am. But I think, as we talk to investors, we work hard to be transparent. We share what we see as the immense opportunity and huge impact we can have. But we try to be candid about, this is not an overnight thing. This is not going to be three guys in a dorm room, throw it at the wall and then it turns into something ridiculous overnight.

But by investing thoughtfully, by building consistently, we can build a truly transformational company. And I think our investors understand the scale of the opportunity. They look at the team we've built. And it's a serious team. I put the talent in Aurora, pound-for-pound, against any organisation. And the strength of the partnerships that we've put in place and the business model. And I think when folks look at that package, they start to see what I see, which is a company that has a huge potential in front of it.

Nothing is forgone, of course. And we're certainly not arrogant enough to think that. But we're teed up to go have a really exciting and huge impact in the world.

TS: We're delighted to be partners on that capital provision journey with you. But you've raised $800mn in a very difficult environment for raising capital. It's much broader support than just us. There's real buy-in. Could you just talk a bit about capital and what's needed to get you to the point of being a profitable, cash-generative business and if you see any risks there on that front?

CU: As you mentioned, this summer we raised a little over $800mn. And it was from the kind of folks like yourselves that you just want to be part of your company. And we were able to do that with a very concentrated set of large, long investors and really proud to have all of our partners along the journey with us. I think those folks, when they look at the opportunity, they see that the competitive side has mostly fallen away.

And that we have great technology and we're doing what we said. As we look forward, what we said at the time when we raised the capital was, we needed to raise about $1.6bn from that moment. And that then it turns out, we raised about 800. We've got 800mn. We've got about another 800mn we expect to have to raise to get to free cash flow positive on a run rate basis. Do I think there's risk in that? Of course, there's risk in that.

I can't see the future on what the markets will do. Do I think it's a very manageable risk? Yes. In that our team is, frankly, they're kicking butt.

TS: You talked about the talent density in Aurora, and I'm interested just to explore that a bit more. And what do you think of as the corporate culture and what's really important to you in developing that?

CU: For me, it's really been about, how do we make sure that we can have a team that really works together? This is very much a team sport. And we've put in place a collection of values that we think emphasise that. One of the ones we talk about a lot is 'no jerks'. In the valley, this mythology of, you go hire the brilliant jerk, the 10X engineer. And for me, I'd much rather hire the 9.5X engineer who actually works well with others and that's a team player.

Because, again, you just can't do this alone. We just have to have a team that works together well. We need that team to be focused. One of our values is focus for impact. Think about what matters most. Go do that. Spend the energy on that.

We have a value of win together, which is this broader teamwork. And that we collaborate. We engage. We push back, of course. It doesn't mean that we all sit around singing Kumbaya every night. But it's about the mission and about delivering the product.

Operate with integrity is one of our values. And this is really, again, people are going to trust us with their lives. And we need to be worthy of that. And if we're not, you can't just paint that on at the end. It has to be intrinsic to the company. We want a diverse workforce, of course. We want to have that breadth of perspectives and opinions. It really matters. We have a diversity of locations. We're in eight cities in seven states. We're not just living in the Silicon Valley bubble. We've got, half our team is in Pittsburgh, for example, so we get a good set of perspectives.

And then finally, we want folks to rise to the occasion. Early on in the company, we actually had a value, which was be reasonable. Which was, again, part of that notion, expect best intentions from others and assume positive intent kind of thing.

And what we realised at some point was that what we're doing is not reasonable. That we're thinking about transforming something fundamental. And the only way to do that is to take on things that are beyond the reasonable. That if you would... Most rational people looking at this company when we founded it said, hey, we're going to go transform transportation, seven years ago. Odds are we would fail.

And we had to have folks who were willing to rise to the occasion and take on the big challenges that we have. And that really mattered. And then you need to pay them enough so that they feel like it's fair.

TS: My colleague, Kirsty Gibson, is just back from visiting you in Dallas. And actually, got to ride on one of the trucks doing its delivery run. And the feedback from her was that everybody she met absolutely lived up to that characterisation of how the company operates.

CU: Thank you. It's one of those things as a leader that makes you proud, is you go out to... I go, not as often as I'd like, to go see our team down in Texas. And our operators and the care and thoughtfulness they put into what we do and how they make things happen, it's amazing. And then you talk with our engineers and the passion they have for this. And our lawyers, our marketing folks, people get what we're about and why it matters.

TS: What would you say is your biggest challenge from here?

CU: We've laid out a roadmap we share publicly. And there are three major milestones we put on that, was, one, to get to Feature Complete. Which meant all the stuff was in place. It just wasn't verified and wasn't necessarily performance enough. And we were able to complete that at the beginning of this year in Q1. The next big one was to get to Aurora Driver Ready. Which meant that the vehicle was safe enough that we would be comfortable having to go out in the road with nobody in it.

If we had a vehicle platform that had the redundancies and had the interfaces, we needed to do that safely. And then finally, by the end of next year, we're working to launch commercially where we've got the Aurora Driver on a truck out on the road. And when I think about the risks the company faces, it's, can we actually get the technology to work in a way that's safe? Then, can we deliver the technology in a way where it makes sense on a unit economic basis?

That it costs us less to provide the driver than people are willing to pay for it. And then it's, can we scale to a point where we're having an impact in the world and we're generating more revenue than we're spending? And then finally, this meta risk of, can we raise the capital we need to to get to the point where we're self-sustaining? And when I look at each of those, on the technology front, the first one, can we make it safe enough? At this point, I'm certain on that.

And we expect to demonstrate that at Aurora Driver Ready. And the team is working hard on that. The next one around unit economics, the partnership we put in place with Continental just fundamentally enables that. The hardware, being able to both scale that hardware and do what they do best, which is take cost out of existing systems, among other things they do very well, that makes me have conviction we're going to be able to get to a unit economics that makes sense.

And then when I look at the impact this will have on other companies' businesses, the FedEx, Werners, Schneiders of the world, the demand is there.

And each of those are risks. We spend a lot of time mitigating them. But as I look forward, it feels like we just go execute it. And I guess the thing that I spend time worrying about right now is, how do I help our team deliver as quickly and safely as we can?

But it feels like it's one of these things where I have more conviction now than I've ever had on, this is going to happen and it's going to be huge.

TS: Maybe just to finish off, and we ask all of our guests the same final question. And it's the opposite of the last one, really. Which is, what does the world look like if Aurora succeeds in that mission?

CU: It's exciting because transportation is so fundamental to our society. And this will be one of the biggest changes in it since the internal combustion engine. For the last 100 years, we've been optimising that. But we've had a person in the left seat in the US, not so much in the UK, with a steering wheel in front of them, [unclear] that vehicle down the road. And what I can see clearly is we're going to reduce accidents, collisions on the road.

And that will save, in the US, a large fraction of the 40,000 Americans that die on the road every year. That it's going to be cheaper and easier for people to bring goods to market. It's going to extend the reach of local entrepreneurs, farmers. It's going to make it dramatically easier for people to get around in their community. That owning a car is the second most expensive purchase people make outside of their house.

And at this point, probably their education. So maybe third most expensive. And making that more accessible through transportation as a service, it's going to be profound. And those are the things I can see. We're going to have safer, more efficient, better roads. But when you talk about changing something fundamental in the way the cost and the benefits of this technology or transportation works, my imagination is not big enough to see how profoundly the world will look different in 50 years because of that.

TS: I agree that that's just a really exciting prospect. And thank you so much for coming along on the show today to talk about it.

CU: My pleasure, Tom. Thanks so much.

CS: Tom, I really loved that conversation. Chris is such a thoughtful person and leader. And it was just really inspiring listening to how they're going to tackle this problem. I'm interested from your perspective, though. Can you remember actually how you came across Aurora in the first instance?

TS: I think Chris' reputation preceded him. I'd seen the headlines from the Carnegie Mellon team and the Transamerica autonomous competitions. We were big shareholders in Alphabet as the Waymo programme was developing. When he

decided to set out on his own and set up a company, we were really interested to speak to him.

CS: And we obviously spend a lot of time talking about the importance of these founder-led companies. And Chris talked a lot about culture, and he talked about the fact that they meet people in Aurora. They're excited about the mission. And I loved his phrase about the talent that they have. Pound-for-pound is probably as good as any other company. But what is it about Chris? What is it that he brings to the company that you think increases the chances of success that Aurora has?

TS: I think what he brings is you have that huge credibility from his academic background, his deep understanding of the technology. But what hopefully came across when chatting to him is he's also a leader and somebody that people want to work for. He's got a real sense of what's right and fair and a grown-up attitude to bringing this technology to the world. For example, the focus on safety.

That it's all very well having this exciting technology, but what's really important is industrialising it and making it safe and making it readily available.

CS: And then from that, he talked about building a truly transformational company. And he also talked a little bit about the competitive environment and how some other players have struggled against the backdrop. When you take a step back, what is it that you think is Aurora's competitive edge?

TS: I think a really important one is their ability to strike up partnerships. We talked about PACCAR, Volvo, FedEx. It's, how do you take this established, old-world industry and actually successfully deploy technology into it? What are the distribution channels? And that ability to form genuine partnerships with people who provide really valuable inputs and work with them in a way that actually creates a business model for Aurora that's really attractive, I think is a really important differentiator.

CS: And Chris was really keen to emphasise that safety has been really at the epicentre of the Aurora business model for a long time. And when we think about the potential threats to this business model going forward on its route to self-commercialisation, what do you think are the most significant risks for Aurora? And how do you think they're placed to overcome those risks?

TS: I think safety is a key one. If you get big accidents with this technology, the scrutiny will be so much higher than human-caused accidents. And the regulatory response to that will be existential threats. Actually, having a credible safety programme and a clear approach to how you try and mitigate those events, minimise them and having public acceptance of that is absolutely crucial. And I think that's why you hear him focus on it.

CS: And then just as a final question. We talked a lot about the size of the industry. Trucking in the US alone was an $800 billion industry. But I think he said something like four times the size of that globally. You asked him the question, what does the world look like if they get it right? And he said his imagination wasn't big enough. But how do you describe the scale for the opportunity that you see ahead of you for Aurora?

TS: I think that the first part is displacing humans. There's a fee for the technology. But then it's all the secondary effects that come from that. If this is much safer, isn't it irresponsible to then use a human driver? If you can get far greater productivity out of it, what does it mean for us at utilisation? What does it mean for the number of trucks on the road? What does it mean for the way that supply chains work?

There's all of these follow-on consequences that come from success in this area. And I think it's absolutely right to say that we don't exactly know where that will take us, but it is very exciting.

CS: I think that's a very good note to end on. Tom, thank you very much for your time. I've really loved listening to you and Chris today. A huge thank you to our guests today, Chris Urmson of Aurora and Scottish Mortgage Manager, Tom Slater. In the next episode, we welcome Dominik Richter, the CEO and co-founder of HelloFresh, a company whose mission he describes as changing the way people eat forever.

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