

Transcript for #89. Heavy-Duty Electric Trucks With 500-mile range?...
Guest Graham Doorley, CEO, Terraline
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Intro (00:01):

You are listening to Fueling the Future of Transport, hosted by Tammy Klein, the founder and CEO of Transport Energy Strategies. We'll talk all about the fuels and energy it takes to keep the world moving forward.

Tammy Klein (00:17):

Hi, everyone. Welcome to the show today, great to have you. I am very pleased to welcome Graham Doorley, who is the CEO of Terraline. So, Graham, welcome to the show.

Graham Doorley (00:30):

Good morning. Thank you, Tammy.

Tammy Klein (00:31):

A pleasure to have you, and I'm so eager to talk to you about what the company's doing, heavy-duty trucking, and I'm even curious about your experiences in autonomy, but we'll, we'll get to all that. First things first for the listeners who may not be familiar, can you talk about what Terraline does and its mission, and what led you to join Terraline, especially given your rich history of working with Waymo, Google, Tesla, all the big and exciting names?

Graham Doorley (01:05):

Sure. So essentially, I'm an engineer as alluded to in my background and worked in the electromobility, we'll call it, spaces, as you mentioned at Tesla, and then also at Waymo in the autonomy spaces. I love transportation. That's a big thing with me, you'll find, is if it moves, it's awesome and I've always been very intrigued by not only new technology but sustainability. You know, it's the big reason I joined Tesla. I wanted to be a part of that electric vehicle revolution at the time. So, it was very early on there and then wanted to stay cutting edge with technology. And that's why I moved over to Google, which became Waymo but spent a lot of time in the industry and saw this need, especially around heavy trucks. So, we can talk a little bit more about that and I'm sure some of your questions.

(01:56):

But essentially, when I worked with heavy trucks at Waymo, I saw that the industry was a little bit behind in its outlook of the future. The passenger car industry had really accelerated its adoption of electrification and also moving into autonomy. So, from a sustainability aspect, I saw a big opportunity to move into an industry, take the knowledge that I've learned by building electric vehicles and autonomous vehicles, and start applying it to the trucking industry and helping bring that industry forward to the future. and so a big part of it, honestly, was roughly 24% of US transportation emissions come from long haul heavy trucks, like big highway tractors yet they account for something like 5% of vehicles on the road in the United States. So, it's a disproportionate amount. So to me, it made sense to kind of go after the sector and, and help make a vehicle that was commercially viable. so that's really what led to the starting of Terraline back in 2021.

Tammy Klein (02:57):

So, tell us about the model that you all are developing called the Tangra LH1. So, tell us about that and tell us about...what I found kind of interesting when I was researching Terraline and

preparing for the podcast and questions and so forth. The leasing model as a sales corporate model seems really unique in the EHDV space. So what's been the reaction to the industry of the product and then where is the company going in terms of the development process and timeline commercialization, all of that sort of stuff? And by the way, it's a beautiful looking vehicle. I mean, I think you might turn me into a trucker. I don't know! <laugh>.

Graham Doorley (03:54):

Yeah, I mean, happy to talk more about the Tangra. So quick plug, that's actually a mountain range in Antarctica. If you go to our website, you'll see topography maps around and that's actually Antarctica stuff.

Tammy Klein (04:11):

I did see that. Oh, I didn't make the connection.

Graham Doorley (04:14):

We're kind of nerds like that in a way. But so, the Tangra came about. I'll kind of step back. So, I spent a little bit of time working in the autonomy industry, as I mentioned I worked on heavy truck autonomy for about five years at Waymo. And what I discovered working closely with Daimler and [indiscernible] was that these trucks that were building on, which are kind of existing models, are really kind of dated in their designs. Yes, they're more efficient in a lot of ways and more aerodynamic in some ways and advanced in others. But essentially the architecture fundamentally of the truck, which is a frame that has axles and an engine in the front and then a cab on top hasn't really changed in close to a hundred years.

(04:59):

I mean, fundamentally it's the same thing. And so when we start trying to deploy autonomy or electrification onto these vehicles, it's really challenging. You know, they're not designed for that. But we look to the future of sustainable futures of where the market should go to reach zero emission driving or sustainability. And we talk about kind of why the market's going that way. We see that current trucks in their architectures don't work. So, we decided at Terraline to build the Tanga LH1, which is a ground-up, new long-haul battery-electric heavy truck. So this is not based on an existing vehicle. It's not a frame that we're just converting and putting batteries on and saying, 'hey, you can do 200 miles. There's use for that. But we really see a need to get to the long-haul segment.

(05:48):

So, the Tangra's 500 plus mile battery, electric long haul truck. And it's really, it's new thinking. It's a new way of thinking. We're basically building a battery system and putting a truck around it. You know, that's the kind of thinking here. And we're obsessed with efficiency. So, our engineers and I look at every aspect of the design and say, how can we take out mass? How can we conserve energy? Because every kilowatt on the platform has to be taken into account. <laugh> very carefully, because that's more battery you have to add or you can take away. And that gives you more range, more efficiency in the commercial industry, it means moving further, moving faster, moving cheaper. And that's what really matters. It's that kind of total cost of ownership or cost per mile. And so when we talk about the leasing model, we are obviously building a ground-up, new vehicle. Everybody at this point is aware that battery-electric vehicles, whether it be passenger cars or heavy trucks, are expensive. We're not going to sit here and tell you that we're going to make it cheaper to buy than the traditional vehicle traditional truck. Because it's just not the case with battery costs and everything else. So in order to get a 500-plus-mile battery electric truck that is commercially viable from a cost perspective there's a lot of ways you can do this. But we saw an opportunity by leasing the truck. And so what that means

is essentially it's trucks as service, if you will, we're going to provide the vehicle under our full-service lease or our customers they will use it for so many miles and basically compensate us per mile of use.

(07:23):

And the reason we did it this way is because fundamentally, we're designing the vehicle to last for 10 years or 3 million miles. And I'm sure anybody listening to this that's from the trucking industry from a traditional OEM is like, there's no way you're going to do this, but trust me, it's possible. It's just you have to change the way you think about designing a vehicle. And as engineers, we're sitting here, we're looking at how can we make this last longer. And so that gives us kind of two advantages. Maybe three. First, obviously from a sustainability standpoint, we build less vehicles. It's really important and we design the vehicle to be serviced and upgraded much like an airliner. So, airframes last for multiple decades. It's not uncommon. And so then also our costs can be amortized over a lot longer period.

(08:14):

If we make it last for 3 million miles or 10 years, that cost of the truck now is expanded over multiple years. And it's then cost per mile to drive is a lot lower. So then when we turn to the leasing side, we're basically looking at it like, we can get a customer a truck and from day one they can drive it on a cost-per-mile basis less than it costs to run a diesel. So it's about, I think 51 cents or so if I'm not mistaken - our numbers change almost every day depending on what the fuel prices and labor price are - but it's substantially cheaper to run per mile than a diesel. So our customers will see that benefit immediately. So it basically takes the barrier of entry out. All this said, it takes a barrier of entry to getting into electric trucks and it lowers that down so that we can get more trucks on the road faster with our customers.

Tammy Klein (09:13):

So, to me, when I was looking at it, the first thing I thought was, okay like UPS, FedEx, all of the big ones...Walmart, Amazon, all of the big fleet providers, they have deeper pockets to invest. They are investing in this space. They're investing in a whole range of different fuel types, vehicle types, so on and so forth. But when I looked at what you're offering in terms of the leasing, it's the barriers of entry. You're removing risk, which opens up the pool of potential users in a way that I think the traditional models really don't. Am I right? Am I wrong?

Graham Doorley (09:59):

Yeah, no, no, a hundred percent.

Tammy Klein (10:00):

Suddenly it's accessible to a smaller fleet owner that cares about ESG. Seems they're very...fleet owners are very cost per mile driven, very economics driven. They can look at the economics and they can take a risk that would otherwise be out of their potential ability to do otherwise.

Graham Doorley (10:30):

Yeah. I mean, we'll just say, Tammy, our goal here is to promote sustainable transportation. Reduce emissions. So, if we can get this truck into the hands of more people, that's obviously better. Now of course, we are a business. We do have to make money. And you pretty much hit the nail on the head that our idea is to reduce the risk, say really take on more of the risk ourselves as a company. Because we're confident in our product and we're confident in our ability to deliver. So we're taking on some of that financial risk. And there's a lot of ways we can look at that from a business perspective, but essentially from a customer's perspective, yes they

can come lease the vehicle. Now, some larger customers that you mentioned do like to purchase vehicles and they don't always want to lease.

(11:13):

We do have options to do that too. Of course, if you want to purchase it you can absolutely do that. but it helps the smaller fleets and our foray into the industry and going and talking to a lot of these companies have shown that they're pretty amenable. You know, when we show them the metrics and the cost-per-miles, which we've done a ton of analysis on, and talk to an enormous amount of customers built out actual simulation models internally to drive these calculations we can show really fundamentally how much cheaper it's to drive. and it's very appealing to a lot of customers. And since we are a new manufacturer coming up we do have to kind of prove ourselves in the industry and we're ready to do that and stand behind our work. which I think is a breath of fresh air for a lot of these customers.

Tammy Klein (12:02):

So, what are you thinking in terms of...you just started less than two years ago, you're in the design and development phase. When do you go commercial into manufacturing? Do you have a sense of what the timeline might look like when we actually will start to see some of these rolling out of the manufacturing facility, so to speak?

Graham Doorley (12:27):

So, we're moving as full speed ahead as fast as we can. It does take a while, unlike the typical Silicon Valley, I'm actually sitting here in Silicon Valley and right next to Tesla of all things. Building hardware takes a while. My team of about 20 has experience. We've deployed around 19 or 21 vehicles on the road into production. So, we have a lot of manufacturing, design and manufacturing experience, the majority of which were electric and or electric autonomous vehicles. So, we set some aggressive targets, certainly by middle to end of the decade you're going to see our trucks on the road. Now I can't say exactly at this point the specific date, but we are also going to have a prototype on the road shortly.

(13:16):

I'm very excited about this. It's sitting behind this wall, so there's a pretty significant prototype coming that I think is going to show the world what Terraline's really about. We did deploy for a testing last August, a vehicle, you find it on YouTube referenced on our website as well. That was more of a development vehicle, but it showed some early work on our powertrain, on our battery systems, on our communication protocols to really get that technology going. But our goal is to get 'em out as quickly as we can. And we are working hard to do that. So expect us to have a major force within the middle to end of the decade, but soon you'll see more about us from our first prototypes.

Tammy Klein (13:58):

So, I want to talk more broadly about the EHDV space. What are the biggest opportunities and challenges that you see in this space right now? Is there enough support from a policy perspective to help this industry scale up? Is IRA enough? Is the infrastructure law enough? Is Advanced Clean Fleets in California and Advanced Clean Truck programs in California that now other states are implementing? Is it enough, is more needed? What will it take?

Graham Doorley (14:35):

Yeah, I mean, of course always more is always needed. I've welcome Biden to rain down from the heavens with capital. But it's been good it's been so...

Tammy Klein (14:46):

So far so good in that regard, <laugh>.

Graham Doorley (14:48):

Yeah. I mean I can't complain, especially in California. You know, we're lucky in the fact that between the Inflation Reduction Act and the infrastructure bill, there's roughly \$160,000 for every heavy truck that zero-emission to be put on the road. So, the government is really helping out and that kind of buried entry, and that, of course, helps us deploy faster. But fundamentally, let's talk infrastructure side, let's just talk about customer adoption. It comes down to, are fleets going to use the trucks? Do they want to use the trucks? The government can give more money and do the things that they want to do, but is it going to push the big fleets? And what we've seen is they have their own sustainability goals that when it surprised me. So, I left Waymo, and I went out into the...really dove into the trucking industry.

(15:40):

It was already in the trucking space, but really got in with these customers, started talking, and it blew me away how much these customers want to move to zero-emission vehicles, sustainable fleets. So their goals are much more aggressive than government and they want zero-emission vehicles yesterday. And so we even had a customer ask us, I can't say who if we wrote you a blank check, how many of these trucks can you build us next year? Like, quite literally, seriously said this <laugh>. And, we did the analysis, we said we can build this many prototypes for you and it's going to cost X amount. But so while the government subsidies, what I'm getting at are very helpful. In helping us deploy and build battery factories and, and get EVs on the road, fundamentally, the customer need and desire is already there. So it's just kind of helping stoke that fire. Now from a production side, the Inflation Reduction Act, which for all respective purposes would be called the climate bill, it does produce a lot of capital for building battery facilities and upfitting factories for EV manufacturing. So we certainly hope to take advantage of that in the future.

Tammy Klein (16:49):

So how concerned are you about the competitor fuel types, as it were? You know there's renewable diesel, which is prevalent right now in California to perhaps a lesser extent renewable natural gas. There's conventional diesel which is still a force, it's still being used. No, the big one that really comes to my mind is hydrogen, because what I often hear is, electrification is great for light duty, medium duty, long haul, let's do hydrogen. So, what's your reaction to that and how do you think of the competitive fuel types as it works?

Graham Doorley (17:40):

I'm sure we could spend hours talking about this but I'll try to summarize a couple of points. First, anything that gets us away from burning dinosaurs is great. Like, to me if it ends up being hydrogen or...I guess really just hydrogen at this point renewable energy or renewable diesel or green diesel, wherever we are on blue diesel, whatever they're calling it these days, is a good stopgap to get us to eventually zero-emission driving. And so, I applaud any of that. But to me, the answer is battery electric clearly. But it's, it's not just that. Hey, we worked at Tesla, we were just battery only and that's it. We actually spent a lot of time looking at fuel cells.

(18:24):

So the team here packaged fuel cells. And what I mean by that is we built out a vehicle in computer space. And we put a fuel cell. We talked with crowd-compressed hydrogen companies. We looked at their tank sizes, we built out a system on the vehicle that could take hydrogen. And what we found was essentially from an engineering perspective, a hydrogen long

haul truck is still a battery-electric truck. It just has a hydrogen fuel cell providing energy into the battery system. So, you're still kind of doing battery stuff there. And when we started looking at the industry, we started talking to the big customers. We said, "what do you need? What is, what would make a lot of sense for you from a long haul perspective?" And we started to hone in on this idea of about 500 miles.

(19:09):

And so, when the industry essentially developed around a human driver's ability to drive per day, because it's regulated by law, they can only drive so many hours. And it ends up being that these distribution centers that are the major kind of hubs and spokes of our US logistics system are less than 500 miles apart. And so when we approached the customer said, "hey, if we could get you from one hub to the next hub in one day, in one cycle without having to stop and charge, would that be cool?" And they're like, "that would be great." And you know, they start having all these scenarios, which again surprised me. They're like, we could run this and this and we could have these lanes and all this stuff. So what we found was about 500 miles gets us most...it's like 96% of the routes in the US.

(19:53):

And so then we went back to the engineering side and said, "okay, this is our target now, here's where we have to hit. Can we do this? What's it going to take?" And we started saying, "well, how big does our pack size need to be versus fuel cell and how much power," and ended up being that we can do it with battery. And that cuts out a whole separate fuel source. So, you don't have to have electricity and hydrogen because you would need to charge your battery. Even if you have a hydrogen fuel cell, you're most likely going to have to charge your battery and refill hydrogen. So it gets rid of that whole thing and that extra weight and batteries essentially can do it. And as we're seeing from our design, now caveat this, the only way you're going to get 500 miles though is by ground-up design. And I applaud Tesla. They built a 500-mile truck. so, they showed that the industry, all the naysayers, seriously, you can...

Tammy Klein (20:47):

It can be done.

Graham Doorley (20:49):

It can be done. And so that immediately kind of shut down a lot of that conversation and we're a lot different than Tesla in many, many ways. But speaking about the hydrogen side we looked at, we looked a little further into it and fundamentally hydrogen is great for certain things, potentially aircraft or even really long-haul driving. If there's a reason why you need to go a thousand miles, then hydrogen makes sense because the battery is just the weight and it just becomes too much. You're basically hauling extra battery to haul more load. But with a fuel cell, you're fundamentally taking electricity, creating hydrogen, transporting the hydrogen, putting it through a fuel cell, which is not that efficient. They're about maybe 60% for the best. And then converting that back into electricity and using it.

(21:37):

So it's inherently inefficient. Whereas our system right now is, for better or worse, our grid for electricity is much, much more efficient. So you end up your overall efficiency of battery electric is much higher. So, it just makes more sense. And as we progress towards the future doing our ground up design, battery energy densities are increasing our designs are getting more efficient so we can haul more or essentially drive further with less energy. So as hydrogen becomes more available, battery electric is just going to become better. And so it's, it's like the Betamax

versus VHS or Blu-ray versus HDTV, I firmly feel battery is going to prevail in this space. Others may disagree, but that is our stance. And I'm going to stick by it for now.

Tammy Klein (22:27):

So, the trucks are coming. But what about the charging? What's your view about how charging should be built out, where it is today? Is there enough of what the power requirements might need to be, whether you think it'll be there and just...there's a lot happening. So I've worked on charging issues, the nuts and the bolts for the last few years specifically. And there are some challenges, everything from working with the utility backlog to expedited permitting, you name it. So how confident are you that the charging will be there and how do you see that all playing out? How does it affect you? Well, potentially?

Graham Doorley (23:26):

So as a driver of an electric vehicle now for, oh, well over a decade. So, I've had EVs when people really didn't know much about EVs. I've been dealing with the charging problem from its infancy now. I'm not talking about EV one kind of days, but you know, early, early 2010s kind of timeframe. Charging just really was hard to find. And so, I'm very used to never having charging. So when I drive now and I find that, "hey, there's charging stations around," it always kind of blows me away. But when we talk about commercialization, so there's definitely...if the trucking industry in itself is a little slow, but talking about the industry that's even slower, it's the utilities. So it's not just a problem for heavy-duty trucks.

(24:12):

This is a global problem, certainly a national one that Biden just talked about today. And right. Rolling out more charging and Tesla's going to open up more of their chargers for other vehicle use. So that's great. The amount of heavy-duty trucks on the road compared to passenger cars is small <laugh>. So, we need to solve this problem for everything, not just heavy trucks. Now we have some of an advantage here because unlike passenger cars where America's built on driving and you can drive everywhere and the freedom of going where you want means you have to put chargers everywhere. You know, a prolific amount of charging all over the place. So that when you're at your coffee shop getting your coffee or you're driving to Yellowstone you have to have chargers.

(25:00):

Whereas for trucks if we design them correctly to have that hub-to-hub model and have that capability, we can localize charging. And so that's a bit of an advantage. And so, we are actually working with a company I can't name yet but I'm very closely working with 'em. Just had a couple meetings yesterday. They're, their sole focus is to build out commercial charging for heavy trucks. and they're really kind of pushing this forward, working with utilities, working with customers to get these kinds of facilities built up quickly. and so we can localize our charging, which is where we have a little bit of an advantage. It's a little bit easier because you can work with utilities on a single spot years in advance, and you can build out that infrastructure. So the other thing is we're talking about today, whereas we're, we're going to be rolling out trucks, as I mentioned, kind of middle to end of this decade, several years away, and we're already preparing to talk through charging with our customers. So we have multiple years to kind of bring that online which gives us a little bit of advantage if you were to, if we were to sit here and tell you we're making 10,000 trucks a quarter or something, and we're going to deploy them next week, and all our customers, we would be in a spot.

(26:14):

There's not a lot of charging capabilities. But that's our take. So I do, I think fundamentally it's a problem for us. It's not a problem, it's a challenge, but that we're addressing. but I don't think it's going to help, it's going to keep us from being able to scale.

Tammy Klein (26:30):

So do you think that there needs to be, in the light-duty side, there's sort of the alternative fuels corridors that the DOE has worked very diligently on with industry. There's NEVI funding. Do you think that there needs to be sort of a similar approach for this space? It, isn't necessarily an alternative fuels corridor, but it's about the hub putting into place the hubs and then the government sort of working on the same sorts of things, but applied to heavy-duty trucks uptime, reliability, other sorts of standards and the like and funding,

Graham Doorley (27:14):

Yeah. Additional funding. Of course, more funding always helps. And I mean that seriously because you know, building out a...we're going to have to upgrade our grid fundamentally to deal with all of the EVs, whether they'd be passenger cars or heavy trucks. Now, I do see, again, because trucks tend to mostly run, now I'm talking heavy-duty trucks or even light-duty. there are certain areas they, there's high concentrations of the, that would make sense to deploy more charging. and these trucks need a lot of power where, where they need essentially a charging facility for heavy trucks or even medium-duty trucks requires multiple megawatts of power. This is huge entire power stations, <laugh> essentially need to power these things. And so it does, it would help certainly to build strategic charging facilities in very high-use areas like corridors.

(28:08):

We can just name a couple. The 5 or 80 or whatever, where there's trucks running kind of all the time. so that would definitely help. But again, I think where we can start is installing them with customers or near customers and kind of starting to roll out hit the big high volume areas where there's a lot of trucks moving in segments of road and start deploying EVs there and then start scaling that up. It's unreasonable, I think to say that we're going to have heavy trucks all electric in 10 years and they're all going to be all over. It's just, it's going to take a bit to get to that point. But we sell all on the 225,000 class eight vehicles a year in the United States. So taking even a chunk of that away and making them electric's a big win. Yeah. And, over the next couple decades, I foresee we would quickly alleviate that to be all electric, but it's going to take a little bit of time.

Tammy Klein (29:08):

So, I want to ask you about autonomy and the status of autonomy, especially given your deep and long experience there. How do you see the future of autonomy evolving in vehicles in general, light heavy, so on and so forth. And from the heavy-duty perspective, what do you think we can expect in the next 10, 15 years in the heavy-duty space?

Graham Doorley (29:36):

Good question. So, the media has really, let's say ... I don't want to say thrown out autonomy, but not treated it kindly the last few years. There was a lot of perception that autonomy was going to show up in a couple years and it was going to be everywhere and solve all the problems. You know, it's a hard problem to solve by building autonomous vehicles, it takes time. And I worked at Waymo for just shy of eight years. It was like a few weeks shy of eight years. And I saw us develop from what was then Lexus with Lidar on top, to building our own vehicles, to building multiple iterations of our self-driving systems, then building autonomous heavy truck

systems. they're, the amount they advanced even a year was incredible and they were advancing faster every year.

(30:28):

So, it's like exponentially getting better. So, the technology isn't going anywhere. So regardless of what the media says, and, and I don't mean you particularly just mean the general media, has been pretty negative on, 'it's dead,' 'it's not coming.' That's just not true. It absolutely is coming. The technology's not going anywhere. It's here to stay. So then let's talk about rollout. In many ways, and I obviously firmly believe autonomy in the heavy trucks will be the beachhead where we're going to see it, it makes the most sense. it is a rather...it's a more restricted use case as they like to say. So, when you've got surface street driving and, and taxis and whatnot, that's a really hard problem. That's the hardest problem. There's so much going on all the time that it's very difficult to solve, but highway driving, it's, it's more restricted.

(31:18):

The amount of things that can happen are just less. And so it's a little bit easier to solve that use case, therefore, it makes a lot of sense. Plus your cost per mile is such a big driver in the industry that if you can reduce that significantly with autonomy, it helps adoption. So there's, there's a kind of a lot going for putting heavy trucks...autonomy on heavy trucks, which is why we saw it. That's why we saw all the big companies start trying to do heavy traffic. And so I, I still feel in the next couple years, and, and I would even say within the next two to three, you're going to see fleets of autonomous heavy trucks really start to make headway. They've gone a little bit more under the radar because of all kind of negative attention, but it's there and it's testing and they're making good developments.

(32:05):

And in many respects, the technology is ready to go. It's just how do we scale it Now? That's why Terraline is here, <laugh>. So part of the Tengra is, it's an EV and it's a human-driven EV but we are enabling autonomy in our platform. So we're, we're looking, which is why the truck behind me, you'll see the kind of sensors on the Tengra you'll see the sensors on the vehicle. The idea is we're future-proofing the vehicle, we're, we're making it available and enabled for autonomy. There's a lot of ways we do that. but essentially the architecture is designed to accept an autonomous driver when ready. And so we're, we're essentially saying we still feel very strongly that this industry will move to be fully autonomous in the next couple years, and if not, at least have the ability to be autonomous within the next couple years. And that's why we're building on our platform. so there's a lot more to say, <laugh> on this topic, and, and so happy to, to expand on any of that.

Tammy Klein (33:02):

Yeah, I think it is interesting. I mean, I've been through many hype cycles in my career just working on fuels transport energy issues. And I think yeah, I think autonomy has kind of gotten kicked in the pants <laugh> by the media, which is just that downward curve of the hype cycle before things like sort of reality and things kind of start to level out. But I do think like for light duty I live in south Florida on an island around the Everglades, and you really seriously don't know what's going to pop out at you at any minute. <laugh>. I mean, good luck you know, seriously. but I think for like autonomy on highways like you're saying, and then this concept of platooning, which I think is really, really interesting. also, I just think for the heavy-duty space, it just seems to make a lot of sense.

Graham Doorley (34:10):

Absolutely. And, in fact Florida is one of the more progressive states in the autonomous sector. I mean, I think former Senator Brandis, I'm not sure if he's still there, but he's been pushing we've spoken to him a lot to kind of create a corridor of autonomy in Florida and Texas. and of course, Texas is friendly to autonomy. Arizona is friendly to autonomy. And so, we're already starting to see these trucks are running and, and the public may not be super aware, but in Florida and Arizona and Texas, there are class 8 vehicles running autonomously right now, every day, all day. Wow. And successfully.

Tammy Klein (34:43):

I didn't know that. Wow.

Graham Doorley (34:44):

And so, yeah. Yeah. And so, it's there, there are some of its testing, some of it's actually hauling freight now. So, it's there. It's just yeah, kicked in the pants, I think is a polite term, <laugh> for what's happened to autonomy. But there was a lot of hype and there was a lot of silliness that was created. A lot of companies that just try to get on the hype train that we're seeing go away and the industry's consolidating, which had to happen. So there's going to be a few very successful players. There'll be a handful of them that really push this frontier forward. Obviously, I strongly feel that Waymo is one of them, but Waymo's one of them. but there's others. And I'm very bullish on autonomy in, in the near future.

Tammy Klein (35:27):

So fun. And last question, what excites you most about the space and why? I mean, you left Weymo, you're creating a new company. You're creating a new vehicle design. It's a climb. so, you must love it. so, what excites you most about this space?

Graham Doorley (35:51):

Ah, geez. as you put it, we're building a new vehicle. And as an entrepreneur and a vehicle, I love vehicles in general, it's just that ability to create something new and interesting, but have a, have a real impact. Like really pushing an industry to change, to be more sustainable. That's what excites me is when we start seeing our vehicles on the road driving zero emission. You know, that's a huge win. That's why I get up every day. and that to me, that's the most exciting thing. And, hopefully we can help change the industry faster than it's noted for. And so that's really why we're here.

Tammy Klein (36:32):

Well, Graham, thank you so much for being on the show. Good luck with Terraline. Thank you. And, please come back as you all really get going into the development process further and further and further. It was a pleasure to have you on.

Graham Doorley (36:45):

Thank you, Tammy. It was a pleasure. Anytime we'd love to come back

Tammy Klein (36:48):

And I'd love to take a ride in one of those vehicles just putting it out there, <laugh>.

Graham Doorley (36:53):

Well, you are in Florida, which is again, a friendly state. so hopefully we'll be able to get you in one in not too distant future.

Tammy Klein (37:00):

That'd be fun. That'd be fun. Take care. Thanks so much.

(37:04):

Thank you.

Intro/Outro (37:05):

You've been listening to Fueling the Future of Transport. This show is hosted and edited by Tammy Klein, produced by Carolyn Schnare, and engineered by Aleksander Nolic. To hear more great episodes of this show, learn more, and sign up for a free biweekly newsletter, visit transportenergystrategies.com.