



## **AllianceBernstein Electric Revolution Pit Stop Conference**

### **Ford Motor Company Fireside Chat**

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#### **Participants**

Doug Field, Chief Advanced Product Development and Technology Officer, Ford Model e

Toni Sacconaghi, Analyst, Bernstein Research

#### **Presentation**

Toni Sacconaghi:

Good morning everyone, and welcome. I'm Toni Sacconaghi from Bernstein. I follow IT hardware companies and electric vehicle companies in the United States. And I'm super excited to have Doug Field from Ford join us today and we're going to be doing a fireside chat for the entirety. So Doug, welcome and super great to have you here.

Doug Field:

Thank you very much. I'm glad to be here.

Toni Sacconaghi:

So let me just start with some Safe Harbor comments and an introduction to Doug, and then we'll plunge right in. So I want to point out that today's discussion may include forward looking statement about Ford's expectations. Actual results may differ from those stated. The most significant factors that could cause actual results to differ are included on page 23 of Ford's third quarter earnings presentation, posted at [shareholder.ford.com](https://shareholder.ford.com).

In terms of Doug, many of you know him. He is the Chief Advanced Product Development and Technology Officer at Ford Model e and reports directly to CEO Jim Farley. In his role, Doug oversees design in vehicle hardware engineering across the enterprise, and leads development of Ford's electric vehicles and digital systems within Ford Model e. Doug joined Ford a little over a year ago from Apple, where he served as vice president of special projects. Prior to that, he was Senior Vice President of Engineering at Tesla, where he led development of the Model 3. Coming back to Ford is sort of full circle from a career perspective for Doug, because he began his career at Ford in 1987 and worked there for six years. So again, I think this is one of Doug's first public appearances since he joined Ford, so we're privileged and appreciative for the opportunity, Doug. Thank you.

Doug Field:

Thank you.

Toni Sacconaghi:

So, as I noted, you were a high profile hire from Ford. It's been just over a year, I think. And maybe you could just start by telling us why you joined Ford, and how you were finding the culture kind of 30 years later from when you last left?

Doug Field:

Well, I wouldn't have joined if the culture was the same as it was 30 years ago. I joined originally because I loved automobiles and thought they were such a great intersection of humans, art, technology, design, and engineering. And the American auto industry at the time, I felt like, had a lot of hubris and a lack of urgency for change. And I ended up then heading into technology areas to really have a chance to do some brand new things and try and see if I could have an impact to the world.

The reason I came back. I initially started conversations with Jim because he has an insatiable curiosity for technology. So we met. He asked me a lot of questions on a regular basis. I gave him answers that I'm sure would've gotten me fired if I was inside of Ford, I assume. But he kept coming back and asking for more, and then eventually asked me if I would come to Ford.

What he told me, and what I subsequently heard from Bill Ford, and then from Jim's entire staff, was we have to turn this place upside down or we will lose the opportunity of Ford to be relevant at all in the next 100 years. So right there, there's a level of urgency and a level of humility that I haven't seen. And the really interesting opportunity for me is to combine mature industrial might with new technology. And there are very, very few success stories like that. And I know how much automotive startups have struggled with the depth of capabilities required to make cars in high volume at a high quality. And if we can combine that with the kind of technology that is evolving so quickly in the industry, we will have something to be reckoned with here, and that's what I came to be a part of.

Toni Sacconaghi:

Got it. And culturally, coming from technology driven organizations like Tesla and Apple, what have been the biggest challenges at Ford, or what do you think they are more broadly for traditional automotive OEMs?

Doug Field:

Well, when I was talking about the industrial might from decades or even in over a century of building cars, the hardest part is how you separate history from baggage. One of the things that I was very pleasantly surprised about is that I wasn't selling Ford at all when I came in on the need for change. Ford is committed to this at the top of the company, and it's really about how do we do this? And there is not active resistance to change, but there's very, very deep grooves worn into the dirt that it's very hard to get the cart out of. It tends to fall back in.

So the things that have made Ford so successful: adhering to standards, following process, not taking too big of risks, taking some risks but not too big of risks, have made the products great, but are also the things that we have to figure out how to change. So the biggest challenge, and I'm sure it's true with any mature company, is how do we hang on to the stuff that has made us great, and how do we shed the things that are holding us back? It is not always so easy to know which is which.

Toni Sacconaghi:

So if we kind of zoom out, Doug, and just think about the automobile industry in a period of unprecedented change, can you paint me in your eyes a picture of how you think the auto industry

changes over the next five years? And are there things that you see that you feel are not fully understood or are underappreciated by either the industry or the investment community more broadly?

Doug Field:

Sure. There are several forces that are turning the industry upside down. One is electrification: the move from internal combustion engine powered vehicles to electric vehicles and all of the infrastructure changes that go with that, all of the changes in the supply chain that go with that. So, that's the first. The second is software. That software now will define a vehicle in the same way it does many other technology products that we deal with on a day-to-day basis. And the third is really around autonomy: the idea that you can be in a car and still have viable time left. And whether that's L3 or L4, that is a completely new concept that allows the car to be something else in your life.

What I think the industry doesn't completely understand is that it's the second one of those, software, that is actually the biggest one. It's the biggest change to the industry. It is going to be very hard to build supply chains and transition over to electric vehicles, but it can be done. It's been shown it can be done, and it's a matter of everyone getting on board and changing and building things like the infrastructure for charging.

Software is a completely different way to even just think about cars. The software that's in cars today is generally distributed and it's distributed coming from suppliers. And it's that way because software is sort of substituting for some functionality that used to be done mechanically. So most auto companies have been gluing together pieces of software handed to them from the outside, and that's not a software defined product because you can't update it, you can't control it, and you can't create new functions and features. So I think in terms of the customer's perspective, the biggest change by far, and people don't really understand it yet, is that software will define the product for them.

Toni Sacconaghi:

Great. And I'm going to probably dig into more detail than most folks realize on software in a moment. But maybe before we do, can you maybe provide your perspective on what bottlenecks, if any, do you see hampering EV adoption over the next 10 years?

Doug Field:

Well, there's cost. But even with a premium, Tesla has demonstrated that EVs offer enough advantages to customers, not just in efficiency, not just in environmental friendliness, but in acceleration, in packaging. People just love EVs, and so people will pay a premium for that, and there's a lot of growth still in the EV industry even before costs decline and become equivalent to ICE vehicles.

I would say that the infrastructure is the biggest thing that really has to be nailed for widespread adoption. Most people will charge their EV at home 90% of the time, but if they have a vehicle that they can't go longer distances in, past 300 miles, it really becomes much more difficult to commit to one. This is where Tesla's done such an amazing job. They have picked great locations. They've established very high-quality capabilities in reliability in their charging systems and the rest of the industry now at this point, the growth is going to come from a number of partners and from companies that are going to build out charging networks that aren't necessarily the same as the companies that build the cars. And so, a lot of coordination is going to be required to get the right levels of compatibility, capability, reliability in that charge network, so people just don't have to worry about it.

Toni Sacconaghi:

Interestingly, you didn't mention access to raw materials or potential bottlenecks around scaling battery production, etc. So A, I'm curious about that. And B, I'm also curious about the charging infrastructure as an impediment, because I sort of go back to the Ford Model T in 1908 or 1909, and penetration of automobiles at that point was much, much lower. It was actually just crossed 1% in 1909. But I think 90% of US households had a car 15 or 18 years later, and there had been no infrastructure from the feeling perspective, and that all evolved very quickly. I'm surprised that, that's a concern given we have a precedent where arguably there was less visibility into how dramatic ICE vehicle adoption would occur back in 1909, and we were able to get through that.

So I guess two follow ups on that. Do you not see anything on the raw materials or battery production side that can be an impediment? And secondly, why do market forces not help work things out from a charging infrastructure perspective akin to what we saw with gas stations 100 years ago?

Doug Field:

So I'll answer in the reverse order. So when I talked about charging infrastructure, I was responding specifically to the word "adoption," and it's interesting to compare it to the Model T. So I think one thing that is interesting is that I believe at that time that the adoption started to really rocket, most people refueled at home and didn't necessarily depend yet on the massive infrastructure that would build up over time on gas stations placed everywhere. Also, just being able to afford a car was transformational to people's lives. There was nothing that they were substituting it for maybe other than a horse or something like that. So the EV has a tougher row because you have a substitute, it works well, you're used to it, you know what it's all about, and now you're trying to substitute for it. That's always a harder thing for a new technology to do than to land and provide a function that nobody has had before.

On the battery side, yes. Even if adoption and demand continues to climb as we expect it, the next bottleneck to actually these vehicles ending up in people's hands will be battery materials. And the companies that go very, very far upstream into vertical integration and capture the materials years and years ahead of time, lock them up, and build a clear strategy around the battery supply chain will win. And it's interesting in some ways that goes all the way back to Ford's obsession over vertical integration with the Model T, going all the way back and owning the fields that fed the sheep, that made the wool that stuffed the seats. And this type of change is going to push companies to vertically integrate in ways that they haven't been used to in many, many decades.

Toni Sacconaghi:

Now, if I could follow up on that. So when you talk about vertical integration, does that necessitate equity ownership, or do you envision the industry integration taking the form of firm partnerships?

Doug Field:

I don't think we know how it will land over the long term, whether there'll be a smaller and smaller number of players in the raw material space. Right now, it's certainly about partnerships, and some partnerships do require equity to have the strength of cooperation and the resourcing for someone to actually do something as capital intensive as mine materials and process materials. But I don't think there's a single model out there yet that's evolved, that is a one size fits all deal. We find over and over that when we go to different countries and different companies and partner with very different kinds of people, that each one kind of becomes its own deal. And so we have a fairly significant organization with a ton of capability and they spend all their time just on this. Just on finding the right places that are near

to the markets that we want to sell and represent the right kind of partnerships that we're going to build on.

Toni Sacconaghi:

Okay. Well, why don't we talk a little bit more about software, because you highlighted this as sort of the most defining change for the automotive industry going forward. So at a high level, do you see software as creating strategic differentiation among OEM's models, and/or do you see it as really driving incremental high-margin revenue opportunities? And what is ultimately sort of the OEM belief going forward?

Doug Field:

Well, I think there are several stages of software adoption in automobiles. So one is below the customer's direct interaction level, and this is in the area of controls. And if people want to build simpler vehicles, vehicles that they can over-the-air update, that they can collect data from, that they can do over-the-air recalls on, you have to build underneath the customer a network of software-driven modules that you control and that cross their traditional boundaries of the supply base. So that I think is table stakes, but it's actually one of the hardest steps. And then on top of that, you can do things like have your own in-vehicle infotainment system. And Ford has done a lot of work long before I got here on in-vehicle infotainment and just connecting cars. We adopted modems in every one of our cars a number of years ago and it's creating a huge opportunity, but we still have the software migration to go through.

When things start to become really interesting is when your car is doing things your phone can't do. So I think anything that you put up on a screen inside a car that you can do with a phone is table stakes. Because CarPlay, Android Auto can do that, you assume that any electronic device that you have with a screen, whether it's your computer, your iPad, your iPhone, can do this. It can map, it can play music, you can even get radio stations over cellular, all of these things are table stakes. So what becomes interesting is what can you do in a vehicle you can't do with your typical day-to-day digital devices. And that's where it gets into interesting things around autonomy, around the experience that you have around connecting you to other people and places when you're in the vehicle.

And we think that initially the autonomy aspect of this really impacting people's safety, and the people's quality of travel is going to be a huge one. But like all industries, I think all software capabilities, you get ahead, you offer something, the industry catches up, it becomes table stakes. And you have to keep moving, and you have to keep moving very quickly in the world of software or everything that you've done in the past, if you're sitting on it, will turn into commodity and legacy. You had to pay a lot of money for a word processor and a spreadsheet function Word and Excel when you first bought a PC. And now you fully expect that you can write documents right out of the box with any digital device that you would buy. You'd never assume that, oh, I've got to go pay a whole bunch of money. So those applications moved from features with revenue streams to table stakes, and the industry will do the same thing here.

Toni Sacconaghi:

So if we roll that kind of tape forward, given the competitive nature of the industry. I've looked at kind of pricing power for automobiles over time, and it's actually below consumer CPI despite the fact that a car today is so much more technically superior than a car from 20 or 30 years ago. And new functionality that you see, like backup cameras when they first came up were several thousand dollars, today, they are table stakes. Airbags when Mercedes came out with the first airbag, \$1,000 for the passenger airbag,

\$1,000 for the driver. Curtain came out, it was another \$2,000. Now, even your most modest car has 10 airbags in it. And you don't even ask, and you're certainly not paying incrementally for them.

And so I guess the question is, at end state, is software ultimately a differentiator? Is it chasm that some folks will technically not be able to cross in terms of the module integration that you talked about and therefore there will be cars that just have superior software functionality that you'll gain market share for? You, Ford, or another OEM. Or is this ultimately a new set of revenue pools that OEMs will be able to tap into that will change profitability of the industry going forward? Because you paint a picture certainly of opportunity, but then I think you very realistically say, hey, if you're not always one step ahead, that becomes table stakes. So at the end of the day, is everything table stakes, and are we still at an industry that's getting 1.5 to 2% kind of price inflation over time in a CPI market that's 2 to 2.5% and the consumer is ultimately winning?

Doug Field:

Yeah. Well, to start with on the hardware, I think we're building on vehicles that actually do have differentiation in the hardware. The fact that Apple did thing... Or excuse me, that Ford did things like partner with Apple very early on CarPlay. In all its vehicles, the fact that it has done things like the Mega Frunk in the front of the Lightning, the new Bronco, all of the clever features in a Maverick. There are things that Ford is doing right off the bat that give us an advantage to build on. But yes, can those be copied? Yes, they can be copied over time, but it takes time. You have to tool and build up new vehicles to do that.

So on software, the dilemma that you just described of can you ever build the kind of business that software companies have out of an auto company, I believe it is, yes. I do not believe everyone will be able to do it, not by a wide margin. The level of creativity, the kind of talent, and the speed at which software businesses run is very, very foreign to the auto industry. And Tesla has said before, "we're not a car company in Silicon Valley, we're a Silicon Valley company that makes cars." And OEMs that are really committed to being in the world of software have to build very, very different kinds of organizations and processes and cultures to do that. It's going to be about speed. Your ultimate defense against competition is can you come up with new ideas, deliver them in fantastic experiences where people care about the designs, the details, the interactions. And even little things that you provide if you do them right and you do them in a way that's super easy and intuitive, people respond to that and pay for that.

So the most important thing we are doing at Ford right now is taking all of the capabilities we've built to date on everything from the low-level control software to our early IVI work and then building that and connecting it to a lot of really brand new talent all the way at the senior leadership level at Ford. And I've been delighted at how we've been able to attract, just in the year since I've gotten here, people that I really feel like I'm building the best team of my career. We have people joining from all different parts of Silicon Valley and taking on the really big tough questions of how do we do digital design? How do we build an agile software team? How do we develop the next-generation electrical and embedded system that goes into the vehicle that we build that on top of?

And getting that culture, getting those people merged with Ford in a way that doesn't homogenize it but actually prizes the differences between what we're good at today and what we need to be good at in the future, that's really, really hard. And I don't think most companies can do that. But I think the mistake is thinking that it's a strategic issue. I think it is talent, it's organization, it's culture, that's what's going to build your software muscles and your software momentum that will let you stay ahead. You can't drive those things top down. Can't be done.

Toni Sacconaghi:

Got it. So maybe we can just talk about sort of different areas of the software. You kind of highlighted three if I were to summarize, sort of autonomy, ADAS, control software, and then UI and infotainment. And maybe we could talk about each of those in turn. So on autonomy, Ford just announced a strategic decision to shift capital spending from L4 systems and above being developed by Argo AI to internally focus on L2+ and L3 technology. And I'm reading one of the quotes from the release, "profitable fully autonomous vehicles at scale are a long way off and we don't necessarily have to create that technology ourselves." So there's a lot there and I wanted to unpack and kind of get your perspective.

Was the decision, because you mentioned time in terms of long way off, you mentioned profitable autonomous vehicles as well. Was Ford's decision to focus on L2+ and L3 based on a kind of an evaluation that, hey, we thought this could be two or three years off and it's going to be 10? And in the meanwhile, it's going to cost a lot of money to get there and there are many other players, so that's not an optimal decision for us. Was that basically the rationale, or was there less confidence in autonomy getting there at all, let alone the profitability perspective? Maybe you can shed light.

Doug Field:

Sure. I mean, I think not just Ford, but the whole industry has come to a realization over the last few years that this path is going to be longer and it's going to be expensive, that's not a controversial position. I think when we talk about profitable, there's a couple different ways to look at it. One of the ways I look at it is, even if you develop and crack L4, initially, those vehicles are going to be very expensive. They're going to require maintenance and it's going to take time for them to be able to operate everywhere in all weather. Which means you have to build a business that can handle hundreds of thousands of dollars in material cost for the car, handle the ability to have alternate driver-based fleets if for some reason maps are down or infrastructure is down, or even just the weather is beyond what you've designed for.

So these aren't consumer vehicles, they won't be for a very long time. And, yeah, it's going to take a lot of money to crack it. I think in our case, what we talked a lot about is our passion for L2+ and L3. And that passion is around starting to look at connected data, really trying to understand what's going on in the world, and saying there's still a lot we can do on safety to make people safer and safer. And there's a really incredible opportunity emerging to give people back time on a really tedious part of their journey without having to solve the whole problem, and that you can do that with hardware that is reasonable enough cost that you can deploy this to lots of people. So Ford talks about democratizing technology and that's a big part of what we said is, hey, all the capabilities that have been developed by Argo and other companies around mapping and perception, and machine learning, these are the right tools but we can make so much bigger impact to so many more people if we direct them towards L2+ and L3. My perspective is making capital choices is really important, it gets a company focused, but the limiting capital for us doing these kinds of projects is talent. How many great people do you have that understand the depth of the technology to be able to push forward in L2+ and L3, much less L4. Argo is filled with fantastic talent, and this was a huge opportunity for us to say, hey, everything they've been doing, all the tools they've developed, all the capabilities they have, if we pivot and put those on L3, we can do something really amazing.

And I think a lot of the folks at Argo are responding to that with a lot of excitement that, hey, we can put something out there in a reasonable amount of time that is going to touch a huge number of people. Heck, my family members will be able to see my work. And that's attractive to these folks. And by the

way, they're developing the capabilities and the technologies to ultimately solve L4 at a much wider scale because we're forcing ourselves to live inside of limited compute to work with less expensive sensors. Excuse me. And all of those things are going to be required if L4 is eventually going to be bigger than downtown robo taxis.

I can't hear you, Toni Sacconaghi...

Toni Sacconaghi:

Thank you. You mentioned a number of things there that I just want to follow up on. So one was hundreds of thousands of dollars in material cost per car. And I'm wondering, and do you ultimately believe that LiDAR and associated radar and sensor technology to deliver a L4 car in the near term really amounts to that kind of money? Or are you referring to something more broadly? Secondly, you talked a little bit about the folks at Argo responding ultimately. Can you give us a sense of what percentage of the organization from a headcount perspective will be integrating into Ford? Obviously, if it was a huge subset of the prior talent pool, then that would sort of undermine the decision that you've made to scale back. So maybe you can help on that as well. And I have a couple more follow ups, but let me leave you with two to start.

Doug Field:

Okay. So on the cost front, the cars that cost hundreds of thousands of dollars, that's where the industry is headed right now. And that's where the people who are closest to the breakthroughs in L4 are right now. It won't be like that forever. And what I think the less expensive your hardware, whether it's on the sensor side or the compute side, the more sophisticated your AI and machine learning breakthroughs must be in order to solve the problem, they must be simpler, they must run on less compute and they must be able to gather more from simpler sensors. So humans can drive reasonably well with just their eyes. They don't have LiDAR, but the amount of processing going on in a human's brain that determines how far things are away and recognizes objects quickly and predicts what things are going to do, is a tremendously difficult artificial intelligence challenge.

So I do think that long term these vehicles can be less expensive, but the short term breakthrough is going to require a lot of horsepower and compute and a lot of horsepower in sensors. And then it's going to take time from there. On the second question. Did that answer the first question? Okay.

Toni Sacconaghi:

Yes.

Doug Field:

Okay. On the second question, so running an L4 system, an L4 company right now there, there's actually a lot of spending in a lot of different areas. So you have your technical team, you have all the work you have to do around mapping and sensing and things like that, but you also need to deploy fleets and run those fleets, hundreds of cars in the locations where you're trying to build the initial trials and you're working on a business model. All of those things are a significant portion of the headcount of any company working on L4, not just Argo. So our focus really is on the technical domains, smaller scale fleet, data collection mapping, things like that, and really going deep on the specific engineering skills that apply to L3 as well as L4. So that's a smaller proportion of the entire organization, but the goal is just to find the people that are making the most progress on the technical problem and make sure that they want to be a part of this going forward.



Toni Sacconaghi:

Now, Doug, in response to the first question, you mentioned that companies that were closest to L4 right now, we're using systems that cost hundreds of thousands of dollars. Clearly, Tesla is not using systems that cost hundreds of thousands of dollars. Clearly, on the model of less sensor technology, more AI compute is sort of the objective there. But implicit in your statement was that you felt Tesla and perhaps others who are implementing a sensor light approach are not the leaders currently in autonomy. I just wanted to clarify that and perhaps you could be explicit about who you think are.

Doug Field:

Right. Well, I think there's two ways to work on L4. There's to solve the problem with a lot of hardware and a lot of software and then figure out how to take the cost out and work your way down. And then there's, hey, start with a system like what Tesla has and see if you can continue to build that up using data and machine learning to get it to actually operate in L4. What Tesla's been able to do with cameras only is amazing. It's incredible. But if you were actually to have a demo in downtown San Francisco of Tesla's full self-driving and compare it to a demo that Argo or Cruise or Waymo could do, you'd see that there's still a long way to go. It's amazing what it can do, but there's a long way to go. Most of the other folks who are even like Tesla trying to come in from underneath are still planning to use radar and still planning to use some form of lower cost LiDAR.

And there's a number of companies that are innovating in that space. So to my knowledge, Tesla's really the only one that's really made the bet on cameras only. I understand. I mean there's a purity in that approach that's really appealing. It is how humans work. It is how humans work. And if you can figure out the generalized artificial intelligence challenges that will ultimately be successful. But we are a long way from figuring that out and we are a long way from figuring out how we fit it onto a reasonably sized computer. They're just really two different types of challenges. What do you want to do? Do you want to solve the problem and take all the cost out or do you want to start with an inexpensive machine and figure out how to teach it to drive? They're both very hard.

Toni Sacconaghi:

And when we think about Ford's focus now on L2+ and L3, does that evolve naturally to L4 or implicit in that focus is, hey, we actually think over time we... L4 when it gets there will be democratized and we can license either that wholly or partly to complement our existing capabilities.

Doug Field:

Well, I think it could. There's a lot to play out on L4 and we certainly aren't going to stick our head in the sand while we're working on L3. The excitement really, and the reason we're doing this is the passion we have for the value we could create in a few years on our next generation of vehicles where we're landing brand-new embedded architectures, brand-new EV systems. This is like a third leg of the stool along with our next generation EVs and our brand-new embedded system that's going to create something that really changes the way people think about their vehicles.

And Blue Cruise has already started to show us that the ability to take your hands off the wheel and just look out the front of the car. Even that I've taken very long trips and it's shocking how much more rested and less exhausted you are when you arrive at the destination. So it's just this little peak into what is possible and we're already building all of the data and understanding the customers and what they like and don't like. Everything we learn just keeps saying how big of an opportunity there is to get L3 out

there. L4 will come and we're going to learn a lot in the few years we're going to spend making L3 a reality and I think it's going to make it much clearer what the path is to L4 for us as well.

Toni Sacconaghi:

And Doug, what does L3 success look like and what timeframe? So is it, "Hey, we achieve L3 in three or four years. We believe others won't and therefore we will be able to charge substantially for it. We believe that we will charge modestly for it, but its capability will be so good that will be a key determinant of people choosing a Ford relative to another OEM." What does success look like? Because as you said, if you're not ahead, it becomes table stakes, right? And even base level autonomy at Tesla is now free with Tesla. They have an advanced autopilot and FSD, but the basic advanced cruise control, being able to monitor distance and adjust for it behind the car is now free on a Tesla. So what timeframe and how does success manifest itself if Ford is successful in L3?

Doug Field:

So there's solving the technical problem, which means having a system that can allow the driver to take their eyes off the road and do other things and do that in a broad enough, what we call ODD operational domain, that it's actually a useful feature. If it only works on 100 miles of freeways in clear weather between 10:00 AM and 4:00 PM while the sun is high, that's obviously not a good feature. So you have to solve the technical problem there. I think the magic that we want to deliver really is about the integrated experience. When you solve L4, the user interface actually becomes very, very easy. You get in, you sit down, it goes, you can decide on how you communicate with the vehicle to gain confidence or to set your destination, but it's a pretty simple user interface. The interaction model you need for conditional autonomy is actually much more complicated, but it's also a huge opportunity to create an experience that will blow people away, will feel like they're in a science fiction movie, and also developing in a way that it creates trust.

That is a huge part of this, is developing it in a way where the little things the vehicle does, the ways it communicate to you continue to build trust because it is hard for people to give up control of their automobiles. Everything that they've been taught says don't do that. So that's how I think you create some differentiation and it's a little different than differentiation in L4. In terms of timing, I don't want to get into specifics of launch date, but what I said is true that there's this convergence of our next generation EVs, which I'm so excited about, along with the supply chain that's going to allow us to build millions of those EVs converging with our next generation embedded electrical architecture, which isn't just an EV thing, that's a Ford thing. And that gives us the ability to have software deeply integrated into every single product Ford makes.

And then having L3, L2 plus capability land on that embedded system, which means not just in EVs, but also eventually across the ICE fleet as well. All of those, we are looking to land in the same couple a year timeframe. But I don't want to get too specific on what date that is. When you're talking about the competition, when are they going to do it? Are we going to do it first? What I really want to focus on is building something great, having the best team, doing it right, and moving as fast as we can. And generally, if you have the best team and you're going as fast as you can and you really are focused on something great, the competition has trouble keeping up. If you watch too closely what everybody else is doing and what date they're going to launch everything, you can get distracted and you can end up on everyone else's path trying to go faster than they are. And we need to find our own path as Ford in how we're going to solve this technology.

Toni Sacconaghi:

So success would ultimately sound like in a, wow, these new Fords, the combination of EV range and styling, the embedded software architecture and interface, plus L2+, L3 is really compelling. And this helps tilt the scale ultimately in Ford being a more attractive EV offering more market share, potentially more revenues. But I think that will be dictated sort of by the marketplace in terms of your ability to capture price on that, right?

Doug Field:

Right. And I think that the other thing we shouldn't forget is that they are cars. And the way cars last in our supported for three, four, five, or even 10 years is important to customers. Whether they're built properly, whether they have paint that looks great and lasts, whether they're built in a way that you can see a lot of care was put into them and that they're well crafted, that you don't have squeaks and rattles. And that's where Ford could have a really compelling advantage over some of the folks that are coming into the industry more recently.

It's easy to get just totally overwhelmed by how cool all this new stuff is, but there are basics to how a car functions that are really important to people. And the more people start introducing software and things like that, people are going to be reminded, "Yeah, I don't want to have to take my car in after two years and live without it for three months because the dealer network isn't ready for it." People are not going to want to put up with that when they have choices. So we have to remember, I think that all of this new capability also lands on really compelling physical products that look great, are built great, people want to be in them, the best seats. I mean there's so much that can be done on the hardware side to merge with this as well. And I think people are kind of taking their eye off the ball a little bit on that one right now.

Toni Sacconaghi:

Right. And that circles back to the industrial might point that you raised at the beginning, sort of combining the best of the legacy forward with the innovation that you and others bring. Last question on autonomy and then I want to talk a little bit about UI software. At End State, whenever that might be. From L4, L5, how many solutions actually emerge? I think there are like 40 car companies doing self-driving trials in California right now ranging from upstarts to technology companies like Apple. What do you see, and this is more crystal ball than, I'm not going to hold you to this prediction, but in how many L4, L5 solutions actually emerge and do we ultimately see something like the traditional compute operating system, whether it be in mobile or in PCs emerge where you have two or three or four people, one or two or three of whom are licensing and maybe one or two who actually own the system. How do you see End State?

Doug Field:

Well I think it's different for L3 versus L4 and L5 for a number of reasons. I mean for L4 and L5, I believe there will be a small, very small number of people that ultimately crack that solution and are capable of providing it to the world for a couple reasons. One is it's really, really hard and it's going to take a lot of money to get there. But also if you're talking about cars or vehicles without steering wheels, so an L4 vehicle can either have a steering wheel or not, but if it doesn't have one, it's confined to a particular area or set of conditions, which is the robo taxis. And there's an argument that it is going to be very,

very hard to differentiate in that experience. People will not necessarily own those vehicles. They will use them, they will get in and get out of them.

There are things if you don't do right that will piss a customer off. Hard braking, turning errors. There are things that could get you banned from a regulatory perspective. There are things that can be reliability issues but ultimately those are all detractors. And in terms of something that makes a customer say, oh I really want that one instead of that one, the only thing that you can come up with are kind of the lack of downsides. So whoever solves the problem best and does it for the lowest price is probably going to be able to dominate that robo taxi L4 environment. L5, boy, a product without a steering wheel that a consumer can own and replaces everything we do in a car today that I think everyone agrees that's way off and we have to solve L4 long before that.

L3 is different because I do think there are differentiation in the experiences that you can provide and there are ways to integrate it into all the other things you do in the car. Eventually you're charging, you're trip planning, your schedule, how you want to use autonomy. All these things should start to come together in a vehicle in a way that it's the space that you manage through space and that you manage through time. And it's an environment where you can do tons of things, whether you're moving, whether you're stopped, and it becomes a very integrated experience that is different from L4, I think.

Toni Sacconaghi:

Got it. Thank you. That's clear. So if we could just maybe spend a couple of minutes on UI and infotainment, and you kind of readily noted that increasingly what your phone can do is kind of table stakes. And I guess there are two questions. With Android Automotive and with CarPlay Next Generation coming out next year, are we not going to see that range of capabilities extend significantly? And we've talked about the cost of investment for software and clearly those are about the two most deep pocketed companies globally. And so if we think about role, think about this over the next few years, is it really realistic to believe that OEMs can extend their capabilities beyond the smartphone more quickly than Google and Apple can extend the functionality with their deep software teams?

Given, and especially given the consideration that people are super familiar with their phones, and there is all this third-party data that says, and Ford was first to capitalize on it, people wanted to buy Fords because they had CarPlay and people were familiar with that. So I get conceptually that the OEMs need to create value beyond what the phone is offering, but implicitly doesn't that mean the OEMs are competing against two Silicon Valley, super well capitalized, arguably best software developers in the world and how do they add or win that game?

Doug Field:

Yeah, so this is a really interesting time to watch this unfold. So you mentioned that these companies, Apple and Google have such deep pockets. The other thing is really interesting is for them, automotive is low volume. In terms of where they're going to put their resources, auto is low volume for them. The other thing is auto is very high complexity for them. So a company like Apple has contained a number of products that they can really optimize great UIs around and it is a very different thing to deploy Apple quality experiences across a myriad of different vehicles with different screen sizes and displays and everything like that. They're working on some really innovative ways to do that, that I'm excited to watch unfold. And so a few of the other dynamics, one is you can't have the car become inoperable if you unplug the phone and you can't decide ahead of time, at least right now in the world, that all of your customers are going to use either an iPhone or Android, iOS or Android, and make it not work for anything else.

So you've got to build a UI, the OEMs can't get out of that. You're going to have to build a UI. The things that these companies do so well are exactly the things we are adopting as we move into building off of things like Android Automotive OS. Do not build maps inside of an auto company that is dumb. So leverage Google Maps embedded if you can, or leverage CarPlay or Android Auto. Do not try and build voice recognition inside an automotive OEM, that is also dumb. So build your system around using the voice recognition of Siri or Google and build the system up around that. Those are all things that we shouldn't compete with these companies on. And then when it comes to interaction with your ecosystem in your media, your calendar, your music, those are also places where we should not be trying to get in the way between you and the ecosystem you use every day on all those other products, but now there's the next step.

So there's all sorts of things. We can place cameras in the car at unique positions and keep them in the same position relative to your face. You can't do that with your phone unless you like mount it somewhere and physically lock it to that location. We have speakers located in precise locations all around the vehicle and microphones located in precise locations all around the vehicle that can change the interface. Think about the future of AR. You can put goggles on and walk around or you can sit in your car and have the largest glass piece of space that you look through into the world. That's going to be for a lot of purposes, that's better than any set of goggles. You have to be in the car. But once you're moving in a vehicle, that's a better AR experience than you can ever have, a set of goggles.

When you start combining how autonomy is going to work with charging, you have the opportunity to do unique solutions. So I think there's no single answer. I think it's very important that we are focused on not trying to get in the way of a customer's great relationship with Apple or Google, but that we also recognize that that is a contained set of experiences. I also think that small companies are really going to benefit from things like CarPlay too, because they will get world class design without having to have a large organization that can move very quickly and develop a group with taste. We are investing in this, we are investing in digital design. We've hired fantastic people leading that effort. We've coupled that in with the software talent that we're building and we will have the capability to build really magic and beautiful interfaces with the car. We have to. That's a huge, huge part of the customer experience in the future of automobiles. So we are going to be capable of doing that.

Toni Sacconaghi:

Great. I think we have one more minute, so we'll have to do a Kramer lightning round. Last question. With five new well capitalized players in the auto industry, is the auto industry going to be more competitive going forward? And how do we think about that? We've had a really competitive industry for the last 40 years, in part because it's global in part because consumers have different wants and different geographies. But certainly, from a number of entrants it feels like, well there are many, many more competitors today. Does the auto industry become better or worse for incumbents over the next 10 years?

Doug Field:

For incumbents? Well, I think there's a window of opportunity here while the world gets turned up and down that creates a window of opportunity for incumbents. It always does. To any industry that's transformed by technology. Ultimately the competition will be just as high or higher than it is. The only difference is going to be your competitors are different. Different people are going to win at the end of the day. And I'm here because I think Ford can actually win. It's going to be really, really difficult, which is why the other OEMs are not necessarily going to figure it out. But I think Ford has a chance, has a really good chance to do it.

Toni Sacconaghi:

Well Doug, I want to thank you very much on behalf of investors on the call for your time today. I found you to be incredibly candid and thorough on your responses for which I'm deeply appreciative and I'm sure others on the call are. So thanks very much. We look forward to seeing all that you bring to Ford over the coming years and again, appreciate the opportunity.

Doug Field:

We're building a great team and Ford already has an amazing team to add that onto. They will be who actually pull this off, not me. But thank you. It was great to talk and your questions were really intriguing. Thanks.

Toni Sacconaghi:

Okay, thanks very much.