Ford Motor Company

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Adam Jonas: We're going to get on with this. I realize this is quite an ambitious agenda, just of how quickly we're flying through it and didn't really allow for too many breaks, but again, high-quality problem to have.

Really pleased to have with us representing Ford Motor Company Don Butler, Executive Director, Connected Vehicle and Services. And as I was talking to Don here, I asked him -- I'm really bad at memorizing bios. I said, "Remind me how long you've been at Ford," thinking he was going to say 20, 30 years, sometimes there's 40, sometimes -- there's someone at Ford that's been there 50. I don't know, there's got to be a couple. There's a couple. And he's like, "Four and a half years." Well, you're a baby.

So, why don't we start off that way, Don? Just tell us kind of how you got to Ford, why you've chosen to kind of work your craft there, and some of the key messages of your mission at running Connected Car at Ford.

Don Butler: Yes, sure. Thanks, Adam, and it's great to be here to speak with you all this morning and to share a little bit about where Ford is from a mobility and connectivity standpoint. As Adam mentioned, I've been at Ford four and a half years now, so I joined in January, and immediately upon joining, Mark Fields called me and said, hey, we need you to represent us at CES in Las Vegas, and so that was quite a daunting way to move into the company. But, actually, it was a great experience for me.

And the reason that I was able to dive in right away was because of my background. So, prior to Ford, I spent most of my career with General Motors, and immediately prior to this connectivity position within Ford, I led Global Strategy for Cadillac, also spent quite a bit of time with OnStar, GM's telematics subsidiary in two different stints, and first of which was running business development and planning for OnStar. And, interestingly, some of the folks that I interacted with and negotiated with -- so we did our first CDMA agreement with Verizon, and Lowell McAdam was the person who was negotiating with me. Obviously, he's gone on to bigger and better things, and happy retirement for him I think, as well. And the first device agreement that we had, again CDMA, was with Qualcomm, and Paul Jacobs was who I was working with there.

And so, it's interesting that the industry has moved maybe a little bit more slowly than a lot of us anticipated, but now it's absolutely turbocharged in terms of what's happening with connectivity. Number of different positions within GM, started as an electrical

engineer, got my MBA, saw (ph) planning roles, marketing roles, engineering roles, but all wrapped around technology and how technology is influencing and impacting the industry. The reason that I landed at Ford, couple of things. Number one, I needed a culture change, and was really enthused about what Alan Mulally was bringing to Ford. And they were looking for a person that could bring together a technical side in terms of understanding depot (ph) technology and where it was headed, a marketing or consumer experience, or should I say user experience perspective in terms of what would these technologies enable and how should we think about it from a customer-centric viewpoint, and then, finally, someone that understood enough about how you need to merge sort of the consumer electronics pace with the vehicle cycle development plan pace. And so, sort of a unique skill set, and just fit the position that they were looking for.

And so, I've been there now for four and half years. And primarily, my role has been driving what we call embedded connectivity within Ford. Beginning in 2007, Ford saw, right, the mobile device and the SmartPhone and really thought that interacting with the SmartPhone was the best way to make the vehicle capable of interfacing and interacting in consumers' lives, and so, therefore, Sync and being able to interact with your mobile device, the apps, the content, the media that's on that device. But, they were slow -- or I should say we, let me correct my pronouns now -- we were slow to adopt embedded connectivity, which GM led with OnStar. And so, part of my role was to really get that shift happening with in our business.

And fortunately, now we are on track to, by the end of next calendar year, 100% of our vehicles in the U.S. will be connected, embedded data modem connection, if you will, so that represents two million vehicles a year. At the end of this year, 2018, more than four million of our vehicles will be connected. And it's not only embedding that connection within the vehicle, but it's also making sure that the infrastructure and our systems are able to accommodate the data, the services, and everything else that we'll be delivering, as well. So, maybe that's enough of a preamble.

Adam Jonas: So yes, let's go that -- into the targets of where we are today and then where you want to go. So, that's 100% of new vehicles with embedded connectivity by?

Don Butler: By 2019.

Adam Jonas: By 2019.

Don Butler: So, essentially, as we start the 2020 model year, 100% of our vehicles will be connected by that point. And roughly--.

Adam Jonas: --Full U.S. -- that's a U.S. target?

Don Butler: U.S., actually U.S. and China, which we've said that publicly as well. And then, globally, roughly 90% of our vehicles, new vehicles going forward, connected by 2020.

Adam Jonas: And that number's in the kind of six-million-unit kind of range?

Don Butler: Correct, right.

Adam Jonas: And that's -- and remind us then the starting point today, like just so we can understand the delta?

Don Butler: So, we're roughly around 40% penetration today. And so, it's represented a huge uptake.

Adam Jonas: Yes. Is that a 4G pipe, 3G pipe?

Don Butler: 4G.

Adam Jonas: 4G pipe, okay. So -- and tell us what kind of data are you -- what kind of data are you collecting, and what can, or what does Ford do with that data?

Don Butler: Sure. That's a -- I could probably spend the next 45 minutes answering that question. So, we collect data as a result of essentially three different pathways, right? One is just consumers interacting with the vehicle, so remote start, remote lock, remote unlock, just those kinds of interactions, right? The second thing we collect, and it's kind of related, when consumers request a vehicle health report, or they check fuel status or tire pressure, right, we access that data, as well. And then, finally, we do our own remote diagnostic request. So, that's unprompted, but we can essentially query the vehicle for -- today it's basic diagnostic codes. As we go forward in the future, much more sophisticated in terms of diving into the microcontrollers themselves and understanding what's happening.

And today, because most of that interaction is episodic, right, in terms of things like remote control, it's roughly on the order of two megabytes a month. It's not really that significant from an overall data perspective. But, as we get to 2020, and we've also said this, right, beginning 2020, all of our -- not all, but beginning in 2020, and as we go through major platform upgrades, our vehicles will be capable of over-the-air updates for every significant module on board the vehicle, similar to where Tesla is today. And that--.

Adam Jonas: --Firmware updates?

Don Butler: Firmware updates.

Adam Jonas: By 2020?

Don Butler: By 2020, yes. Yes. And so, in that case, we're talking about much, much higher data throughput. But, I'll give you an example of how we're using the data today and how we anticipate using it, going forward. And I'll talk about that remote diagnostic request, for instance.

So, today, we have the ability to query the vehicle, or in the incident that a diagnostic code is set, right, there's a trigger and we get that. And what that enables us to do is really attack from a -- as our CEO likes to describe it -- from a fitness standpoint, attack where we are on warranty costs. And as I describe the example, I think it'll kind of make sense to you.

So, today, we essentially rely on warranty reports from our dealers in terms of situations that are going on in the field. And if you think about from the time that a customer may see an indicator light coming on in their vehicle, maybe it comes on two or three times, you don't know what's going on, it takes you a couple of weeks to get into the dealer, dealer tries to diagnose it. Maybe it's another week or so. And then, so there's four weeks potentially between the time that light first indicated to the time the dealership figures out potentially what's wrong. Maybe there's another two weeks until they file the warranty report that we then see. And then, maybe we've got another 100 dealers across the country that are sending in these reports. And so, by the time that first indicator

appeared, we're looking at maybe three to four months until we get some sort of indication.

In that time, we've been building these vehicles in our factories at whatever the rates are, 60 jobs per hour or what have you, so literally thousands and thousands of vehicles that have been produced with potentially this issue, right? And so, through our remote diagnostic request or when we get the trigger from that light or indicator being set in the vehicle, we can instantly then understand, okay, what's going on, what's happened, what were the parameters associated with this light coming on, and then, in a sense, not continue to build that problem into our vehicles, going forward. And so, significant warranty cost reduction there.

Adam Jonas: So, what you're describing sounds very worthy initiative that creates value for Ford with managing an important expense that can affect the reputation of the company and improve safety. There's consumer value for what you're describing. But, how does Ford get paid for this stuff? Because everything -- and we're going to get to 5G, we promise, folks, but what you described there does not seem to require that kind of 5G pipe.

Don Butler: No, it doesn't.

Adam Jonas: But, it's also not something that you're obviously getting paid for relative -- that creates a competitive advantage that Ford might have versus all OEMs that presumably, with a few years' difference, will arrive at that same place. You won't be able to sell a car without that kind of stuff soon. So, how does Ford get paid for this? Kind of what's the model? Looking outside improving consumer experience or warranty, what's the monetizable data opportunity for Ford?

Don Butler: Sure. I would say that the cost benefit is very real, right, and so that's really dollars that are flowing to the bottom line, so I don't want to be dismissive of that.

From an overall services perspective, there is pricing built into the vehicle for this remote capability, right? And so, we do get pricing upfront, and then we are looking at what sort of model makes sense from a subscription basis, going forward today. With a Ford vehicle, for instance, those services are included for five years, but we might look at adjusting that time period and moving to more of an ongoing subscription basis.

And then, the other thing that we're looking at, particularly as we get into over-the-air update capability, is being able to deliver new services post-vehicle sale, right, and engaging with consumers from the standpoint of delivering services that they might find delightful. And even potentially taking things that we have today and repackaging them based on the value that someone might ascribe to it.

I'll give you a specific example. Today, we -- and I'm not saying we're going to make changes here, but today we include Car Play, Apple Car Play, the linking technology, with the vehicle. Well, roughly half of our consumers have iPhones. The other half have Android-based phones, right? And so, maybe there's a model in which we have a flag, or we download Car Play post-vehicle sale if that's something that you really want, and there's some nominal charge that's associated with that, right? And so, taking what we have today and repackaging it and making it more amenable, and making it more relevant for the consumers for whom there's specific value, and having those consumers being willing to pay us for that value.

Adam Jonas: But Don, isn't the paradigm shift the game-changer that -- where Ford can get to a point where the value of its data from your subscriber base or vehicle population base is so valuable that it's worth much more to you than to the consumer so that -- such that you would -- whether if Ford's doing a transportation-as-a-service model, it would just be embedded in the cost of the models in a visible, whatever, a couple cents a mile? Or in the case where there's still private vehicle ownership, it's provided, the connectivity comes as standard because you -- the car to you is worth so much less if it's not connected? You follow me?

Don Butler: So, no, I get you exactly.

Adam Jonas: It's because getting such repackaging (inaudible), hey, we used to give you Car Play for free. Here's $5 now. People are going to be like, "Screw that," right?

Don Butler: So, some may.

Adam Jonas: That webcasted (ph), by the way, research is back behind that (ph).

Don Butler: So, there's three facets of value, right, and we talked about the internal benefits, warranty, that kind of thing, right? The second aspect is direct consumer services, and I gave one example, right, and there's other examples. The third, and you alluded to it, is third-party value for that data, right? And so--.

Adam Jonas: --Isn't that like the -- maybe you don't want to talk about it too much here, but isn't that--?

Don Butler: --We think there's huge potential there. We absolutely think there's huge potential there. And one of the examples that we've recently launched, you may have seen about a week or so ago we announced Ford Commercial Services, which is a digital services group leveraging our vehicle connectivity and that technology to essentially provide services to fleets and fleet companies. And there's a spectrum in terms of that value equation. One could be very simply just the vehicle data, again, with the -- in the case of fleet, there's a little bit more flexibility because we're taking the fleet owner as being responsible for that asset, and so there's less of a direct customer privacy issue, because those employees have -- as part of their agreements have said this vehicle is not mine, and it can be used for data, or whatever, right?

So, it can range from the simple to, if you've already got your own back-end systems that can essentially process that data and generate insights from it, then here's the pipe of data. Here's the monthly usage fee for accessing that data. There you go. And that's in tens of dollars per month, right? You can also go to the other end of the spectrum, where we become a full-service commercial services provider for those that may not have that kind of capability in their own back-ends, right? And so, not only the data, but the insights from the data, and then directing that fleet provider in terms of logistics and what you need to do with the vehicle from a service standpoint, efficient routing, and that kind of thing.

Adam Jonas: So, let's make the leap. I want to get Armintas involved here. So, we're about to go from connected car to then when 5G actually might be a gating factor and a liberating factor. So, we leave this world of connected car where the revenue opportunity might be in the tens of dollars a month, and what's -- what would be the cost of equipment, or the cost -- variable cost for the car to enable a 5G embedded connectivity car, roughly?

Don Butler: I actually can't give you an answer.

Adam Jonas: Then don't. That's fine. Okay, all right. We have some assumption of what that is, or we can discuss it offline. So, Armintas, why don't you then go into, as we get closer to the level four, level five, where the data usage kind of goes up by order of magnitude and how 5G plays a role?

Armintas Sinkevicius: Yes. So, Don, just curious, as you're thinking about the future of autonomous vehicles, how much of your development for autonomous vehicles is dependent on 5G? We're trying to figure out how much of it is a need-to-have versus a nice-to-have.

Don Butler: Yes. I would say, today, I would describe it as nice-to-have to the left side of not really needing it. And the reason I say that is because we need to ensure that we are able to operate autonomously in the event that we'd lose a connection, right? And so, having said that, it's in the nice-to-have camp from the standpoint of things like updating maps and things like real-time indication of what we call anomalies, right? So, this is what my HD map is saying. This is what I'm seeing. Let me communicate this back to make sure that everything's okay, or to provide this new information in terms of updating the map.

As we go forward, I think what you'll see is connectivity being a complement, a significant complement to what we're able to do with autonomous. And I heard part of the discussion in the previous session, right? And so, what you can do, as we move into 5G, is, in a sense, broaden the sensing capability of the vehicle. And so, within an autonomous -- or within a network of vehicles that (ph) are operating, if you've got more than one autonomous vehicle, either from a vehicle-to-vehicle communication standpoint or vehicle-to-infrastructure, you can leverage not only your own on-board LIDAR, but you can leverage the LIDAR on another autonomous vehicle, or you could leverage the LIDAR in an infrastructure situation.

And if I could segueway for just a moment, you talked about some of the characteristics in terms of 5G and what's going to be necessary in terms of cells, much, much more dense cells. They will be smaller, and so maybe you won't be so offended, Adam, if it's posted in your -- because it's going to be smaller, and I think there's an opportunity, from the standpoint of municipalities and what they're going to be looking for in terms of things like smart stoplights, smart signs. I think there's an opportunity for a convergence of the needs of the network operators and the needs of cities in terms of making their cities smarter. And to me, I think that's where you can see potentially how this sort of gets broken through in terms of easements versus cities wanting to be smart and wanting to be more connecting, wanting to have the opportunity to have an orchestrated transportation system.

And so, in terms of going back to the autonomous vehicle, so what we can do in that case is leverage potentially maybe there's a LIDAR that's built into the stoplight, and you get visibility around corners and around that whole intersection. So, not only is the vehicles coming up to it, but its range in terms of what the LIDAR sees. And I'm just picking one sensor, right, but the ability then to capture data from either other infrastructure or other vehicles to enhance that experience.

Armintas Sinkevicius: And the data coming from the stoplights and other vehicles, that presumably leads more to EDGE computing rather than having to pay for wireless data through (inaudible)?

Don Butler: Yes. And so, we are trying to be very thoughtful in terms of how we package the data, how we send the data, what needs to be sent immediately, what can be cached. And so, we really only want to have the things that require immediacy to be something that's sent

via cellular. Other aspects can be cached onboard the vehicle, and when it's back into the -- in the depot, we can either, through direct wire connection or through Wi-Fi, sort of offload that. And it really is trying to be smart about what you do.

And the other thing, too, is we talked about EDGE. And if you think about particularly as -- at least from our viewpoint, and we think others are moving in this direction as well, we're going with level four. And so, what we've said is, in 2021, we'll have level four vehicles autonomously in operation. What that means for us is within a well-understood geofenced zone, right? And so, if you think about vehicles operating within an understood geofenced area, as that area changes, we don't necessarily need to send the data that describes that map all the way back to our central database, right? It can reside relatively locally, right, because the vehicle's only going to be operating in that area. It doesn't need to understand what's -- let's say it's in Miami, for instance. It understands that geography, and it doesn't need to understand what's happening in Detroit or in San Francisco. And so, we're really thinking about what needs to -- not only what needs to go off the vehicle, but what can we do at the edge of the network and even at the edge of the vehicle itself in terms of processing and computing.

Adam Jonas: So, as autonomous cars -- seems like it's more -- it's an EDGE compute. It's a computing problem that eventually can become more of a network problem if you're thinking of that spectrum. So, where does cyber fit in there? Because I know a lot of auto companies that -- the logic for why they were so slow in embedding connectivity for mission-critical things like OTA updates that could be more hackable, was that some of it? Was that some of the gating factor? And kind of how does Ford deal with cyber risk (inaudible)?

Don Butler: I'd say that may have contributed somewhat to the hesitancy, and it's actually -- it's ironic, because as you make the vehicle more connected, there's more of a threat surface, right? But then, on the other hand, you then have the ability to remediate and to basically send a patch to the vehicle to correct something that may have been a vulnerability previously.

And so, we've been, again, very, very thoughtful and circumspect in terms of our approach to this. And so, that's one of the reasons that we are part of and helped form the first Auto-ISAC, so the Information and Security Sharing Consortium. We also -- from what we understand, we were the first OEM to have a vehicle cybersecurity audit conducted, right? There are enterprise cybersecurity audits that happen, companies like Mandiant, for instance, conduct those on enterprise IT vulnerabilities. We wanted to look at our own vehicle cybersecurity condition -- I'll describe it that way -- and so, we commissioned to have an outside party come in and basically conduct an audit from all -- in terms of all aspects, everything from our suppliers and their relationships to manufacturing to vehicles in the field to our back-end systems to understand where we were.

We also do penetration testing on all of our vehicles. We've instituted a bug bounty program, for instance. And so, we're very, very careful in terms of our approach in adopting industry-standard practices like not only encrypting the data pipe, but encrypting the data that's on the pipe, things like code signing, for instance. And so, being very, very careful there, because the fact of the matter is our vehicles need to be connected, and so it's -- we're not going to have a choice of not connecting for fear of a cyber-attack. And in fact, because we're connected, not only will we be able to prevent those attacks. Again, we'll be able to understand them much more quickly as well in terms of things like intrusion detection, and then remediate those attacks, or the vulnerability through over-the-air updates.

Adam Jonas: Now, if I ask you to rank in terms of gating factor of 5G playing a role in a connected or autonomous car ecosystem, and if I gave you a choice of technology, cost, or business model, what would be the biggest gating factor between tech, a business model that doesn't exist yet, or just cost? And I would include in cost regulations.

Don Butler: Yes. I'd say cost at this point, and sort of a close second would be business model, cost because it is a more expensive proposition, right, and it's one of those situations where you certainly don't want to be too far behind as 5G starts to roll out. But, on the other hand, you've got to be careful about when you do adopt, and rolling that cost into vehicles without necessarily those vehicles seeing the immediate benefit. I would say, again, sort of alluding to something that the previous panel was talking about, we see China as being a place where things are coming together much, much more quickly, and having the capability in terms of where we see government, where we see business model, and where we see technological capability coming together, our expectation is that China is going to lead, U.S. quickly following after that.

I would say the benefits, though, are not necessarily, hey, the first to begin to implement reaps all of the benefit, right? I think there's more than enough room globally, as well as in terms of players, in terms of a value that's going to be created for everybody to have a successful piece of being able to benefit.

Adam Jonas: And is that maybe a side conversation we could have about China and national security as cars become smarter and tracking where the Communist Party members are going, and the wives and children, and food and medical equipment and military supplies and things like that, but we'll save that for later.

So, just a -- I mean, I find -- isn't the fleet -- if I ask you to cut your addressable market opportunity for connected and autonomous car between fleet and consumer, it seems like fleet, for a variety of reasons, including data privacy, which I know Ford has been very outspoken of, it's consumer's data unless they give us permission, kind of, and that's fine. I mean, Apple has a similar model. So, you have -- I just did some "back of the margin of the envelope" math here. Ford has 80 million cars on earth, roughly. If you viewed those cars as subs just for a moment, and if Ford could get $1 per month from all 80 million cars, just $1 per month, so think about what you pay for Spotify, or something like that. That could be about $960 million of revenue per year. I'm being maybe generous, but the margins on that are pretty-pretty high, potentially. If I used 80% margin at 10 times EBITDA, we're talking about 20% of the market value of Ford for each dollar.

So, you can take haircuts to the margin if you want, but it seems like starting from essentially zero sub revenue, if I'm being -- just round numbers, it's all upside. But, am I wrong in that? I mean, GM just did this deal with Amazon on logistics, if you will--.

Don Butler: --Secure (ph) deliver the vehicle (ph)--.

Adam Jonas: --Absolutely no reason why Ford couldn't do something similar. Am I a little too excited about just the opportunity for Amazon, et cetera, to tap into that vehicle ecosystem, particularly in the wake of Softbank being this kind of watershed transaction that really woke up the market's awareness for cars and untapped ecosystems for commercial and fleet usage?

Don Butler: I think there's a huge opportunity. It's one of the reasons that I'm in this position, because I see the opportunity and because I want to help bring it to fruition. And it's twofold,

right? It's vehicle as a content platform, both content coming off the vehicle as well as content delivery to the vehicle, and it's around not necessarily displacement, which would be tough, right, if you're trying to substitute for something that already exists. It's additive in the sense of data that -- or capabilities that people don't even access to today. So, deliver the vehicle pieces, that's a great example of that, right? And fair to say, we've -- we have also -- I mean, we've talked about Amazon and Alexa. We have a really good relationship with Amazon. We understand kind of where they're headed. And as things come together, you may see future announcements from us in that regard, as well. But, the ability then to remotely interact with that vehicle is something that didn't exist before.

And so, being able to leverage it for delivery, that's great. I think the data aspect is huge. And when you think, going forward -- and one of the other aspects around 5G is, particularly if you think about that autonomous vehicle, and it doesn't even necessarily need to be an autonomous vehicle, when you think about the sensor array that's on our vehicles and the ability for that vehicle to, in a sense, be the barometer for whatever the environment is around it, whether it's weather or potholes or anything else that you'd want to characterize--.

Adam Jonas: --Someone's face.

Don Butler: Potentially, depending on the country.

Adam Jonas: There's bad people out there, bad people out there.

Don Butler: When you think about the opportunity that that represents -- and again, it's not -- it's additive, right? It's additive onto existing data sources that we have today. And so, I do agree with you that, from a commercial perspective, I think that's a sweet spot for Ford, given our strength in commercial vehicles in the U.S. and actually globally, for instance. We think it makes a lot of sense for us to really look at that from the standpoint of building on that existing capability in terms of the connections that we've got, the relationships that we've got with those players, and then building these digital and data services businesses on top of that, really, really huge. And we've even -- and you've seen us discuss this relative to AV, right? AV is going to be personal and commercial, right, because we want high utilization, so ferrying customers during the day but packages during the evening, for instance. So, commercial absolutely dovetails with where we see the sweet spot being.

Adam Jonas: Keith, you're standing up there. You got any questions for the -- Ford's connectivity, or you just chilling?

Keith: (Inaudible - microphone inaccessible.)

Adam Jonas: So, the question for the Webcast, is there a role for software services company.

Don Butler: So, it's interesting. As we make the shift, and I would say we are well underway, of not just being a hardware company, but we view ourselves as a software and services company, we've actually begun to insource much more of the software. Let's take our Sync infotainment system, for instance. Previously, that was a traditional kind of tier one model, and we outsourced the software and the hardware, and it was built based on kind of waterfall specs. And took a long time. We weren't able to move as quickly as we would have liked. We acquired some resources from BlackBerry and basically turned them into our internal IVI software team, and now we're able to spend (ph) much more quickly on that software, and we're actually implementing more of a build-to-print (ph)

model for the hardware, so it's very analogous to what Apple is doing with the iPhone, for instance. And so, built to our design. We control the software. We control the experiences. For us, we're able to move much, much more quickly, and we're also able to then capture more of the value.

Similarly, on the data and analytics side, we were, I believe, one of the first OEMs to have a Chief Data Analytics Officer, Paul Bellou (ph). And so, we've staffed up that capability internally. Having said that, we do want to leverage the capabilities of others where it makes sense. And so, Azure right now is our -- more from an infrastructure-as-a-service standpoint, but that's our cloud provider. But, we've shifted to pivotal cloud foundry as a framework, and so we've got the ability to point to AWS or Google, or Azure as the situation might dictate. And then, there are some things that, from our standpoint, if it's not germane and core to the vehicle experience, then yes, we'll work with others.

And so, some of those areas in terms of mining the data, maybe we'll work more closely with an Accu-Weather, for instance, or someone else, because that's not necessarily an area that we want to plumb, but we do want to provide the capability of developing services, and maybe working with a partner to craft those services. So, more internal focus in terms of software and services, but then leveraging partners where it does make sense.

Adam Jonas: But, as an aside, Ford owns about $700 million worth of pivotal, so I don't know if you were responsible for that investment, but good job. More questions for Don? (Inaudible?)

Unidentified Participant: (Inaudible - microphone inaccessible.)

Don Butler: Just slightly, yes. So, we are also very active members of 5GAA. In fact, I do sit on the Board, and we believe that the 5.9-gigahertz spectrum in the U.S. needs to be opened for cellular usage. We absolutely believe in the safety benefits and leveraging it for vehicle-to-vehicle communication. We just think the technology choice needs to be different. And the reason for that is exactly what, again, you all were talking about in the earlier session. As we see this migration to 5G, we view DSRC as on a path to being relatively static and not moving forward with where we see communication technology going.

We also see, as I mentioned previously, this potential intersection of the need for more cell density with the need for cities to have smarter infrastructure, and we believe that we can leverage that from a vehicle-to-infrastructure communication standpoint. We've mentioned that all of our vehicles will be connected in the U.S. by the end of next year. That core cellular connection basically with cellular vehicle to everything communication, not to over-simplify it, but then it becomes a feature on top of the core connectivity that we already have in place. And so, instead of a separate radio, separate antenna system around DSRC, we can build on the capability that we're already planning with cellular.

And so, we've been in discussions with NHTSA. You've seen our public response to the proposed rule. We've had very good discussions with NHTSA. We are actually working very closely with them on testing CB to AX (ph) and demonstrating its efficacy. We held a demonstration in April in D.C., and had a couple of the FCC commissioners there, as well, and so they were very amenable to what that represented. We just think it's a better path, going forward, and that's one of the reasons that we're members of 5GAA, and we

think it's going to help us realize the benefit of what we think 5G can bring to automotive.

Adam Jonas: Well, one of the things that I find that an investment community can maybe underestimate is that national security element here of, as transportation becomes a public utility, a public good that's connected, hackable, but also affects the GDP of communities and regions the whole country, and is, of course, capturing data to train a neural network for AI, which might have other uses besides just taking you to work, we have to get it right. And so, the impression we tend to get from the lawmakers is kind of get out of the way. Like, the tendency to don't regulate too early, don't stifle innovation, get out of Elon Musk's way, get out of Jim Hackett's way, and then we'll kind of let the legal system work its course, and we will be at a disadvantage to China in some key areas. But, let it go, because we have to get it right.

Don Butler: And I think, maybe just to add to that, Adam, we favor a much more collaborative approach, because this thing is moving so fast, but, number one, regulation takes so long to develop. By the time you develop, it's going to be outdated, right? And so, we are much more in favor of a collaborative approach and a learning together kind of approach with the right kind of guardrails from a safety standpoint, but we think that's the only way to really benefit, going forward.

And we think, from the standpoint of the U.S., we've been the innovation hub of the world. I think we're going to continue to be that just because of the flexibility that we operate with. And hopefully, our regulators and government officials continue to look at that in a spirit of collaboration and, to your point, not regulating too quickly based on what we think we know today.

Adam Jonas: More questions? Go ahead, George.

George: (Inaudible - microphone inaccessible.)

Don Butler: Yes, that business is so complicated and fraught with -- speaking of regulations, regulation to begin with. We'll partner, right? Now, that's not to say that we might not adopt an MBNO approach at some point, right, but we're not going to get into the -- certainly we're not going to get into the physical infrastructure side of it, and we're not going to get into the buildout side of it. That's going to happen, and we'll work with the right partners.

And what I would say is that we want to be flexible, right? And so, looking at UUSEM (ph) and what that might mean for us, going forward, as opposed to being tied into one particular carrier, but having that flexibility, but no, I don't see us getting into the network business.

Adam Jonas: Questions?

Unidentified Participant: (Inaudible - microphone inaccessible.)

Adam Jonas: You want to compete against Google.

Don Butler: We already do in some respects, right? I mean, the value and the battleground is in data, going forward, right? And it's incumbent upon us to put the enablers in place to position us to build that platform, vehicle as a content platform, and then to carefully negotiate our way to extracting and creating value from that platform. I mean, Google's trying to

organize all the world's information, right, and maybe we would specialize in organizing information around automotive and mobility context. But, certainly, I think increasingly, going forward, the value of our business will be more in software services and data than in the hardware. That's absolutely the direction that we're headed in.

Adam Jonas: An interesting question that is whether your role as landlord of mobile real estate, of that space, that high-value space where we actually at least model humanity (ph) spending even more and more and more time, even though (ph) you may not want to, if you think about the concept of being in traffic today, but it might change over time. Could you charge them rent? Is there -- could you envision a model where you could say Google or Amazon or Apple or whatever, you want access to our customer beyond just the phone in the breast pocket, that's fine. Want access to our data? Fine. But, unless and until you go out and open up car factories with unionized employees, let's talk, maybe we can find some room to partner together.

Don Butler: So, not to get into specifics, but we believe that if we can create a great experience for our customers, and if we create value, maybe with a partner, in delivering that experience, then we should be able to participate in that value creation, so the roundabout way of saying yes.

Adam Jonas: There's a lot going on there. There's a lot going on with that answer. Yes, over here on the edge?

Unidentified Participant: (Inaudible - microphone inaccessible.)

Don Butler: We believe what we are -- maybe the question was do we see ourselves paying Waymo for their software. We're very happy with Argo AI, who are doing our VDS, our Virtual Driver System, and we're very pleased with their progress. And we're actually making sure that they're positioned to be able to offer their capability to other OEMs, for instance. And so, we're very happy with that solution. And it's -- the other thing that I would say is we're not necessarily interested or driven by being first. We're driven by wanting to be right and wanting to be ahead when we do launch.

And so, that's why we're focusing on, in places like Miami, not just the technology, but the business models and the specific services that are associated with that so that, when we get the technology in place, it's not a question of ramping up because we don't know what will happen, but it's a question of leveraging even more of the kinds of partnerships that we have with folks like Postmates or Domino's, for instance.

And so, short answer to your question is no, we're very happy with our own VDS and what we're doing with Argo AI.

Adam Jonas: All right. We're going to cut it there. Don, thank you very much for kicking off the panels. I can't wait to see how fast this stuff changes, and look forward to having you back in a year or so to kind of mark the progress made. Thanks very much.

Don Butler: Cool. Thanks, Adam. Thanks, everyone.

Adam Jonas: Thank you.