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SELF-DRIVING CARS: ROAD TO DEPLOYMENT

TUESDAY, FEBRUARY 14, 2017

House of Representatives,

Subcommittee on Digital Commerce and Consumer Protection,

Committee on Energy and Commerce

Washington, D.C.

The subcommittee met, pursuant to call, at 10:15 a.m., in Room 2123 Rayburn House Office Building, Hon. Robert Latta [chairman of the subcommittee] presiding.

Present: Representatives Latta, Harper, Burgess, Upton, Lance, Guthrie, McKinley, Kinzinger, Bilirakis, Bucshon, Mullin, Walters, Costello, Schakowsky, Lujan, Clarke, Cardenas, Dingell, Matsui, Welch, Kennedy, Green, and Pallone (ex officio).

Staff present: Mike Bloomquist, Deputy Staff Director; Karen Christian, General Counsel; Paige Decker, Executive Assistant & Committee Clerk; Blair Ellis, Digital Coordinator/Press

Secretary; Melissa Froelich, Counsel, Digital Commerce and Consumer Protection; Giulia Giannangeli, Legislative Clerk, Digital Commerce and Consumer Protection/Environment; Katie McKeough, Press Assistant; Alex Miller, Video Production Aide and Press Assistant; Paul Nagle, Chief Counsel, Digital Commerce and Consumer Protection; Mark Ratner, Policy Coordinator; Dan Schneider, Press Secretary; Olivia Trusty, Professional Staff Member, Digital Commerce and Consumer Protection; Madeline Vey, Policy Coordinator, Digital Commerce and Consumer Protection; Gregory Watson, Legislative Clerk, Communications and Technology; Everett Winnick, Director of Information Technology; Michelle Ash, Minority Chief Counsel, Digital Commerce and Consumer Protection; Jeff Carroll, Minority Staff Director; Lisa Goldman, Minority Counsel; Caroline Paris-Behr, Minority Policy Analyst; Tim Robinson, Minority Chief Counsel; Matt Schumacher, Minority Press Assistant.

Mr. Latta. Good morning. I'd like to call the Subcommittee on Digital Commerce and Consumer Protection to order, and the Chair now recognizes himself for five minutes for an opening statement.

Again, good morning and welcome to the first hearing of the 115th Congress for the Digital Commerce and Consumer Protection Subcommittee. It is a pleasure to be here with you all today.

Before we get started, I want to thank Chairman Burgess and Vice Chairman Lance for all the hard work they did in the last Congress here on the subcommittee. I also want to recognize the new Vice Chairman of this subcommittee, the gentleman from Mississippi, and glad to have you board. Also look forward to working to advance an innovation agenda that creates jobs and puts consumers first, and I also want to recognize the gentlelady from Illinois, our Ranking Member. I appreciate we're going to be working with her this Congress. Also look forward to working in a bipartisan fashion to grow the economy and protect consumers.

Finally, as Chairman, I look forward to working with all the members of the subcommittee to continue exploring areas in the emerging digital economy that are creating new opportunities for economic growth, job creation, and consumer empowerment in America.

I recently had an opportunity to visit the auto show here in Washington, DC. The showroom floors were filled with vehicles

equipped with innovative features and newly designed systems that promise to enhance the safety, mobility, and convenience of our drivers' experiences.

I was also greatly impressed with the creativity and ingenuity of the auto industry to build the vehicles that we could only dream about just a short time ago. The technological advancements in this sector are nothing short of amazing.

Today, this subcommittee will continue its focus on self-driving vehicles and their potential to completely transform our transportation system. We'll hear about what testing is happening, what testing needs to happen, and what the time frame is for that deployment.

In 2015, there were over 35,000 lives tragically lost on our nation's highways. Over 1,000 of these fatalities were in my home state of Ohio. Based on early estimates, traffic fatalities in 2016 are even going to be higher. Unfortunately, we also know that human error accounts for over 90 percent of all the traffic accidents. These are startling statistics; however, the emergence of automated vehicle technology and growing investments into fully self-driving vehicles promises a significantly reduced lives lost on the roads by decreasing traffic accidents making our roadways safer for all users.

As the auto industry works to make self-driving vehicles a reality, adequately testing these vehicles will be critical

to refining their systems for commercial deployment and gaining consumer confidence that are safety.

Today, conventional vehicles undergo a range of tests in laboratories or proving grounds and on public roads before they are sold to consumers. In each of these settings, vehicle engineers and professional test drivers go through detailed assessments and inspections of vehicles to insure compliance with crashworthiness and crash avoidance standards, and to verify a vehicle's overall structural integrity. Cars are put through thousands, sometimes hundreds of thousands of miles of testing to insure that once the vehicle is on a dealer's lot it is safe for consumers and their families.

Unlike conventional vehicles, fully self-driving vehicles are intended to operate without the input or control of human drivers. No longer will manufacturing be able to rely on drivers to take corrective action in the event of an unexpected system failure, or an unplanned roadway activity. Flexible and unregimented tests will be essential to certifying the safety and reliability of the technology empowering self-driving vehicles.

As we discuss this testing of self-driving vehicles today and steps to commercial deployment, I look forward to learning from the witnesses about how auto makers and other entities are testing these technologies in plans for future deployment.

I also look forward to hearing about how the existing testing environment can be improved to facilitate the innovation and development of potentially life-saving automated vehicle technology in this country.

Ohio's Transportation Research Center recently announced a significant investment into a Smart Mobility Advanced Research and Test Center in East Liberty, Ohio to allow for the testing of self-driving vehicles across thousands of acres of road courses. We need to understand how to insure more states take positive steps to move testing forward and to insure that testing doesn't become a roadblock to innovation.

Robust vehicle testing is essential to the successful and safe deployment of self-driving vehicles. Testing will not only provide auto makers and other entities with the data they need to make these vehicles as safe as possible, but it will help build consumer confidence in this technology which is central to realizing the future benefits of self-driving vehicles.

I thank the witnesses for taking the time to be with us today and I look forward to a thoughtful and engaging discussion. And at this time, I have about a minute left, and is there anyone on our side that would like to claim the minute? The Chair recognizes the Vice Chairman.

[The statement of Mr. Latta follows:]

**********COMMITTEE INSERT 1**********

Mr. Harper. Thank you, Chairman Latta, for calling this hearing today to build on the subcommittee's previous efforts to examine and better understand the world of self-driving cars.

As many of you have noted today, the developments and innovation in self-driving cars has the potential to provide countless improvements to our transportation system, and invaluable safety enhancements that could save thousands of lives every year.

Of particular interest to me is the potential benefits and new opportunities that self-driving cars would provide to Americans with disabilities, including those with intellectual disabilities who are unable to obtain driver's licenses and must rely on friends, and relatives, and sometimes uncertain modes of public transportation in order to get about their daily lives, including running errands, or just getting to a job. In the disability world, lack of transportation is widely viewed as the top impediment to success at advancement in society.

Self-driving cars could offer the disability community a really tremendous opportunity. We're looking forward to hearing more about this. With that, I yield back.

[The statement of Mr. Harper follows:]

**********COMMITTEE INSERT 2**********

Mr. Latta. The gentleman yields back, and the Chair now recognizes the gentlelady from Illinois, the Ranking Member of the subcommittee, for five minutes for an opening statement.

Ms. Schakowsky. Thank you so much, Mr. Chairman. This is the first hearing of the newly renamed Digital Commerce and Consumer Protection Subcommittee. For me this has always been the Consumer Protection Subcommittee, but I'm glad to see that the name consumer protection is now an official name where it belongs.

This subcommittee has important work to do on behalf of American consumers. We are kicking off the Congress with a hearing on auto safety which comes as the number of traffic deaths nationwide is increasing. In consumer product safety, we need to boost recall effectiveness and prevent safety issues before products are sold. Meanwhile, the emergence of new technologies poses new challenges for cyber security and personal privacy. The work of the subcommittee impacts Americans' everyday lives. We need to be watchdogs ensuring that innovation occurs to the benefit of American consumers.

Chairman Latta, I know that we'll be able to work together on a bipartisan basis to advance consumer interests over the course of the Congress, and I also want to take a brief moment to welcome two new Democratic members of our subcommittee, Ben Ray Lujan and Debbie Dingell. I also want to welcome back to the

subcommittee Doris Matsui and Gene Green, and of course our members from the last Congress, Joe Kennedy and Tony Cardenas and Yvette Clarke. I'm very excited to work with all of you and the rest of our subcommittee colleagues.

Today's hearing continues our discussion of self-driving cars where we left off in November. Self-driving cars have the potential to greatly reduce the number of accidents caused by human error. However, we need adequate testing and oversight to insure that human error is not replaced with vehicle error.

I share auto manufacturers' optimism about the long term promise of autonomous vehicles, and today I want to focus on how we get there.

Testing is necessary before we can confidently put consumers in self-driving cars, and what is that testing? The "just trust us" approach simply doesn't work for passenger vehicles, not after the industry's failure that we've seen from Takata airbags, to the VW emissions scandal. The long term viability of self-driving cars depends on manufacturers and government working cooperatively to share data and promote safety.

As we think about testing, we need to figure out the specifics of how many waivers are necessary for test vehicles in the coming years, and how specific those waivers should be. We need to decide what safety tests or standards are necessary, and we need to determine how states and the federal government can best work

together to insure safe roads.

I want to apologize that I have to step out for a moment, as I told the Chairman. I also have a Budget Committee meeting this morning. I hope to be back later to ask questions of our witnesses. I want to thank those that I met before this hearing for their time and their information, and I want to thank you all for being here today.

I now yield the remaining time to Congresswoman Matsui.

Ms. Matsui. Thank you very much, Congresswoman Schakowsky, for yielding me time.

Autonomous vehicles have incredible potential to change so much more than just cars. This technology gives us a way to think about mobility. It has the potential to expand access to seniors, Americans with disabilities, and so much many more who may not be able to drive today. This technology allows us to rethink urban landscapes and public spaces we may no longer need for parking spaces. And perhaps most importantly, it promises safety benefits for American families.

All of this innovation will rely upon connectivity, placing new demands on our roads and highways, and the spectrum and infrastructure that powers wireless communications. We need a framework that insures we're building the connective future of the 21st century economy. Driverless cars will have an impact to both our local economies, communities, and our global

competitiveness.

As we consider this new landscape there is an important role for state and federal regulators, technology companies, and traditional manufacturers, and Congress to play in deploying this future.

I look forward to working with all of you in this exciting area, and I yield back the balance of my time.

Mr. Latta. Thank you very much. The gentlelady yields back. And right now, I don't believe the Chairman of the Full Committee is here, so I will formally pass on the Chairman's testimony at this time. And the Chair would recognize for five minutes the gentleman from New Jersey, the Ranking Member of the Full Committee.

Mr. Pallone. Thank you, Mr. Chairman. I wanted to start by congratulating you on your new Chairmanship of this newly named subcommittee, and I'm hopeful that the subcommittee will use its mandate to watch out for the little guy. And I'm very pleased that the words "consumer protection" once again appear in the subcommittee's name.

Today's hearing on self-driving cars is an example of our consumer protection oversight obligation. I recently read something in Recode that I think can sum up where we are, and I quote: "A decade ago, self-driving cars were a matter of debate. Today, they're an inevitability."

And since we know they're coming to the marketplace, I'm pleased that instead of talking again about the potential benefits achieved in the out years, we will actually get into the weeds a bit. And I look forward to hearing about where we are today in the testing, what needs to be done to establish that these cars are reliable and safe.

As I said at our self-driving cars hearing in November, we need these vehicles to be safe not just when all cars on the road are autonomous, but also during the decades of transition time when they share the road with human drivers.

I look forward to hearing how innovators are being -- are using testing, modeling, analytics, and other tools to demonstrate that these vehicles are safe, that they meet the challenges of interacting with other common obstacles on our roads, such as bicyclists, pedestrians, and wet snow-covered pavement. I also want to hear about how they're insuring strong cyber security and privacy protections are in place to defend against hackers.

Autonomous driving, like so many of the latest technologies has been created in this country by hardworking men and women, many of whom are immigrants who bring amazing skills to our workforce. We are a nation of immigrants, and any efforts to put up roadblocks to immigration will also put up roadblocks to our efforts to be ahead on the technology curve.

At the same time, with as many as 47 percent of American workers vulnerable to computerization, we need to find ways to tap these technologies to help workers find new opportunities through education and training.

So thank you again. I yield the remainder of my time to Representative Dingell. Oh, she's not here. Oh, she's right here. I'm sorry. How could I miss you with that beautiful dress?

Mrs. Dingell. Okay. I'm just going to talk loud. No one's ever said I didn't have a big mouth.

Thank you for yielding, Ranking Member Pallone. There's never been a more exciting time to be in the auto industry. And, Mr. Chairman, it's an honor to be a member of this committee. The Midwest is here. You know, it's technology.

Mr. Latta. Yes, but Digital Commerce --

Mrs. Dingell. We're trying to stay in the forefront of innovation and technology.

There's never been a more exciting time to be in the auto industry. Automated vehicles are not just something you read about in a science fiction novel. In reality, they're already here, and helping transform mobility and the transportation of people and goods. Transportation is no longer the accurate word; mobility is.

In 2015, 35,092 people died on the road in this country. This would be a public health epidemic if it was in any other

industry. Automated vehicles will help us save lives as many of my previous colleagues have noted, that since 94 percent of accidents are attributable to human error. It also an issue of international competitiveness.

Automated vehicles will be developed globally whether we like it or not. I think it's critical that America be at the forefront of innovation and technology by taking the lead in developing these potentially lifesaving advances or we'll lose our competitive edge in this critical space.

My home state of Michigan is leading the way in this area. I am proud that the American Center for Mobility at Willow Run is in the 12th District and will focus on testing, verification, and self-certification of automated vehicles, and was just designated as an automated vehicle proving ground by DOT.

Michigan in a very bipartisan way, my colleague, Mr. Upton, and the Governor, and others are dedicating considerable resources to automated vehicles, and I'm committed to helping it and the United States remain leaders in this vital area.

That being said, safety, including cyber security, has to be our top priority here. Nobody wants to let unsafe technologies on the road, but we also don't want to prevent vehicles that improve safety from reaching consumers either.

I'm looking forward to working with Committee and stakeholders to strike the right balance between supporting

innovation and making sure that consumers are safe.

I yield back the balance of my time.

Mr. Latta. The gentlelady yields back, and as I mentioned when the Chairman of the Full Committee arrives, he'll be afforded the opportunity to give his opening statement.

That now concludes -- we now conclude with the members' opening statements. The Chair would like to remind members that pursuant to the Committee rules all members' opening statements will be made part of the record.

We want to thank all of our witnesses for being with us today and taking the time to testify before the subcommittee. Today's witnesses will have the opportunity to give opening statements followed by a round of questions from the members. Our witness panel for today's hearing will include Mike Ableson, who's the Vice President of Global Strategy of General Motors; Mr. Anders Karrberg, the Vice President of Government Affairs at Volvo Car Group; Dr. Nidhi Kalra, Senior Information Scientist of Rand, and Co-Director at the Center for Decision Making under Uncertainty; Mr. Gill Pratt, Executive Technical Advisor and CEO at Toyota Research Institute; and Mr. Joseph Okpaku, who is the Vice President of Public Policy at Lyft.

We appreciate you all being here today, and when we begin the round of questions, we'll start with Mr. Ableson, and you will be recognized for five minutes. And we appreciate again you

being with us today.

STATEMENTS OF MICHAEL F. ABLESON, VICE PRESIDENT OF GLOBAL STRATEGY, GENERAL MOTORS; ANDERS KARRBERG, VICE PRESIDENT OF GOVERNMENT AFFAIRS, VOLVO CAR GROUP; NIDHI KALRA, CO-DIRECTOR AND SENIOR INFORMATION SCIENTIST, RAND CENTER FOR DECISION MAKING UNDER UNCERTAINTY; GILL PRATT, EXECUTIVE TECHNICAL ADVISOR AND CEO, TOYOTA RESEARCH INSTITUTE; JOSEPH OKPAKU, VICE PRESIDENT OF PUBLIC POLICY, LYFT

STATEMENT OF MICHAEL F. ABLESON

Mr. Ableson. Thank you, Mr. Chairman.

Good morning. My name is Mike Ableson. I'm the Vice President of Global Mobility Strategy for General Motors. I want to thank Chairman Latta, Ranking Member Schakowsky, Chairman Walden, and Ranking Member Pallone, subcommittee members for inviting me to tell you more about General Motors' vision for the coming transformation in mobility, and the opportunities that self-driving vehicles hold for the future safety of the American public.

If I could, though, I'd first like to relate a very personal story that has struck very close to the heart of myself and my General Motors colleagues. This last September, one of our colleagues, Steve Kiefer, suffered an incredible tragedy. His son was returning to college after spending a weekend at home when he was struck and killed by a distracted driver. Watching

Steve and his family go through this terrible avoidable loss has just increased the determination of all those that know Steve to make this technology available as soon as it's ready so that we can avoid these losses in the future. But, unfortunately, Steve is not alone. Ten percent of vehicle fatalities and 18 percent of injuries and crashes are due to distracted driving, more than 30 percent of fatalities involve a drunk driver, and 28 percent of fatalities are speed-related.

Vehicle crashes continue to be the leading cause of death for children and adults ages 4-34. With 94 percent of fatal crashes caused by human behavior, there's tremendous potential to do much better.

Self-driving cars won't drive while impaired by drugs or alcohol, they won't be distracted by a cell phone, they won't drive drowsy or recklessly, and their speed will always be appropriate to the conditions at hand.

For years, auto makers have committed our resources to protecting passengers when crashes do happen. Today, through the continuing development of this technology, we have the opportunity to avoid crashes all together. Not only are we committed to building safe and reliable self-driving vehicles, we also believe that self-driving vehicles will provide tremendous benefits to society in terms of convenience and quality of life. Such vehicles will provide unprecedented access to

transportation to those who need it most, like people with disabilities, those in under-served neighborhoods with limited access to public transportation and the elderly.

General Motors is incredibly optimistic about the future of mobility. Auto makers are faced with a tremendous opportunity to create a new model for personal transportation that changes the way society thinks about the automobile, and we are rising to the challenge.

In June of last year, GM began testing self-driving Chevrolet Bolt EVs on public roads in Scottsdale, Arizona, the very challenging urban center of San Francisco, and in December we announced that we would begin testing in Metro Detroit. We have more than 50 self-driving vehicles testing in these three cities today, with more planned in the near future.

We also announced that GM will produce the next generation of our self-driving test vehicles at our Orion Assembly Plant in Michigan. The vehicles produced at Orion will allow us to accelerate the testing and validation of this exciting new safety technology.

Expansion of our real world self-driving vehicle testing program will allow us to deploy self-driving vehicles within carefully defined parameters and boundaries through controlled ridesharing projects. The safety of our customers is our driving principle. Developing self-driving technology to uphold this

standard is our top priority.

Our test vehicles currently have a person behind the wheel to monitor and evaluate performance. The safety data gathered by these test vehicles will provide statistically significant data to prove that our vehicles are ready to operate without a human driver.

Current federal motor vehicle safety standards have served the motoring public well for years; however, as technology has evolved, standards which take years to develop have lagged behind. Current FMVSS do not contemplate vehicles without human drivers. Without changes to those regulations, it may be years before the promise of today's technology can be realized, and in the meantime, thousands of deaths could have been prevented.

At the same time, we understand that we must be able to prove to our customers, our regulators, and the American public that our vehicles are safe. NHTSA has already begun a collaborative process with stakeholders to facilitate the safe testing and deployment of self-driving vehicles. While important regulatory work continues, it is imperative that manufacturers have the ability to test these vehicles in greater numbers to gather the safety data that will be critical to inform large-scale deployment of lifesaving self-driving vehicles.

One good way to accomplish this goal is to grant the Secretary of Transportation authority to grant specific exemptions for

highly automated vehicle development. This authority would be similar to authority currently provided under existing law.

During this hearing alone, another eight people will have died on U.S. roads. Eight more families that have to experience the painful loss that our colleague and friend, Steve, did. This is far too great of a cost to our nation and our citizens, and we are within reach of a solution.

We look forward to working with the committee to help create the right policy framework to bring this lifesaving technology to our roads as quickly and as safely as possible. While we have more to learn, our self-driving Bolt EVs are getting smarter and better each week, and we are anxious for the public to be able to experience the technology firsthand.

Let me very clear. Our priority is and always will be the safety of our passengers and fellow road users.

Thank you for your time today, and I look forward to answering any questions the members of the committee might have.

[The prepared statement of Michael F. Ableson follows:]

**********INSERT 3**********

Mr. Latta. Thank you very much, Mr. Ableson, for your testimony. And the Chair now recognizes for five minutes, Mr. Karrberg.

STATEMENT OF ANDERS KARRBERG

Mr. Karrberg. Thank you.

Chairman Latta, Congresswoman Dingell, members of the subcommittee, my name is Anders Karrberg, and I'm Vice President of Government Affairs at Volvo Cars.

Volvo came to the U.S. in 1955, and last year we sold 81,000 cars here. Together with our dealers, we employ about 10,000 people with 300 direct employees in New Jersey. Next year we will open our first American factory in South Carolina. This will add up to 4,000 jobs during the years thereafter. Our factory will be the first all new American car factory in 10 years.

Safety is a founding principle for Volvo Cars. We invented the three-point safety belt, we waived the patent so that safety belts could save millions of lives. Our vision is that no one should be killed or seriously injured in a new Volvo by 2020. Therefore, we are very excited about the benefits that self-driving cars will bring.

Roads will be safer. It's been said many times but cannot be overstated, over 94 percent of all crashes are due to human error. Self-driving cars will be important to reduce crashes. Also, self-driving cars will free idle time for the driver to do something more productive while being in the car.

Our vision is to every year give back one week of quality

time to Volvo commuters by 2025. However, going forward there are some very important preconditions. Technology must be safe, consumers must trust it, and the proper national framework must be in place. These preconditions are fundamental when we bring this technology to market.

The first self-driving Volvo will be an XC90 SUV. It will be offered to customers in selected cities in the U.S., Europe, and China in 2021. The cars will be capable to operate unsupervised SAE Level 4 during normal traffic conditions on designated commuter roads only. Our approach is not to provide unsupervised driving anywhere any time. Instead, we start with less complicated conditions where consumer benefits are the highest. Thereafter, step by step we open up for more complex traffic as technology matures.

When we develop these cars we take a comprehensive approach. Groundwork engineering is based on our extensive experience from developing active safety and driver support systems. We design systems that are critical for safety with redundancies. We perform virtual testing based on data from historical crashes. We will start behavioral testing with up to 100 real customers on real roads this year in Sweden. We plan to extend those to London and China, and we cooperate with Uber on engineering the hardware.

Our intention is to test ourselves also in the U.S., but the patchwork of state regulations is a concern. In just the last

two months, at least 50 new bills have been introduced in 20 states. This started to become a problem already in 2015 when we publicly called for federal guidelines. Last year we got them, the Federal Automated Vehicle Policy, a very positive initiative even if it needs several improvements. So what could Congress do?

First, to accelerate traffic safety improvements, press avoidance technologies should be rated in NCAP. The U.S. is woefully behind other major markets having already done this. Active safety systems are building blocks of self-driving cars. They take partial control when cars risk a crash, and would help build consumer confidence in unsupervised driving.

Second, Congress should encourage NHTSA to update the FAVP with an explicit request that the states refrain from legislating and regulating self-driving cars.

Third, Congress should incentives for states to adopt the model state policy in the FAVP, as is. A patchwork will delay making roads safer in America. It's also a competitive disadvantage. This is a race for jobs. I've discussed lots of regulations with politicians in the U.S., Europe, and China. Six years ago, I put the U.S. in the lead; seeing the patchwork, I'm not so sure.

Thank you for the opportunity to testify. I will take any questions later.

[The prepared statement of Anders Karrberg follows:]

**********INSERT 4**********

Mr. Latta. Well, thank you very much for your testimony today, and the Chair now recognizes for five minutes, Dr. Kalra. Thank you.

STATEMENT OF NIDHI KALRA

Dr. Kalra. Thank you. Chairman Latta, Congresswoman Dingell, and distinguished members of the subcommittee, thank you for the opportunity to testify today on the safety and testing of autonomous vehicles.

For those who may not know, RAND is a nonprofit, nonpartisan research institution committed to improving public policy through objective research and analysis. And in the interest of full disclosure, my spouse is the co-founder of a Silicon Valley startup working on autonomous vehicles, though his work has no bearing on my testimony, or vice versa.

Now, as you know, traffic crashes pose a public health crisis in the United States, and autonomous vehicles have the potential to mitigate this crisis. As a society, we want them to be as safe as possible, as quickly as possible, but they probably won't eliminate all crashes, and they may introduce new safety risks, particularly in the near term. So today I'd like to describe several challenges that stand in our way of realizing the safety benefits and mitigating the safety risks, and then I'll propose some solutions.

The first challenge is that there isn't yet a practical way to prove that autonomous vehicles are safe before they're allowed on the road for consumer use. The second challenge is that there

is no consensus about how safe they should be before they're allowed on the roads, so together this means we neither know what tests autonomous vehicles should have to take, nor what should constitute a passing grade.

Now resolving this is urgent because real world driving experience is crucial for improving autonomous vehicle safety, but this presents a third risk. Learning in real world settings presents risks to early adopters and other road users from which late adopters would benefit. You know, it's like allowing teenaged drivers on the road; they may not be safe drivers yet, but they need good driving experience to become safe drivers. In the meantime, they pose risks to themselves and to others, which we try to limit with age restrictions, and permit restrictions. We may need similar policies for autonomous vehicles and their teenagers.

Now, there's a clear and essential role for sound policy making, and I'll make three recommendations. I first recommend that we rapidly develop practical methods of testing their safety. These methods can be developed by industry, researchers and academics, federal regulators, but wherever they come from they need to be vetted, validated rigorously, objectively, and independently.

Now, it's not enough for testing methods to exist. Second, I recommend building them into a flexible, adaptive regulatory

framework that specifies what level of safety performance autonomous vehicles need to meet before they're allowed on the roads. A lower threshold of safety might be okay for demonstration projects designed to improve their performance in controlled environments, but a higher threshold of safety might be warranted for widespread consumer use in uncontrolled environments.

As with teenage drivers, the framework should balance the need for real world driving experience with the need to protect the public from undue risk. And the framework should be revised as the technology evolves. Such a framework would likely fall under NHTSA's jurisdiction, but should be developed in collaboration with industry, state and local policy makers, and the public.

Now NHTSA has already released federal policies for autonomous vehicles, but these don't specify testing methods, or performance requirements, or develop such a framework. They're also not requirements but guidelines at this time.

Now, a regulatory framework like the one I'm proposing will take time, and in the interim, I thirdly suggest that strategic pilot studies and data sharing can help. Pilot studies could start with real world testing in controlled conditions, like operating vehicles in well maintained areas in favorable climates, and then could be expanded as safety is demonstrated.

Risks can also be lowered by designing and operating vehicles

so that if a crash does occur, the risks are lower. For example, by limiting vehicle speed or insuring that all pilot study passengers buckle up.

As for data sharing, developers already use the experiences of a single vehicle in their fleet to improve the performance of the entire fleet. This could occur faster if experiences could be shared across the industry to improve the entire technology.

Now, there are certainly nontrivial concerns about protecting trade secrets, and also about insuring that the right data is shared and that it's truly useful, but these concerns could be addressed, and they should be addressed so that they can be balanced with the need for safe autonomous driving.

So to conclude, you know, we can't predict what the future of this technology will be, or what its impact will be on American transportation safety, but we can shape that trajectory with well-designed policies.

So I want to thank you for the opportunity to testify today. Thank you for allowing me to appear before you, and I look forward to your questions.

[The prepared statement of Nidhi Kalra follows:]

**********INSERT 5**********

Mr. Latta. And thank you very much for your testimony today, and the Chair now recognizes for five minutes, Dr. Pratt.

STATEMENT OF GILL PRATT

Mr. Pratt. Chairman Latta, Congresswoman Dingell, and members of the subcommittee, thank you for the opportunity to appear before you today.

My name is Gil Pratt. I'm the CEO of the Toyota Research Institute. Before working for Toyota, I was a Program Manager in the area of Robotics are DARPA, which is the U.S. Defense Advanced Projects Agency.

Now, TRI focuses on the development of artificial intelligence and related technologies. It was formed in January of 2016 with a five-year, $1 billion commitment from Toyota. TRI is located wholly within the United States, with its headquarters in Palo Alto, California, and additional teams in Ann Arbor, Michigan, and in Cambridge, Massachusetts.

TRI is intensely focused on the development of autonomous vehicles. We're currently pursuing two paths to autonomy, a system called "Guardian", and a system called "Chauffeur." Under Guardian, the autonomous technology operates in the background and it's constantly monitoring the environment stepping in only when a collision is imminent. Under Chauffeur, the technology takes over the driving task from the human driver.

We are currently testing and refining both Guardian and Chauffeur. Because they have the potential to save lives, our

hope is to deploy these systems as soon as possible, but only once we know that they can be deployed safely, and responsibly.

Society tolerates a significant amount of human error on our roads. We are all, after all, only human; yet, human beings show nearly zero tolerance for injuries or deaths caused by flaws in machines. So the question is, how safe is safe enough for this autonomous technology to be deployed?

As we sit here today, it is not clear how this measure will be devised or by whom. Before developers can complete testing of these systems and deploy the technology, policy makers such as yourselves will need to answer this foundational question.

Policy makers must also keep in mind that testing is a necessary means to an end. The goal is to develop a vehicle that can save lives and improve the efficiency of our roads. We cannot reach that goal unless we are able to test our technology in real world environments, including on public roads. Testing is what will allow us to determine when our technology achieves a sufficient level of performance, and is ready for deployment.

One of the most significant challenges that we face is the patchwork of policy initiatives at the state level. Many of the other witnesses have referred to the same thing. Under a patchwork of inconsistent state laws, autonomous vehicle technology may meet performance requirements in one state and not another state. Such a situation will impede the ability of a developer to test

the same system across multiple states, slowly the development and deployment to the technology. Policy makers should work to promote and advance a single national framework with appropriate safeguards.

We believe that the Federal Automated Vehicle Policy that was released by NHTSA was an important step in cementing federal leadership in this area. However, we also believe that there are several areas that should be addressed before the policy is fully implemented. This includes clarifying in the FAVP itself that NHTSA does not intend for states to regulate vehicle performance, reconsidering the applicability of the safety assessment to the testing of autonomous prototype vehicles by traditional auto makers, and reassessing the need to submit a new assessment for each significant update to a prototype. The reason for that last comment is that we develop these systems very quickly, and it will create tremendous red tape to have to submit that assessment every single time that a change is made.

There has also been growing discussion of the need for data sharing. We support the goals of data sharing, but we also believe that there's a significant amount of work to be done to insure that it does not create paradoxical incentives to avoid difficult test conditions, which would actually worsen safety, not improve safety. We look forward to working with other stakeholders to determine how to share data in the most practical and effective

manner.

Before closing, I would like to provide a couple of additional observations. First, with regard to testing, the truth is that millions of physical test-driven miles are necessary but they are probably not sufficient to achieve the reliability that we need for autonomous vehicle technology, particularly if those test-driven miles are through easy or predictable routes. All testing miles are not created equal, and developers should be focused on testing scenarios where driving is challenging, or even exceedingly difficult. We believe that with adequate evidence of validity, computer simulation of billions of test miles are needed to accelerate and expand the range of testing of these systems, and that these simulated miles, if they're valid, should be an acceptable equivalent to real world testing.

Finally, it's important that the federal government begin looking beyond testing to deployment of these systems. This includes updating the Federal Motor Vehicle Safety Standards to address the handful of standards that are inconsistent with, or incompatible with autonomous vehicle technology.

I thank you very much for your time, and look forward to working with you to advance this important technology. Most of all, I look forward to taking your questions. Thank you.

[The prepared statement of Gill Pratt follows:]

**********INSERT 6**********

Mr. Latta. Thanks very much for your testimony today, and the Chair now recognizes for five minutes Mr. Okpaku for five minutes. And thanks very much for being here today.

STATEMENT OF JOSEPH OKPAKU

Mr. Okpaku. Thank you, Chairman Latta. And thank you, Congresswoman Dingell, and members of the subcommittee.

My name is Joseph Okpaku, and I am the Vice President of Government Relations for Lyft. Thank you, again, for the opportunity to testify today on this very important topic.

Lyft was the first company to establish peer-to-peer on-demand ride sharing and currently is the fastest growing ride share company in the United States. Today, Lyft connects nearly 18 million people per month with efficient, affordable, and safe rides in over 250 communities across the state, across the country.

Lyft was founded with the mission of improving lives by offering the world's best transportation, and in less than five years we have proven to be a powerful driver of positive change with respect to economic empowerment, enhancing the efficiency of public transportation, and connecting communities that were previously under-served by prior transportation options.

The proof is in the data. Since our launch in 2012, Lyft has worked to reduce traffic and congestion, increase mobility options, prevent DUIs, stimulate local economies, and provide economic opportunities to our drivers. And this is only the beginning.

Autonomous vehicles hold a tremendous potential to not only further improve the quality of life for our users, but also to literally save the lives by decreasing the frequency and severity of motor vehicle accidents. Lyft's commitment to testing and deploying AVs is rooted in the belief that the inherent safety benefits of autonomous vehicles should be affordable and available to all segments of the public regardless of income, geography, or disability.

Furthermore, Lyft believes that the introduction of AVs via a ride sharing network will fundamentally transform cities and the way that people move around them. The convergence of ride sharing and AVs provides Lyft with the tools to create a perfectly efficient transportation network that will greatly reduce the need and demand for car ownership and significantly expand transportation options, particularly for segments of the population that currently have limited access to transportation options due to age, infirmity, or disability.

As vehicle ownership rates decline and consumers continue to engage with the Lyft platform, we will see fewer cars on the road, less congestion, and increased positive environmental impacts. A world with fewer cars provides a tremendous opportunity to reorient, re-imagine, and redesign our urban fabric. Cities in the not too distant future could be built around people instead of cars. They could and should be defined by communities and

connections, not pavement and parking spots. They could and should include common spaces where culture can thrive, and where new ideas can be shared in the very places where cars previously stood parked and empty.

Lyft stands at the center of this coming transportation revolution as we believe that the transition to an autonomous future will not only occur through individually owned cars; rather, it will be both more practical and appealing to rely on autonomous vehicles when they are part of a ride sharing network fleet. To this end, it is our goal to operate a pilot in a major city this year that will permit consumers to enjoy for the very first time a Lyft in an autonomous vehicle. However, there are very serious challenges to be faced in binging the full value of autonomous vehicles to market for mass consumption, and the greatest potential obstacle is constrictive legislation and regulations.

The worst possible scenario for the growth of autonomous, as some of the members of this panel have already stated, is an inconsistent and conflicting patchwork of state, local, municipal, and county laws that will hamper efforts to bring AV technology to the market. This scenario is well on its way to becoming reality.

Since the beginning of the year, over 20 states have filed nearly 60 bills to regulate the testing and deployment of AVs;

and while most of the bills are well-intentioned, it is our position that states should not rush to regulate this technology.

It's our view that if a state does choose to take legislative or regulatory action with respect to autonomous vehicles, such action should be premised on removing impediments in current law to the safe testing and deployment of such vehicles, and creating a pro-competitive and technology-neutral playing field.

In order to facilitate the continued innovation, testing, and development of AVs by all industry participants, I would urge Congress to examine two potential avenues for action. The first is revising NHTSA's exemption authority to allow for a greater number of autonomous vehicles to be allowed on the road for testing and deployment purposes. The second is directing NHTSA to begin a rulemaking process to update current FMVSS standards to accommodate the development, deployment, and introduction into commerce of AVs at a commercial scale.

Lyft looks forward to working with the members of this committee to insure that AVs can be tested and deployed safely and efficiently in communities all across the country. The tremendous potential that AVs offer to save thousands of lives, to increase access to transportation for so many, to reduce congestion, and to reorient our communities for the better around people, not cars, is an achievable near term reality. With a collective effort, we can all insure that this potential is

reached.

Thank you again for the opportunity to testify today, and I'm happy to answer any questions that you might have.

[The statement of Joseph Okpaku follows:]

**********INSERT 7**********

Mr. Latta. And thank you very much for your testimony today. We appreciate it, and that will conclude the opening statements from our witnesses. And the Chair now recognizes himself for five minutes to begin the questioning of our witnesses. And, again, we appreciate you all for being here.

Mr. Ableson, I'd like to start my questions with you. Can you discuss GM's timeline for deploying self-driving cars? If you'd pull that mic right up there.

MR. Ableson. Yes. We currently have deployed in three cities vehicles that are operating at a Level 4 automation with drivers in them. We are collecting data on how the vehicles operate. When we have convinced ourselves that the vehicles are operating properly and are at a level that would inspire confidence in the technology, we will then make those vehicles available for members of the public to experience still with drivers.

At that point, we will continue to collect data on a wider scale, and only when we have collected enough data to convince ourselves that we're truly ready to go driverless, will we then remove the drivers from the vehicles and let them operate as self-driving vehicles.

Mr. Latta. Follow-up; cyber security is a huge issue out there across what we deal with in this subcommittee, and across the Congress today. Can you tell me or go into some detail as to how you're looking at insuring against cyber threats?

MR. Ableson. Again, cyber security is an issue that General Motors takes very seriously. We have, of course, had the OnStar Service for 20 years, and so we are not new to the connected vehicle space. But specifically around cyber security, we were also the first auto maker to appoint a Chief Product Cyber Security Officer, who reports both to the CEO and to the Board of Directors. We were also a founding member of the Auto ISAC, an industry committee to share best practices and learnings on cyber security.

Jeff Massimilla is our Chief Product Cyber Security Officer, and is also the Vice Chairman of the Auto ISAC, so it's an area that we've been very active in. We work with companies from other industries from the defense industry, the aerospace industry to make sure we have the most current learnings not just in the auto space, but in industrial spaces wherever they are.

Mr. Latta. Thank you.

Mr. Pratt, in Toyota's comments for NHTSA on its Federal Automated Vehicles Policy, Toyota mentioned that it would be deploying automated driving systems in a step-by-step manner as the technology matures and becomes available.

Would you walk us through what that step-by-step process looks like, and how long you think it would take for that technology to mature to a point where it might be ready to be deployed?

Mr. Pratt. Sure, I'd be glad to.

First of all, we have a number of automated vehicle technologies that are already in our cars today, and these include the Toyota Safety Sense system, and the Lexus Safety Sense system. In particular, automatic emergency braking is one of the types of this Guardian system that I spoke about before where the autonomy intervenes when the human is driving in order to prevent an accident. So that's already happening now, and we believe we're saving many lives as a result of doing so.

Now, as you desire to have the human being take less and less control of driving and have the autonomy take over more control, you ascend up the SAE levels that you may know about. And our plan is to be self-timed in this regard. We don't have a specific date for when we're going to remove the driver from the car, very much like GM; but rather, we are going to test and to see when the system is safe enough to do so. And, of course, this doesn't happen all of the time, it happens at the beginning only some of the time in certain areas, certain weather, certain traffic conditions at the beginning with human beings supervising the autonomy and in the end where you can trust it enough so that you don't need a human being.

So there's no definitive date for those steps, but a step-by-step process of gradually removing the amount of supervision that's necessary by the driver, eventually with the goal that no supervision is necessary, but checking each stage

that the system is safe enough.

Mr. Latta. Thank you.

Mr. Karrberg, a large part of Volvo's brand has always been about safety. How does this impact what Volvo is doing before it puts a self-driving car on the street for testing and deployment?

Mr. Karrberg. Yes, safety is clearly a priority throughout the whole development process for these cars. So we're targeting 2021 for this, and in order to make the safety to come at the right point, we are doing a number of different approaches when it comes to engineering.

First of all, we will engage fully in major part into computer simulations. So we have a database of about 40,000 traffic accidents that has happened in the past in Volvo cars. We'll take those, and we'll combine them with data from the U.S., data from Germany, so that will be about 50,000 traffic accidents we will put into the computer. And we will ask the computer how can you avoid this accident when you have AV technology? So that is one input when we go forward.

Moreover, you have to test this in public roads to learn about the behavior on how customers really interact with this. And so we will step-by-step introduce to these drivers more and more advanced technologies, so we will plan to be ready by 2021.

Mr. Latta. Thank you very much. My time has expired, and

the Chair now recognizes the gentleman from New Jersey, the Ranking Member of the Full Committee, for five minutes.

Mr. Pallone. Thank you, Mr. Chairman.

We've heard concern about the period before cars are fully autonomous, when there's still a driver, that that driver doesn't need to be active all the time. And even if the driver is in front of a steering wheel and trying to pay attention, if the car is doing most of the work, we know it's hard for the driver to stay engaged. And some have suggested that we could see an uptick in accidents with vehicles that are relying on drivers to re-engage in a split second. So let me start with Mr. Karrberg.

Volvo has said that it will skip Level 3 automation, as I just described, and go from Level 2 to Level 4. Can you explain that decision, and is it due to the fears that I just mentioned?

Mr. Karrberg. We pretty much agree with you. At Level 3, the driver -- the car is doing the driving. The car is doing the monitoring, but the driver is the fallback. So you could end up in situations where the driver has to take back the control; that could happen within seconds. So we are concerned about the Level 3 stage within SAE and, therefore, we are targeting Level 4 as the end game.

Mr. Pallone. Okay, thank you.

And Dr. Kalra, did you want to comment on that?

Dr. Kalra. I agree. There is evidence to suggest that Level

3 may show an increase in traffic crashes, and so it is defensible and plausible for auto makers to skip Level 3. I don't think there's enough evidence to suggest that it should be prohibited at this time, but it does pose safety concerns that a lot of auto makers are recognizing and trying to avoid.

Mr. Pallone. All right, thanks.

Let me go back to Mr. Karrberg. Volvo has said that it will take complete liability at Level 4. Can you explain that decision?

Mr. Karrberg. Okay. It is really not that strange. Car makers should take liability for any system in the car, so we have declared that if there's a malfunction to the AV system when operating autonomously, we would take the product liability.

Mr. Pallone. Okay. Now, researchers and investigators have demonstrated that the threat of a hacker accessing and controlling a connected car is real. In these reports after vehicles have been accessed remotely, drivers are shown losing control of the horn, brakes, steering wheel, windshield wipers, and more.

So I just wanted to ask how real is the threat of vehicle hacking, especially in the autonomous context? And do you expect the nature of the threat to evolve as the technology develops? And then, also -- well, I think you kind of -- did you talk about this at all yet? No. If you, Dr. Kalra, yes; would you respond to that?

Dr. Kalra. Sure, I'd be happy to.

It is a very real threat. Transportation is one of the areas that receives a lot of attention from hacking because it is, you know, a way to disrupt our transportation system, so there's a great concern there. And cyber security is not something that can sort of be shrink wrapped on top of the vehicle because there's so many parts that contribute to the ultimate vehicle that it has to be baked in from the ground up. And it's not only hacking for fun and profit, but autonomous vehicles provide an avenue for terrorism, as well, because there's a way to use these vehicles to -- you know, the threat is no longer sort of suicide bombers that blow themselves up, but now we have vehicles that can drive around. So I don't want to overstate the risk at this time, but we need to think very broadly about cyber security not only as a hacking opportunity, but also as a terrorism opportunity.

Mr. Pallone. All right. Did you want to --

Mr. Ableson. If I could add a comment.

Mr. Pallone. Yes, sure.

Mr. Ableson. I completely agree with the point that because of the cyber security threat, as we contemplate self-driving vehicles we need to design the vehicles from the ground up with that threat in mind. And, certainly, in our case as we deploy the self-driving Chevy Bolts, they look like the Bolts that we sell to retail customers, but we've gone very deep into the systems of the vehicle to make changes appropriate to insure the cyber

security in those vehicles.

Mr. Pallone. Sure, go ahead.

Mr. Pratt. And I wanted to add a little bit to that, too. So, Toyota Connected is a subsidiary of our company that's primarily focused on this. Zach Hicks is the CEO. Toyota is presently the Chair of the Auto ISAC that was described before for sharing information about cyber security threats.

I think it's important that as serious -- to understand that as serious as this threat is, there are also mitigations that we can employ. And, first of all, is to make sure that the safety technology on the car does not depend on the wireless network in order to operate. So our philosophy is that all of the safety functions have to be self-sufficient on the car itself, and only information over the wireless network used to improve the efficiency of operation.

Mr. Pallone. Mr. Karrberg, sure.

Mr. Karrberg. I just fully agree with the previous speakers. I just want to add that the comprehensive approach you need to take to cyber security also encompasses suppliers and dealers.

Mr. Pallone. All right. My time is out, so thank you, Mr. Chairman.

Mr. Latta. The gentleman's time has expired, and the Chair now recognizes the Vice Chairman of the subcommittee, the gentleman from Mississippi, for five minutes.

MR. Harper. Thank you, Mr. Chairman. And thanks to each of you for being here. What an exciting topic. I mean, this is remarkable now.

Mr. Ableson, I've got just a not too technical question, but let's say you've got your driver out of the self-driving car, it is self-driving, and I'm driving along and I come across it, and I honk my horn. Will it do any good?

Mr. Ableson. We haven't reached that point of deciding whether -- how and whether it would be appropriate for vehicles to react, and in what way, to honking a horn, so I'd have to go back and ask the technical folks.

Mr. Harper. Well, that's -- you know, there's so many interesting scenarios as you go through these --

Mr. Ableson. There are a lot of scenarios.

Mr. Harper. -- on what's going to happen, and whether or not you -- another car with a driver comes across a self-driving car without a driver in there, and they realize that. It will freak some people out, so how that's going to be dealt with will be part of the fun part of this process.

Mr. Ableson. Absolutely.

Mr. Harper. For me, this is so exciting on a personal level, because my wife and I have a son with special needs. He's 27, he works Monday through Friday, but he's completely dependent upon us for his transportation, either myself or almost always

my wife because I'm here, or our daughter, if so some reason she's out of town, so the possibilities are so good here for people in the disability community, particularly those like my son with an intellectual disability, that is great, very social individual, but limited in many ways to what he can do. So what this opens up for whether it's running errands, whether it's going to the grocery store, the bookstore that he loves, or getting to and from work. So as you look at that, can you elaborate on the work that GM is doing to provide this type of transportation, this access in the future? I know you have discussed it.

Mr. Ableson. We have, and I agree with you, it's a very exciting opportunity for some of these communities. And while we recognize the potential benefits, there's a whole lot more work, obviously, that still needs to be done.

However, inside General Motors, we have a specifically designated employee resource group committed, or composed of people with various physical challenges, and they're already working with our engineering group on the potential for self-driving vehicles going forward. So we look forward to continue to engage, obviously, internally with our own employees, but also with external groups on how to realize this potential for those communities.

Mr. Harper. All right, thank you. And thank you for that work.

Dr. Pratt, can you also comment how your company is considering the needs of the disability community in the development and deployment of self-driving cars?

Mr. Pratt. Yes, I'd be very glad to.

In fact, our President, Akio Toyoda, decided to change the company's policy on autonomous driving as a result of a meeting with a blind person who asked him, "Can I enjoy the mobility of your cars, as well?" And suddenly the whole company decided to change its policy.

I wanted to add one more part to this thing, too, because we have to not forget about aging society. Right now in the United States, 13 percent of our population is over age 65. Because of the baby boom, in 15 years that fraction will from 13 percent to 20 percent. And this is an extraordinary thing.

My sister and I had the experience of having to take away the car keys from my father because he was now too elderly to drive. That's something I don't think anybody should have to go through both, of course, for my father, and also for the parent's children. Our goal is to make that not have to happen in the future.

Mr. Harper. That's great. Thank you very much.

Mr. Karrberg, can you answer that question about what Volvo is doing for those with disabilities?

Mr. Karrberg. We fully recognize the potential for self-driving cars to bring a happier life to disabled people,

and blind people, and so on. Every Sunday, I meet my father. He just turned 100 years, and he asks me every time, "When can I have this car?"

For Volvo, initially, we are targeting commuters, commuting because that's where we think the biggest benefit for the -- and interest from the consumers are.

Mr. Harper. That's great.

Mr. Okpaku, tell us about how this works from a ride sharing perspective.

Mr. Okpaku. Sure, and thank you for the question, Vice Chairman.

One of the things that we've been really pleased to see with Lyft and with ride sharing generally is the ability to provide options for the disabled community, and for the elderly community.

One of the initial challenges, especially with the elderly community, was that not everyone had a smartphone or felt comfortable using a smartphone, but we've recently adapted that process so that you don't even have to have a smartphone to request a Lyft. So we've already seen and heard from a lot of the disabled community about how much ride sharing has increased their quality of life, increased their mobility, same thing for the senior population. And in terms of the potential to have that same impact with autonomous vehicles, again, the role that ride sharing plays is the ability to bring AVs to the market at a scale that would

really address this issue in a broad and sweeping way. So Lyft and ride sharing, we believe, do play a very specific role and a very important role in insuring that AV technology can be deployed and used by those who most critically need it.

Mr. Harper. Thank you each so much. It's an exciting moment, and we look forward to the development.

I yield back.

Mr. Latta. The gentleman yields back the balance of his time, and the Chair now recognizes for five minutes the Ranking Member of the subcommittee, the gentlelady from Illinois.

Ms. Schakowsky. So even though we're some time away, I think, for fully self-driving cars on the road, but manufacturers have developed some very exciting safety technologies right now from blind spot detection, to rear seat notification. And I want to focus for a few minutes on those discrete technologies.

Last year, 39 children died from heat strokes in cars. These are tragic accidents, and I've heard devastating stories from parents who will absolutely never be able to forgive themselves.

Last year, Representative Tim Ryan, Peter King, and I introduced Hot Cars, a bill to equip new vehicles with rear seat notification to warn drivers that a passenger may be left behind.

So, Mr. Ableson, what is GM doing to prevent child heat deaths?

Mr. Ableson. As you said, these are tragic circumstances,

and General Motors has moved aggressively. We've already announced that we're implementing on 17, 2016, excuse me, 2017 and 2018 models a rear seat reminder system that's monitoring when a rear door is open on the vehicle. Then when the ignition is turned off at the end of the journey, chimes sound and a message is put up on the instrument cluster reminding the driver to check the rear seat. And we think this has been a very effective system to implement, and one that I'd say is already in production on many models.

Ms. Schakowsky. Thank you.

Dr. Pratt and Mr. Karrberg, are your companies working on technologies to prevent child heat deaths?

Mr. Karrberg. Thank you for raising this important issue. These are, of course, very tragic accidents. First of all, consumer education is very important in this field. However, what we have recently introduced as an option in our cars is a motion sensor. It cannot sense heartbeats but it can sense if an animal or if a child moves. It's a first step to this, and I would be happy to provide for the protocol later on exactly how efficient these technologies are to protect our children.

Ms. Schakowsky. Yes. The problem, of course, is that often the baby is sleeping, and so there is no movement. Dr. Pratt?

Mr. Pratt. So I run the research lab, so I don't know the particular details of the implementation, but I can speak to what

we're doing research on. And so we are working on this issue and, in particular, we're working on systems that monitor the insides of the occupants in a car for any number of things. Even if a person is sleeping it turns out that there is research technology; again, I don't know when it will be fielded, which can amplify the very small motions that happen as a result of heartbeat and changes in skin temperature, as well. So there are ways that in the future we might do it, but I'd be glad to get you more information from the company in terms of when we're planning to field such things.

Ms. Schakowsky. We're going to reintroduce our legislation, and I'd really appreciate all the manufacturers to take a look at our bill that would first begin with a study, and then move into regulation.

Automatic emergency braking is another important safety technology. Dr. Pratt, in your testimony you said that automatic emergency braking will be standard in almost every Toyota model sold this year. How soon will Toyota get to 100 percent?

Mr. Pratt. I'm not exactly sure. I believe that it's a very small minority of models, some of which are in very unusual sizes, so very large trucks and things like that. So I don't know the answer, but I'd be glad to get it to you.

Ms. Schakowsky. And, Mr. Ableson and Mr. Karrberg, what are your companies' timeline for automatic braking?

Mr. Ableson. So at General Motors, we agreed with the voluntary rollout that was proposed last year by NHTSA, and we're working aggressively to execute that. I don't know the exact date by when it's complete in our company, but I'd be happy to get people to our people and send you the details.

Ms. Schakowsky. Mr. Karrberg?

Mr. Karrberg. We've had automatic emergency braking standard globally since 2013. And on our large platform, the new cars coming out there, it is a very involved system that brakes for not only vehicles, pedestrians, but also cyclists, and large animals day and night.

Ms. Schakowsky. So I had a couple of other questions about various technologies, but I guess the point I really want to make is that, obviously, some of these are available, in one manufacturer, not available in another manufacturer. Sometimes it's optional, sometimes it's standard. It seems to me that it would be great if we could harmonize these safety features and make sure that if they really are saving lives, that they are standard. I'm not saying it always has to be exactly the same technology, but the same goal at the end of the day so that we do develop these safety features. And I yield back. Thank you.

Mr. Latta. Thank you. The gentlelady yields back. The Chair now recognizes for five minutes the gentleman from New Jersey.

Mr. Lance. Thank you, Mr. Chairman, and good morning to the

distinguished panel.

Mr. Karrberg, once automated driving systems or fully self-driving automobiles are ready for use by the American people, how should manufacturers provide instructions and education to consumers about the proper use and limitations of these systems or vehicles?

Mr. Karrberg. Yes, that is clearly a priority, and that's why we start to introduce these vehicles supervised levels already this year to about 100 real customers on real roads to learn how they interact with the cars, what supports they need in order to fully understand it. And we will design the cars accordingly.

Mr. Lance. Would that require further testing of the public? Would I have to go back to the State of New Jersey and be tested further in this regard?

Mr. Karrberg. We will do tests of how people behave in different areas, so we'll do tests in Sweden right now. We plan to move on to London and China, and hopefully will do it in U.S., as well, to learn how different types of drivers interact with the cars.

Mr. Lance. Mr. Ableson, GM?

Mr. Ableson. I think it's a very important question. And I would say, at General Motors we intend to roll out autonomous vehicles first in ride sharing fleets. We think when --

Mr. Lance. In ride sharing, did you say?

Mr. Ableson. Ride sharing, yes; similar to a Lyft fleet.

Mr. Lance. Yes.

Mr. Ableson. One of the advantages is that it gives the public the opportunity to experience the technology without having to necessarily buy and own an autonomous vehicle. It also gives you the opportunity then when you book the ride to provide the user the information they need on the autonomous vehicle operation.

Mr. Lance. When do you estimate that this might be in use in GM's vehicles?

Mr. Ableson. So as I said, we're doing testing on public roads right now, but to be honest, the exact date is going to depend on how quickly the data can be gathered. And we have to prove, as I said, to both ourselves and our regulators that we're ready before we go driverless.

Mr. Lance. To the distinguished panel, do you believe that these automobiles will be used on all of our roads, or will they first be used on limited access highways, the Interstate highway system, for example, or other similar roads? Dr. Pratt?

Mr. Pratt. I'd be glad to take that. First, let me just add onto that last question with regard to driver education. I think education is absolutely key, and some of the issues are having to do with how much trust a driver puts in the system, and learning not to either under-trust or over-trust the autonomy that's there.

Whether or not it will need changes to the requirements for

a license, we don't know yet. We'll still learn, but also keep in mind that we need to educate that public in terms of how they interact with these cars. Think of a pedestrian choosing to cross the road, what should they expect the autonomous vehicle is going to do?

Mr. Lance. Yes.

Mr. Pratt. So we think that that's very important, as well.

Mr. Lance. I was taught Driver Ed in gym class in high school, but the year I was taught that is a national security secret.

Mr. Ableson. I'd like to address your question --

Mr. Lance. Yes, Mr. Ableson. I'm sorry.

Mr. Ableson. -- about will they expand to all roads? I believe over time you will see them used on all roads. We're starting with the urban environments and speeds are --

Mr. Lance. New Jersey is the most densely populated state in the nation and, obviously, this is of interest to me representing New Jersey because of the congestion that exists in this most heavily densely populated state in the country.

Yes, Dr. Pratt.

Mr. Pratt. So, I grew up in Springfield, New Jersey, so I know that.

Mr. Lance. It's in my Congressional district. Darned glad to meet you.

Mr. Pratt. A wonderful place. I think that that is very

important. It is important, however, to realize that the ability of an autonomous car to go anywhere at any time no matter what the weather or the traffic, is what we call Level 5. And we, as an industry, believe it'll be sometime before we get to Level 5.

Believe it or not, there are places in the world that are worse in terms of traffic congestion than New Jersey, and so I think that we'll hit New Jersey before we handle the whole world. But it is going to be in stages with the easier cases coming first.

Mr. Lance. All right, thank you. And before I yield back my time, I assume Mr. Karrberg from Sweden, you did not grow up in my Congressional district. I yield back 10 seconds, Mr. Chairman.

Mr. Latta. The gentleman yields back the balance of his time, and the Chair now recognizes for five minutes the gentlelady from Michigan.

Mrs. Dingell. Thank you, Mr. Chairman.

As I mentioned in my opening statement, it's critical to insure that automated vehicles are truly safe before they're available to consumers, but we also need to insure that there aren't any barriers that would prevent lifesaving technologies from bringing benefits to society as a whole. And I want to be really clear here. We should never let an unsafe or unproven vehicle hit the road, so that our challenge as Congress is how

to strike the right balance between supporting innovation and making sure that consumers are safe.

So I know all of my colleagues are asking all the questions on the other side, so I do want to just get the record here on some things. So I have a few questions for all the members of the panel since I have limited time, and I would ask you to just answer yes or no. Yes, the famous Dingell, yes or no.

Do you agree that Federal Motor Vehicle Safety Standards need to be updated in order to support the deployment of automated vehicles? And let's just go down the row.

Mr. Ableson. Yes, we do.

Mr. Karrberg. We do.

Dr. Kalra. Yes.

Mr. Pratt. Yes.

Mr. Okpaku. Yes.

Mrs. Dingell. All right. It's my understanding that a rulemaking by NHTSA to update Federal Motor Vehicle Safety Standards will take several years. If that rulemaking were to commence today, it's likely not to be completed by the time many in the industry have announced that you want to deploy automated vehicles. Is that correct?

Mr. Ableson. Yes, that's correct.

Mr. Karrberg. Yes.

Dr. Kalra. Yes.

Mr. Pratt. I'm not sure. And the reason I'm not sure is that I would hope that NHTSA, if the need were great enough, could speed up its actions. But if they couldn't, the answer is yes.

Mr. Okpaku. Yes.

Mrs. Dingell. Thank you. Love your faith in government. I understand NHTSA has the authority to exempt motor vehicles from safety standards based on a number of factors, but this exemption authority is limited by law in amount and duration. Could expanding this exemption authority provide an interim path to automated vehicle deployment during the rulemaking we just discussed?

Mr. Ableson. Yes, absolutely.

Mr. Karrberg. Yes.

Dr. Kalra. Maybe. It's more complicated than the number of vehicles right now. There's no reason to believe that that limit is going to be hit, and equally important is to think about on what basis those exemptions would be granted given that most of the time it's -- when one requests an exemption, it's on the argument that the vehicles are -- that are seeking exemption are just as safe or safer, and there's no way to show that. So that would be an equal concern with the number of vehicles.

Mrs. Dingell. It's an important point.

Mr. Pratt. We have the same concerns as the previous witness.

Mr. Okpaku. I would say the answer is yes. And very quickly,

I would say that the development and the expansion of the ride sharing industry where in 2012 there were, you know, maybe only a few thousand rides being completed, and the next year, you know, millions of rides, shows the demand for resources like this. So I think it's a wholehearted yes.

Mrs. Dingell. Thank you.

This question is for all the panelists, but you're allowed more than yes or no. We had already drifted that way.

We've had a good discussion about a few proactive things that the federal government should be doing here, but in your opinion are there any specific things that Congress should avoid doing that would stifle the development of automated vehicles?

Mr. Ableson. Speaking for General Motors, we wouldn't want to see the government taking steps to specify a specific technology or specific solution. I think as long as we keep in mind that the goal is to prove that the vehicles are safer than drivers today. I think the NHTSA guidelines published last year are a very good step in that direction in that they don't specify a technology, but specify what the expectations are before vehicles are deployed in a driverless fashion.

Mrs. Dingell. Mr. Karrberg, you all have like a minute and 9 seconds.

Mr. Karrberg. Yes, we would not like Congress to engage in traditional rulemaking because that would stifle development,

that would take much longer time because this is an area where technology is developing very fast, as you know. Also, we -- I agree with the gentleman from General Motors, it's clear that technology-neutrality is important. Politicians should not pick solutions when it comes to technology. That should be done by the industry.

Dr. Kalra. Technology-neutrality is important, and so is developing regulations that are adaptive and flexible, and designed to keep up. In terms of what they shouldn't do, I'm not specifically sure.

Mr. Pratt. I would agree with all the witnesses before that an evidence-based approach is really the best one where the government sets what the criteria are for performance, and that that's done at the federal level, but does not dictate what the ways are to meet that particular level of performance.

Mr. Okpaku. I concur with the general statements of the rest of the panel that it has to be very concerned about, you know, even with the most well-intended law, inadvertently precluding or restricting potential innovation to make this technology even safer.

Mrs. Dingell. I'm out of time. Thank you.

Mr. Latta. The gentlelady's time has expired, and the Chair now recognizes the gentleman from Kentucky for five minutes.

Mr. Guthrie. Thank you, Mr. Chairman. Thank everyone for

being here.

It's very interesting to me. I kind of follow the automobile industry, and I understand, I can conceptually figure all this out even with driverless cars when everything standards conditions, everybody drives the speed limit, nobody blocks the left lane. But you've got to wonder how it's going to work if you're going to turn left, and you're out in the middle of the intersection, and the oncoming traffic uses up all the yellow, or if -- maybe this happened to somebody here. You're on the Parkway coming from the airport, lined up to get on 395 like the good citizen, and somebody comes at the last minute and forces themself right in front of you because they don't want to wait in line. Nobody here does that, I'm sure.

But the question is, I guess my question first, Mr. Ableson, does a car have to be perfect? Do self-driving cars have to be perfect to allow them on the highway? And how do we get to the point where they're safe enough, safe enough that we allow them on the highway?

Mr. Ableson. So I think the point is, there's no way to prove statistically that something is perfect. We have to agree on the metrics by which we're going to use to show that the vehicle is better than human drivers and it's, therefore, appropriate to start deploying without drivers, to your point.

I think it's -- that's why this testing in real world is

so important because you'll see those real life conditions that we all deal with on a daily basis as human drivers, and we'll make sure that the vehicles can react appropriately.

Mr. Guthrie. And, Mr. Karrberg, if you'd like to comment on that; and particularly, what is your view on what level the vehicles are safe? For example, a Level 3 car, what about Level 3 cars?

Mr. Karrberg. Yes. First, what I'd just like to comment on, the traffic conditions you initially described here. That's not where we're going initially. Those are complicated traffic conditions, so we are targeting commuter roads in the beginning because that's where the consumer interest is, and that's where the technology will arrive in 2021.

Sorry, your next question was?

Mr. Guthrie. Just comment on the Level 3 cars, for example, what do you consider safe?

Mr. Karrberg. Yes, exactly. Now as I stated, at Level 3 the car is driving, the car is doing the monitoring; however, the driver is still fallback. And the driver may have to be able to take back control in very short time. And that is far less safe than if you go to a Level 4 car where the Level 4 car should be able to put the car into a safe mode, unless the driver takes over the control. And should be able to predict the traffic so that that can be done in a safe manner.

Mr. Guthrie. Mr. Okpaku, I guess the nature of your business is picking people up and running them around town, so it really wouldn't be the commuter -- I mean, I know people use you, too, on commuter highways. I get that, but are they -- what you're talking about, Mr. Karrberg, are people commuting into work every day and being able to do things, and not be distracted because the car is taking care of that issue. But your guys are picking people up in hotels and dropping them off at Capitol Hill. I mean, those are the kind of things -- so how do you see this working with driverless cars in that kind of environment?

Mr. Okpaku. Sure, and thank you for the question.

So, Lyft is looking at this from the viewpoint of a network. One of the things that we have the expertise in is how to manage literally thousands of cars that are all transporting different people around a particular city, and making sure that they're doing so in the most efficient manner. For example, is a car that is two blocks away from you but going away going to get you quicker than a car that's four blocks away from you but headed your direction, things of efficiency of that nature.

So I think, number one, that's one the areas of expertise that we can bring to the AV revolution, if you will, is making sure that it's operating in the most efficient manner, and that knowing how all the vehicles can interact with each other most efficiently and most safely to get passengers where they're going.

And if you think about the reductions in traffic and the reductions in congestion, I think that a ride sharing platform is going to be very instrumental in insuring that those benefits are gained.

Mr. Guthrie. Okay, thank you. And, Dr. Pratt, my home state company. Would you like to comment on what -- how safe does it have to be to be safe?

Mr. Pratt. Sure. Well, this is a question that we're thinking about extremely deeply now, and we feel that there may need to be a safety factor multiplying human performance. In other words, if an autonomous car is only slightly better than the average human driver, that may not be good enough, because emotionally we can empathize with a human driver that has an accident because that could have happened to us. On the other hand, when a machine makes a mistake, our empathy is much less.

We don't know what the safety factor has to be, and what we would like is to work collaboratively with government to try to figure out what that answer is, but we worry that it may not be one. It may be that the public will not accept, if let's say there are 35,000 fatalities a year because of human driving, would the public accept 34,999 because of a machine? I think the answer might be no, and so we don't know what factor needs to be there.

Mr. Guthrie. All right, thank you. I had some more questions. I'm out of time. I yield back seven seconds.

Mr. Latta. Thank you. The gentleman yields back the balance

of his time, and the Chair now recognizes for five minutes the gentlelady from California.

Ms. Matsui. Thank you, Mr. Chairman.

I want to switch a little bit here. Many of you express concern with a potential for a patchwork or different state standards for autonomous vehicles. As our state often is, California has been a leader in trying to develop a framework for safe testing and deployment of this technology.

I do understand the need for laws and regulations to be flexible, and do encourage innovation, and California's North Star is always innovation. But at the same time, I would be concerned about undermining safety and accountability standards, which I believe, ultimately, would harm not only the driving public, but consumer confidence in your products and services.

I think that we could all agree that we need some rules of the road. Can each of you provide your perspective on where regulation might be needed at both the state and federal levels, starting here?

Mr. Ableson. I would say at General Motors, we recognize that if a patchwork were to develop, especially on the technical sides of the issue that would be an issue for the industry. However, we've also seen some states pass some very thoughtful legislation that supports the development, like Michigan did recently.

With NHTSA, we recognize that both the states and the federal government have a role to play going forward, and we look forward to working with the governments at all levels on rolling out the technology.

Mr. Karrberg. The way forward we think is really the approach that NHTSA now has taken with the Federal Automated Vehicle Policy. It's flexible, it's not traditional rulemaking which will go very slow. It's something in between. It's not perfect, but I think that is the way forward.

Dr. Kalra. I think federal regulations are needed to set both testing methods and what thresholds of safety are needed for different levels of deployment of autonomous vehicles. Until those are in place, states really are on the forefront of balancing the competing needs associated with this technology, and so in the interim for those federal regulations, I think it would be important for the federal government to provide supports to states in developing regulations that aren't contradictory, and that pave the way for those federal regulations. And the policies that were put forward last year take a first step towards that.

Ms. Matsui. Thank you.

Mr. Pratt. I agree with some of the members of the panel here that really it's the federal government that we believe should take the leading role. To be very clear, we totally support very rigorous regulation of this, very high standards for safety,

but we think it's important that there be one standard, that it not be a patchwork of different ones.

I want to give an example of what might go wrong, and it actually comes from California, where we have one of our lab s. And as you may in California, there is a requirement if you're doing autonomous car development, that you report to the government what your disconnection rate is every time that the car has a failure of a certain kind. That's not such a bad idea, but that information then becomes publicly available, and it creates a perverse incentive, and the incentive is for companies to try to make that figure look good because the public is watching. And that perverse incentive then causes the company to not try to test the difficult cases, but test the easy cases to make their score look good.

We think it's very important that there be deep thought about this kind of issue before these rules are made. And we think that concentrating that thought in the federal government is the best idea.

Mr. Okpaku. Thank you for the question. And if I can just touch really briefly on the patchwork of state legislation really quickly. This is something where ride sharing has a really unique experience, and a recent experience in this because over the last three or four years we've seen the ride sharing industry go from unregulated to wholly regulated. And what we were seeing were

cities that were next to each other literally implementing ordinances that conflicted with each other where a vehicle could not drive -- pick up a passenger in one city and drop them off in the other city. This is a very real situation that we were facing for years, and luckily, that's a situation that has been resolved. So the concern that the members of this panel are expressing with respect to a patchwork of regulations is a very real one, and one that we experienced very recently.

To the heart of your question, I agree with the general sentiment of this panel that, you know, some of the state bills and proposed regulations that we're already seeing, we're seeing proposals that would infringe upon the federal government's, you know, realm and expertise in regulating safety standards. I think that's something that's rather dangerous, so if I was going to encourage a state to focus on anything, it would be focusing on making sure that they were not infringing upon that which is the province of the federal government.

Ms. Matsui. Okay. I also understand what you're talking about, but I always believe that states should be the test bed for innovation to a great degree here. Other than what you said, are there any specific concerns about California's testing regulations? I live in Sacramento, so I live where the governor lives, so it would be kind of nice to have this information.

Mr. Pratt. So from my perspective, the reporting of

disconnections is the number one issue.

Ms. Matsui. Okay. And I think I've heard that, yes.

Mr. Ableson. I just wanted to say, I don't agree that necessarily the reporting in California would encourage companies to do easier testing. We certainly are testing in a very difficult environment, making the data public anyway.

Mr. Karrberg. I'm unaware of the details of California, but it is an onerous reporting. It is a very, very comprehensive data sharing requirement, and also a costly deposit per car.

Ms. Matsui. All right, yes. I think I've heard from you, and I've run out of time, so thank you very much.

Mr. Latta. Thank you very much. The gentlelady's time has expired. The Chair now recognizes for five minutes the gentleman from West Virginia.

Mr. McKinley. Thank you, Mr. Chairman.

As one of just two licensed engineers in Congress, this is an intriguing process that we're going to undergo. I'm fascinated with that, but I've got a series of questions. I don't know how the time frame we're going to be able to get through all of them. But one of them is, since I've learned that we were going to have this hearing, I've tried to do a little bit more reading about this. And I don't see so far, I don't see anything about third party certification for public safety, putting public safety first overriding competitive pressures.

Do we have some provision that will require a third party, like an IVNV that we have here before this process advances much further? Quick answers, if you could.

Mr. Ableson. I'm not aware that there's any requirement at the moment for a third party.

Mr. McKinley. Second. Okay. The second, are there going to be global standards, because I've heard mention that Europe and China would be -- are we going to adopt standards that are comparable, and is that underway so that we would be to sell American cars in China, AVs over there?

Mr. Pratt. I would have to say our experience in the automotive industry over some time is we don't get global standards, that the regulating bodies tend to move in similar but differ in the detailed directions.

Mr. McKinley. One thing I've not heard also is -- so I'm a little concerned about lack of global standards, is cost. No one has mentioned cost up here. What is the projected additional cost per vehicle that could be -- now I guess you could probably answer it well, that depends upon whether you're going to go to Level 2, 3, or 4. I understand that, but let's just say it's fundamentally, not Level 1 where we are right now. What are some cost projections that we're facing, and is the overall goal that it will be universal, or will it be an option that you -- I, as a buyer, can choose not to have automated? Dr. Pratt?

Mr. Pratt. So, the costs presently are very high, in the many thousands, if not tens of thousands of dollars. Part of the reason that you're seeing a push to use it in ride share systems at the beginning is because there you can amortize the cost over a higher utilization of ride share vehicles. However, we should keep in mind the incredible rate of decreasing costs in the electronics industry particularly with scale. Think about your cell phone and the cost of the camera that's inside of your cell phone which rivals some of the best cameras that you could buy for personal or professional use in the past, these now cost pennies to put inside of a cell phone. So we don't know the actual numbers, but we are confident the cost will decrease very rapidly.

Mr. McKinley. Do you see, Dr. Pratt, for all -- maybe at the end, do you see this as something that -- it's going to be universal, or is this always going to be an option for your car?

Mr. Karrberg. It will start as option, and eventually, 10, 15 years out it will -- some functions will be standard.

Mr. McKinley. It'll be standard. Okay.

The last, because I heard some very interesting arguments, very heart wrenching and the like, so is the automobile through this autonomous process, would that put us into entitlement program, or is this something that's a privilege to be able to have a car?

Mr. Okpaku. If I may, that's one of the reasons why, again,

Lyft is really intrigued about autonomous vehicle technology, because we believe that the only way to insure that it can be equitably provided to all segments of society is to have ride sharing exist on a ride sharing platform. So that is Lyft's interest in this committee hearing today, and the --

Mr. McKinley. And I think you said that -- I think maybe it was in your testimony that everyone should have this available to them.

Mr. Okpaku. Exactly.

Mr. McKinley. That sounds like an entitlement, and my concern, of course, with that would be -- I'm just, in the very short time I have left. I'm just curious; everyone has been talking from 30,000 feet. I don't understand, is someone going to get in one of these cars? Let's just say they're going to Level 4 or Level 5, and they're going to program something and take me to Destination X, and this gets you there? You sit back and enjoy. Is that really --

Mr. Ableson. Yes, that's basically the goal. And as we said, it will take a long time before it gets everywhere for everyone.

Mr. McKinley. Will you have -- again, my curiosity. Will you be able to interact with your car? You see that visually as you're driving down, you get a phone call, or an email, or something, and pick up milk on the way, and you have to stop and go get milk. Will you be able to tell your machine to pull into

that --

Mr. Ableson. Absolutely. In fact, your machine may know the closest place to get milk and suggest a destination to you.

Mr. McKinley. Fascinating. As I said, I think this is intriguing, and as one of the two engineers, I'll be fascinated to follow how it proceeds with this, but also getting the cost down so that it is affordable for more people and not -- yes?

Mr. Karrberg. Just a comment on cost. Yes, the systems will be expensive at start, but come down in cost in the outer years. But you should also know that you save cost on fender benders, car insurance is likely to go down, also, and fuel economy is going to be improved.

Mr. McKinley. Just in closing, I hope you also would take a look at the fuel efficiency, because I know from engineering perspective, the people who use cruise control use more gas than otherwise. And I would assume that one of the fundamental focuses on this will be using a form of cruise control in your car and, therefore, I'm questioning whether or not this is going to be fuel efficient. It may save lives, but I don't -- I'm not buying yet into the argument of fuel efficiency.

Mr. Ableson. I would just add, that's one of the reasons we're rolling out the technology on electric vehicles. We think self-driving technology in electric vehicles make a lot of sense.

Mr. McKinley. And I've gone over time, and I apologize. I

yield back.

Mr. Latta. The gentleman's time has expired, and the Chair now recognizes the gentleman from Texas for five minutes.

Mr. Green. Thank you, Mr. Chairman, and thank you and the Ranking Member for this hearing today because a lot of us have heard about self-driving cars. I think my wife might be the one because she always complains about my driving. I guess we wouldn't have to use ways to find out where we need to get the closest milk.

But insuring the safety of our constituents is our primary concern, and what used to be science fiction is fast approaching reality. But that's, you know, for the last 50 years we've seen so many different changes. While the technology potential for massive benefit to society like any other new groundbreaking device, there are risks and precautions that need to be considered, and I look forward to talking about this.

Dr. Kalra, in your testimony you talk about the many different approaches to testing this vehicles, and that real world driving experience may be one of the most important tools for improving autonomous vehicle safety. The sharing of data between large groups of vehicles can quickly improve the overall safety of the group based on the knowledge accumulated by each individual car.

You mentioned that Tesla calls this fleet learning. Can you

tell us more about what fleet learning is, and what it can play in a role of improving autonomous vehicle safety?

Dr. Kalra. Sure, thank you for the question.

The idea of fleet learning is -- essentially, what's fundamental to autonomous vehicles is that they're improved by a process of machine learning, which is where computers are designed to learn better ways of behaving or performing without being explicitly programmed to do so. And to do that, they gather enormous amounts of data and use learning algorithms to try to improve their performance. And the more data one can feed into machine learning, the better the performance can become, and the faster it can improve.

So companies like Tesla are using this so that every experience that an individual vehicle has is being fed back into the system and the entire fleet can be upgraded continuously. And, in fact, most developers of this technology are using that technique.

And the question is whether that is limited to -- that kind of learning is limited to an individual developer, or whether there are opportunities for learning across developers. It's not clear -- you know, I agree with Dr. Pratt that that kind of data sharing needs to be thought through carefully, but just as the aviation industry has shown us, sharing experiences can be an essential tool in improving safety quickly.

Mr. Green. You compare risk of the early autonomous vehicles learning from the real world experience of teenage drivers. They may not be good drivers yet, for the experience and practice they develop into good drivers. Although, I would probably submit today that with our distracted driving we could all be 15 or 16-year olds trying to drive because we have so many options today for distraction. Restrictions on learner's permits, and minimum age driver requirements are instituted to mitigate the risk of teenage drivers, and you say similar requirements for early autonomous vehicles would be needed. What do you imagine some of the safety requirements or restrictions would look like when it comes to self-driving cars?

Dr. Kalra. Well, it doesn't necessarily need to be requirements, but many of the things that my colleagues here have described; for example, limiting their driving to commuter roads or at low speeds. There are many ways to reduce risk, either reducing the likelihood that a crash occurs, which means restricting their operation, for example, to good weather, or reducing the consequences of a crash. And these can be sort of industry-developed ideas and choices, or it may be something that down the line is done through regulation to say these are the ways in which we're going to start rolling out. That's an open question, but essentially reducing risk, even if we can't quantify what the risk of autonomous vehicles right now is an important

step.

Mr. Green. In your mind, what does the history of the airbag regulation teach about safety regulations for autonomous vehicles? Obviously, I think we share, you create a bureaucracy that may not be effective, and it may take a long time to get to correct things.

Dr. Kalra. You know, if anything, airbag regulations tell us this is extremely complicated. It's difficult to get right, but it's also very important. You know, airbags were developed in the 1950s, patented. They were first introduced in high end models from the '70s, and it wasn't until the '90s that they were first required in 1999. That took a long time, and one can argue that some mistakes were made along the way because airbags were not smart. The airbags that we have today, they were designed to protect an unbelted male passenger, and the force of doing so would have, for example, killed someone like me. And now we know better.

The difficulty is that that was learned through experience and deployment of the technology that was available at the time. And so there's this conflict between getting safe technology on the road and then learning the ways in which it's not safe. And so airbag regulation is instructive in that it suggests we should temper our optimism, and it's that we need to proceed very carefully and thoughtfully.

Mr. Green. Mr. Chairman, with my one second left, obviously, we have some problems with our airbags, but I yield back my time.

Mr. Latta. Thank you very much. The gentleman's time has expired, and the Chair now recognizes the gentleman from Florida for five minutes. I'll let you get to your chair.

Mr. Bilirakis. Thank you very much.

Mr. Pratt, we've heard a lot about vehicle-to-vehicle communication in previous hearings on this subject of autonomous vehicles. Where does the work you are doing on V2V communication fit into the overall blueprint of deploying self-driving cars?

Mr. Pratt. Vehicle-to-vehicle, as well as vehicle-to-infrastructure communication is of critical importance to autonomous vehicles. Of course, we drive using our own eyes to see other vehicles, but the potential is there for autonomous vehicles to use not only the sensors on the vehicle itself, but also sensors on neighboring vehicles in order to see the world better. And so, for example, if you're going around a corner and there's some trees or a building that's blocking a view, vehicle-to-vehicle communication can give you the equivalent of x-ray vision, because you're seeing not only your view, but also the view from other cars, as well.

It's going to be pretty hard to make a vehicle that is safe in all conditions. That's this Level 5 vehicle that we keep talking about. And the standards may be very high because, again, it's

a machine that's going to be running this, not a human being, so our ability to empathize and forgive will be low. So we have to give ourselves every possible tool in the tool chest in order to try to solve this problem, so I think that vehicle-to-vehicle, vehicle-to-infrastructure is extremely important, and that saving the spectrum for that use is also very important.

Mr. Bilirakis. Thank you very much.

Mr. Okpaku, forgive me if I mispronounce your name, the problem of safety benefits of self-driving cars are significant. We've already talked about the potential benefits in the disability community, which could apply to the elderly community, as well, especially in our community. I represent the Tampa Bay area in the State of Florida. There are many veterans and elderly individuals that could benefit from this technology. Well, maybe they want to get to their medical appointment, so I can see a lot of benefits there.

In Lyft's view, what are some other societal and economic benefits we could expect to see from the deployment of self-driving cars?

Mr. Okpaku. Thank you for the question.

You know, we often talk about the benefit that Lyft in its current form as a ride sharing platform has financially for drivers, but one of the things that I think often gets lost in the conversation is how important transportation is for economic

upward mobility on the passenger side; meaning that one of the biggest factors for economic opportunity is access to reliable and quick transportation. So we've already seen some of the impacts that we've had, we believe, on the customer side just by providing safe, and quick, and reliable options to jobs, to get to and from work that previously didn't exist. So if you buy that concept and you apply it across a grand scale that an AV platform can provide, then I think the economic opportunity that it confers is really significant, and it can really help a lot of people who are in economic need get to and from their jobs that they otherwise would take maybe an hour or two to get to just because they have to rely on insufficient public transportation options, in addition.

But I would also echo what you've already mentioned in terms of the ability for non-emergency medical transportation. We've seen ride sharing start to partner with organizations on that front already. I think the ability to do that at an even greater rate and a more efficient rate expands once you include autonomous vehicle technology into the mix.

Mr. Bilirakis. Very good, thank you.

Mr. Karrberg, it has been suggested that NHTSA's Federal Automated Vehicle Policy, while a welcome action and show federal leadership, it may contain guidance that has unintended consequences of delaying the development, testing, and deployment

of self-driving cars in the United States. Can you comment on that, and how ambiguous -- the ambiguities in the guidance document should be resolved?

Mr. Karrberg. There are a number of issues and questions regarding the FAVP. First of all, I have a comment on the patchwork, the FAVP does not deter sufficiently from the patchwork. Also, requirements on reporting on hardware and software changes that you do during the course of the testing, that is difficult because in engineering you do iterations all the time, and if you report every one of those, that's practically impossible. So these reporting requirements should be limited to major changes.

There is also a waiting period for you hand in your change, and there's a four-month waiting period. That's also onerous. It also calls for third party certification, preapprovals. We are pro self-certification. It's worked for 30 years, and we see no reason to change that. And we also think that for this FAVP, NHTSA should enhance its expertise, also its staffing to cater for and be able to judge on the AV development so that NHTSA itself will not be a part of the potential delays.

Mr. Bilirakis. Thank you very much. Well, I know my time has expired, but if Dr. Pratt wanted to say something, I don't know, Mr. Chairman, is it permissible?

Mr. Pratt. So I would make it short. We agree very much with

what the last witness said.

Mr. Bilirakis. Thank you. I yield back, Mr. Chairman.

Mr. Latta. The gentleman yields back. The Chair now recognizes the gentlelady from California for five minutes.

Mrs. Walters. Thank you, Mr. Chairman.

We've talked a lot about the need to prevent a state-by-state patchwork of laws and regulations for autonomous vehicles, which would inevitably slow innovation and stifle this important technology. You know, while I appreciate Ms. Matsui's concerns about California regulations, I think we need to consider the negative impact on the state regulations.

My entire life, I have seen my state, California, and its over-regulation. I saw it up close in my 10 years in the California State Legislature, and I've seen thousands of our most productive businesses and citizens flee for more friendly states. Within these last few months, the trend was extended to AV when Uber moved its testing to Arizona, after California took action to make the state's regulatory regime less hospitable. The ironic thing is that I can think of few states that would benefit more from this technology considering its promise congestion mitigation and the ability to move products inland from the West Coast ports. Even at the federal level, NHTSA suggested model state regulations are cited as the cause of some states pulling back welcoming regulatory environments for AV.

Mr. Okpaku, can you give me a practical example where a state or local law or regulation impacted Lyft's AV testing?

Mr. Okpaku. Well, thank you very much for the question.

I can give you examples of where we're concerned about the ability of these local legislation and local regulations to impact testing. For example, as of right now, in California there is only one explicitly allowed location, or there's a proposal that would make testing limited to one part of California. And if that legislation were to pass, then the ability to test AV in different environments and different situations would be extremely hampered. So that's one example. That bill hasn't passed yet, but it has been introduced, and that's cause for concern.

We're not at the point yet where any of the legislation that we're concerned about has actually been enacted, but we've seen enough proposed legislation all across the country, whether it's in Massachusetts, all the way from Massachusetts, California, that does raise that exact concern that if enacted, it would unintentionally but definitely inhibit our ability to roll out, and test, and deploy.

Mrs. Walters. Okay. Thank you very much. And I yield back the balance of my time.

Mr. Latta. The gentlelady yields back the balance of her time. The Chair now recognizes the gentleman from Pennsylvania for five minutes.

Mr. Costello. Thank you, Mr. Chairman, and thank you to all of you who have testified here.

I've spent a fair amount of time reading up on this subject, and I must commend each of you because I feel that your testimony, which I have had the time to read through, really does lay out the issues that are in front of us as policy makers in a very thoughtful way, so that we can go about facilitating this technology with you to the public's benefit. And each of you, I think, lay out what the various public benefits that inure from this.

I think each of you also lay out a little bit differently but, nevertheless, the central question here as being are we erecting, or are there regulatory barriers, or is the regulatory framework that's in place facilitative for your technology to be tested so that we can expedite increasing safety, reducing carbon emissions, et cetera, et cetera?

My question, my first question which I will just sort of lay out to all of you is similar to Mrs. Walters, and that -- but a little bit differently, and that is with respect to the state patchwork, which I think most of us think would head in the wrong direction, and mindful that I think preemption occurs here, but perhaps the regulatory language maybe is a little too opened-ended and enables some states to stick their head in a window which they're not allowed to stick their head into that

window because they should be focused on the drivers, not on the vehicle.

Are you aware of any reciprocity agreements between states to facilitate testing or deployment of self-driving cars across state lines? That's the first question. I think that's important, too, because as some of the testimony has reflected, you need to test this technology in a lot of different topographical climate, and urban/rural circumstances in order to know how effective it could be. So that's my first -- and if not, if you have not engaged in reciprocity agreements, is it something that would be helpful to the development of the technology? Go ahead and jump on it first.

Mr. Pratt. So if I might answer first, we have three sites in the United States, one in California, one in Michigan, and one in Massachusetts. We do most of our testing Michigan, and the reason that we do that is because of the different regulatory environments in the three states, and so the answer is no in terms of our utilization of any sort of reciprocity.

Mr. Ableson. We also test in three locations, as I said earlier, in San Francisco, Scottsdale, Arizona, and Michigan. I'm not aware of any reciprocity arrangement between the states. We've worked with the individual states to make sure that we have the understanding to allow the testing to go forward.

Mr. Costello. So does that mean it's not been limiting?

Mr. Ableson. So far we have not had an issue in conducting the testing in those three locations.

Mr. Karrberg. So we are unaware of any reciprocity between states, and also it would be, of course, very beneficial to be able to test across state lines.

Mr. Costello. It would be beneficial. I guess that would really only come about if you did have a patchwork. If you didn't have a patchwork, we wouldn't have to address that.

Mr. Ableson. I agree with that. It becomes a problem if a patchwork does develop.

Mr. Costello. What can Congress do to facilitate the testing and deployment of self-driving cars? And that can be directly related to the NHTSA language, or insuring that states don't get in the way, it could be related to the data sharing, double edge sword, if you will, that I think was part of the analysis that some of you laid out, which I find to be very compelling. It could be things unrelated to those two issues.

Mr. Pratt. So I think to begin with, as we spoke before, I think that the federal government really needs to help the states understand that it's not in their self-interest to try to make their own rules, and they should leave that to the federal government.

The second thing is that the NHTSA guidelines were put out as guidelines. They were not put out as rules to be fully accepted

yet, and there still needs to be some work to improve those guidelines. And I think that we spoke before about particular areas that we feel could be improved. A lot of this has to do with understanding the difference between development and deployment.

During development, it's important that there be a very low overhead, low red tape way of making changes. During deployment, that's actually where you want things to be more official, and it's okay to take more time.

Mr. Costello. Insuring that we do not erect barriers on the development side, I think is the point that you're trying to focus on.

Mr. Pratt. That's exactly right. Exactly, thank you.

Mr. Costello. My time is up.

Mr. Latta. Thank you very much. The gentleman yields back, and seeing no further witnesses, I'm sorry, members asking to question the witnesses -- I'm sorry.

Ms. Schakowsky. Would you --

Mr. Latta. Oh, absolutely. The gentlelady is recognized.

Ms. Schakowsky. Thank you.

You know, I think the best way to keep defective vehicles off our roads is to prevent the sale of used cars under recall until the recall is repaired.

Mr. Ableson, am I correct that General Motors has committed

to not selling used vehicles as certified pre-owned when they have open recalls?

Mr. Ableson. All vehicles that we sell through our certified pre-owned program have been updated for all appropriate recalls.

Ms. Schakowsky. Mr. Karrberg, is that also true in your company?

Mr. Karrberg. I'm sorry, I could not comment on that. I don't know the answer, but I will be happy to submit for --

Ms. Schakowsky. I'd really like to know that. We've been looking at that. And, Dr. Pratt?

Mr. Pratt. And this is Gil Pratt from Toyota. I, myself, don't know since I'm the head of the Research Lab, but I'm glad to find out for you.

Ms. Schakowsky. Okay. We certainly want to make sure that cars that are sold also often have some sort of statement that they've been pre-checked, but really also have open recalls are permitted for resale. So I'd like to hear from that.

Thank you very much, Mr. Chairman, and witnesses.

Mr. Latta. Thank you very much. And, again, seeing no further members asking --

Mrs. Dingell. May I --

Mr. Latta. Oh, I'm sorry.

Mrs. Dingell. May I just ask unanimous consent to put comments from Ford Motor Company in the record of this hearing?

Mr. Latta. Thank you very much. We'll submit that with unanimous consent.

Mrs. Dingell. Thank you.

Mr. Latta. No objection.

Again, thanks very much for our witnesses today. I tell you, this is -- you can see from the folks that were here in the audience today, it's a topic that's on everybody's mind, and seeing where the technology is going, safety factors, also making sure that the folks out there that -- citizens seniors, as we heard, or folks that might have a disability have more mobility to get around. This is a topic that people are looking forward to, especially in the next few years, seeing these vehicles on the road.

And, also, I would like to also submit the following letters for the record by unanimous consent; a letter from the National Association of Mutual Insurance Companies, a letter from the National Council on Disability, a letter from Ford Motor Company, a letter from Global Automakers, a letter from the Auto Care Association, letter from Epic, a letter from Competitive Carriers Association, a letter from Advocates for Highway Safety, and a letter from SAFE.

And pursuant to committee rules, I remind members that they have 10 business days to submit additional questions for the record, and I ask the witnesses to submit their response within

10 days, business days upon receipt of the question.

Seeing no further business to come before the committee, this subcommittee is adjourned. And, again, thank you very much for our witnesses.

[Whereupon, at 12:14 p.m., the subcommittee was adjourned.]