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VEHICLE TO VEHICLE COMMUNICATIONS AND CONNECTED ROADWAYS OF THE FUTURE

THURSDAY, JUNE 25, 2015

House of Representatives,

Subcommittee on Commerce, Manufacturing, and Trade

Committee on Energy and Commerce

Washington, D.C.

The Subcommittee met, pursuant to call, at 10:03 a.m., in Room 2123 of the Rayburn House Office Building, Hon. Michael Burgess [Chairman of the Subcommittee] presiding.

Members present: Representatives Burgess, Lance, Guthrie, Olson, Bilirakis, Brooks, Mullin, Upton (ex officio), Schakowsky, Kennedy, Cardenas, Butterfield, Welch,

and Pallone (ex officio).

Also present: Representative Barton.

Staff present: Leighton Brown, Press Assistant; Andy Duberstein, Deputy Press Secretary; Graham Dufault, Counsel, CMT; Melissa Froelich, Counsel, Commerce, Manufacturing, and Trade; Paul Nagle, Chief Counsel, Commerce, Manufacturing, and Trade; John Ohly, Professional Staff, Oversight and Investigation; Olivia Trusty, Professional Staff, Commerce, Manufacturing, and Trade; Michelle Ash, Democratic Chief Counsel, Commerce, Manufacturing, and Trade; Christine Brennan, Democratic Press Secretary; Lisa Goldman, Democratic Counsel; Ashley Jones, Democratic Director, Outreach and Member Services; Adam Lowenstein, Democratic Policy Analyst; Tim Robinson, Democratic Chief Counsel; and Ryan Skukowski, Democratic Policy Analyst.

Mr. {Burgess.} Very well. The Subcommittee on Commerce, Manufacturing, and Trade will now come to order. Recognize myself for 5 minutes for the purpose of an opening statement.

And I do want to--Mr. Guthrie, you too. I do want to welcome everyone here this morning to discuss vehicle to vehicle communications. It is an innovative technology that is advancing vehicle safety, and has the potential to transform the future of our nation's roadways. Recently this Subcommittee held a hearing on the Internet of things, and the growing digital economy. During that hearing, we broadly examined ways in which different markets, different industries are using the Internet, how they are using wireless connections and network sensors to create products that gather information in real time to predict circumstances, prevent problems, and create opportunities. Vehicle to vehicle communications technology is a manifestation of that digital phenomenon. The ability of cars to communicate with one another, identifying their location, their speed, their brake patterns, their--and other

positioning data, and share that information with other vehicles and drivers. This creates a transportation system in which crashes are avoided, mobility is improved, traffic congestion is avoided, and most importantly, lives may be saved. Given the life-saving benefits alone, I am very anxious to see if this technology takes shape and supports our country's efforts to build a safer and more secure transportation system. With over 32,000 motor vehicle accidents--motor vehicle accident deaths a year, vehicle to vehicle communications promises to significantly reduce those fatalities, and further harmonize roadway activity.

It all sounds great, but the only way this saves lives is to make it real. I am looking forward to examining how vehicle to vehicle technology will work on today's roads, at a time when we face an aging vehicle fleet, where many cars are not equipped with the latest in groundbreaking technology, and where Americans, still facing an uncertain economic future, continue to hold off on buying big ticket items. We must understand how this technology will be accessible and available to everyone, and, in fact, accepted by everyone.

In addition to understanding how we will make vehicle to vehicle communications a reality, I do look forward to discussing how to maximize vehicle to vehicle's driver and vehicle safety benefits. We need to understand the costs and the expenses associated with devices, and what will be required to maintain that communications network. Other considerations are also necessary, including how current roadway infrastructure will impact the implementation of this technology, and what infrastructure is needed to support V2V, and the process for developing performance and safety standards, how the technology will be compatible and interoperable among the entire vehicle fleet, and how the technology will impact driver distraction and disruption, what kind of driver education is needed to operate vehicles equipped with this technology. These and many other factors will need to be considered as we move forward in this technologically advanced transportation era.

As with all network connected products in our day and age, protecting personal information, and ensuring that the appropriate safeguards are in place to guarantee vehicle security will be an essential part of fully realizing vehicle

to vehicle communications, and its economic and public safety benefits. In our examination of privacy and security issues, it is important that we understand what kinds of information are collected from vehicle systems to support this technology, and what other safety applications, and what kind of information can be shared between vehicles. In addition, we must understand the security of those connections, and how it will be impacted with aftermarket devices, applications, and services that are brought into vehicles.

Last month the National Highway Traffic Safety Administration announced that it was taking steps to accelerate road safety innovation, including moving ahead with its proposed timetable of requiring vehicle to vehicle devices in most new vehicles. I have said before, I am anxious to see this technology implemented on our roadways, and to begin demonstrating the life-saving benefits. However, we must make certain that the technology is ready, and that the implementation is done right. We must ensure that the appropriate level of expertise is available to oversee the entirety of the vehicle to vehicle system so that it functions and operates properly, and can speedily remedy

any system failures without disruption. As we all know, lives will depend upon that. And I also want to parenthetically add that I am the Chairman of the House Motorcycle Caucus, and I do see value in being aware of other occupants on the road, even if those other occupants are seemingly small and insignificant. Big trouble can result if you violate laws of physics.

And, finally, I do want to note that there are multiple facets of vehicle to vehicle communications, and the Committee as a whole, through its various Subcommittees, is examining all of them. This hearing, however, is focused on what the technology could mean for safety, and what industry and the National Highway Traffic Safety Administration need to do to bring the technology safely into the marketplace. I want to thank in advance the witnesses for their testimony, and look forward to an engaging discussion on this very important topic.

[The prepared statement of Mr. Burgess follows:]

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Mr. {Burgess.} The Chair recognizes the Subcommittee Ranking Member, Ms. Schakowsky, for 5 minutes for an opening statement.

Ms. {Schakowsky.} Thank you, Mr. Chairman. Auto safety has been a particular focus of mine for years, and so I really look forward to hearing from our witnesses on this developing safety feature. More than two million Americans were injured in car crashes last year, with more than 30,000 deaths. Those accidents and lost lives are tragic, but there have been significant auto safety improvements made since 1979, when a record 51,000 auto-related fatalities were recorded. Safety technologies like seat belts, anti-lock brakes, rear visibility, which I was very involved in passing, though not implemented until--full until 2018, and airbags, despite the Takata recall, have significantly improved auto safety since vehicle deaths reached their peak almost 4 years ago. In order to continue that progress, we must enhance existing safety features, while at the same time considering new and innovative technologies.

Dedicated short range radio communication, DSRC, seems

with technology come new acronyms, which enable vehicle to vehicle technologies, have been researched for 15 years, and it shows serious promise in further reducing traffic accidents. V2V, as well as vehicle to infrastructure, V2I, allows for early detection of traffic risks, and provide advance warning to drivers in order to avoid accidents. Whether it is ensure drivers can make safe left turns across traffic, not knocking over our Chairman on his motorcycle, knowing when a driver can safely pass another car on the road, or minimizing traffic congestion, these technologies have tremendous real world benefits. It has been estimated that DSRC technology could prevent as many as four out of five accidents. Let--I want to hear what you think about that. I know firsthand how beneficial this technology could be--passenger in a little scrape that probably would have been prevented by V2V technology, with a bus, by the way.

However, there are potential technical, privacy, and security vulnerabilities associated with DSRC technology. This technology could be interrupted by other communications traveling over the same spectrum band. We must ensure that geolocation information and driving habits are not able to be

collected by auto manufacturers or subcontractors and used for purposes other than vehicle safety. Even more concerning is the vulnerability of advanced technologies in cars to remote access, which could cause vehicles to be breached and overtaken. Each of these threats needs to be fully vetted, and safeguards must be implemented to prevent them from occurring.

Cars are already being manufactured with DSRC technology. As that technology continues to advance and is incorporated into more and more vehicles and infrastructure, we must establish rules of the road to maximize benefits while minimizing risks. NHTSA is working to develop standards and guidance to maximize V2V and V2I benefits, and I look forward to learning more about the rules--did you have something you wanted me to do? Okay. More about the agency plans to advance and meet that objective. And with just a little over a minute, let me yield right now to Mr. Butterfield for his comments.

[The prepared statement of Ms. Schakowsky follows:]

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Mr. {Butterfield.} Thank you very much, Ms. Schakowsky. Mr. Chairman, thank you very much for convening this hearing. The safety potential of V2V communication is very significant. It is in everyone's best interest to reduce traffic fatalities and injuries. It is my belief that eventually this technology can be helpful to that end. I am also interested in how this technology can potentially benefit even pedestrians, and bicyclists, and those riding motorcycles.

There are many issues to work out to make sure this technology can become effective. I am encouraged by USDOT, and the National Highway Transportation Safety Administration for bringing all stakeholders to the table to work through issues, including reliability, interoperability, data security, spectrum, and deployment. Again, I appreciate the deliberative process that DOT has been taking with the rulemaking. I look forward to discussing the potential of these technologies to improve the safety of all Americans. Thank you for the time. I yield back to you, Ms. Schakowsky. Yes, I yield back to you.

[The prepared statement of Mr. Butterfield follows:]

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Ms. {Schakowsky.} And I yield.

Mr. {Burgess.} The Chair thanks the gentlelady. The gentlelady yields back. The Chair would note that there is a vote on the floor, but I believe we will have time to conclude opening statements, so--

The {Chairman.} Well, Mr. Chairman, in light of the votes happening now, I am going to submit my statement for the record, and yield back.

[The prepared statement of Chairman Upton follows:]

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Mr. {Burgess.} Very well. In that case, Mr. Pallone, you are recognized for 5 minutes for the purpose of an opening statement.

Mr. {Pallone.} I am sorry, Mr. Chairman, did you--are you trying to speed it up? Is that the idea?

The {Chairman.} I did.

Mr. {Pallone.} All right. I will--

The {Chairman.} So I--

Mr. {Pallone.} I will do the same, and--my statement, like Mr. Upton--like Chairman Upton.

[The prepared statement of Mr. Pallone follows:]

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Mr. {Burgess.} Very well. In that case, we will move on to the witness testimony part of the hearing, and I do want to welcome all of our witnesses. Thank you for taking the time to testify before the Subcommittee.

Our witness panel for today's hearing will include Mr. Nat Beuse, the Associate Administer--Administrator of the Vehicle--of Vehicle Safety Research, National Highway Traffic Safety Administration, Dr. Peter Sweatman, Director of the University of Michigan Transportation and Research Institute, Mr. David Amant--I am sorry, David St. Amant, President and Chief Operating Officer of Econolite Group, Mr. Barry Einsin--I am sorry, Einsig, Global Transportation Executive for Cisco, and Mr. Harry Lightsey, the Executive Director of Global Connected Customer Experience at General Motors. We do appreciate all of you being here today. We are going to attempt to get through as much of the witness testimony as we can before we must go vote. So, Mr. Beuse, you are recognized for 5 minutes for your opening statement. Thank you.

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^STATEMENTS OF NAT BEUSE, ASSOCIATE ADMINISTRATOR, VEHICLE SAFETY RESEARCH, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION; DR. PETER SWEATMAN, PH.D., DIRECTOR, UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH INSTITUTE; HARRY LIGHTSEY, EXECUTIVE DIRECTOR, GLOBAL CONNECTED CUSTOMER EXPERIENCE, GENERAL MOTORS; DAVID ST. AMANT, PRESIDENT AND CHIEF OPERATING OFFICER, ECONOLITE GROUP, INC.; AND BARRY EINSIG, GLOBAL TRANSPORTATION EXECUTIVE, CISCO

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^STATEMENT OF NAT BEUSE

} Mr. {Beuse.} Thank you. Good morning, Chairman Burgess, Ranking Member Schakowsky, and members of the Subcommittee. I appreciate this opportunity to testify before you about vehicle to vehicle communications, its readiness for application, and its potential safety benefits. For more than 50 years the National Highway Traffic Safety Administration's vehicle safety activities have enhanced occupant protection when crashes occur. But as Secretary Fox recently said, the Department wants to speed the nation

towards an era when vehicle safety isn't just about surviving crashes, it is about avoiding them. To that end, USDOT and NHTSA have accelerated efforts to bring vehicle to vehicle communications, automated vehicle features, and the full complement of advanced safety technologies to the cars, trucks, and commercial vehicles that Americans drive.

Our studies show that 94 percent of vehicle crashes are due to driver error, and we believe technologies can help reduce or eliminate it. NHTSA has been aggressively pursuing two complementary technology paths to address this issue. One path involves those technologies enabled by sensors, such as V2V, camera, and radar, that alert drivers of impending collisions. The second path involves those technologies, in some cases enabled the same technologies that I just mentioned, as well as additional ones that perform some automated vehicle function, such as automatic emergency braking when the driver doesn't take any action at all. We have already included some warning technologies into the government's five star rating program, also known as NCAB, and we have recently announced our intent to include automatic braking technologies into that influential program

as well. When integrated, these connected and automated vehicle technologies represent the building blocks that will bring us the ultimate of full self-driving vehicles.

V2V technology is based on vehicles--sharing their position, speed, and heading information with each other in near real time fashion. This anonymous exchange of data occurs over dedicated short range communications, otherwise known as VSRC, on the 5.9 Gigahertz spectrum. This piece of spectrum is quite unique. It has been dedicated for a number of years, in large part thanks to the Intelligent Transportation Society of America, the American Association of Highway and Transportation Safety Officials, and the FCC, which had the foresight to actually reserve the spectrum to assist in the development of this important technology.

By providing for enhanced 360 degree situation awareness, the kind that allows a driver to see around corners, V2V technology can assist a driver in many challenging crash scenarios that are very difficult for other sensors to do. For instance, V2V technology can help drivers avoid an intersection crash, one of the deadliest crash types on the roadway, where two vehicles may be on a collision

path, but because of obstructions, are completely unaware of it. NHTSA's testing and analysis of V2V technology indicates that it can address approximately 80 percent of all unimpaired crashes involving two or more motor vehicles.

In 2013 NHTSA achieved a key research milestone when V2V technology was tested in the real world. The safety pilot model deployment tested nearly 3,000 vehicles from eight different manufacturers driven by regular citizens, and not engineers. For just over a year NHTSA and DOT monitored and collected data on the performance of the technology as these drivers went about their daily lives in the Ann Arbor, Michigan area. Data collected from that study helped shape NHTSA's decision to move forward with V2V technology.

In August of 2014, NHTSA issued an Advance Notice of Proposed Rulemaking. That document initiated rulemaking for a DSRC vehicle-based communication system on all new light duty vehicles. NHTSA indicated that the regulatory approach could be to require the basic radio system, security features, and functionality to support inter-operability between vehicles, but we did not specify that we would require safety applications. NHTSA indicated that this

approach would allow the market and automakers to innovate and compete in offering safety applications and a whole host of other applications of their choosing. Concurrent to the ANPRM, NHTSA also issued a comprehensive vehicle to vehicle communications readiness of V2V technology for application report. This report provided details on the technology, results of numerous testing programs, benefits, deployment challenges, as well as security, privacy, policy, and regulatory issues.

In May of this year Secretary Fox announced USDOT's intent to accelerate NHTSA's V2V rulemaking activities, with the goal of issuing a proposal in 2016. Secretary Fox also announced our readiness to accelerate testing of potential sources of interference in the 5.9 Gigahertz spectrum. USDOT, NHTSA, vehicle manufacturers, suppliers, and technology companies have conducted extensive analysis, control testing, and real world field studies of V2V. Our conclusion, based on the body of work, and the observation of commenters to NHTSA's ANPRM, is that vehicle to vehicle communications offers an important opportunity to dramatically improve highway safety in the United States.

While my testimony has focused on the readiness of the technology, and its potential safety benefit, there are also mobility and environmental benefits that will also be enabled by this technology. Similarly, some innovative states have--who have been following the development of this technology have already started making plans to deploy vehicle to infrastructure, in anticipation of the Department's efforts.

Thank you for the opportunity to update this Committee on the game changing potential of this remarkable safety technology, and the agency's progress towards accelerating its deployment. I look forward to answering your questions.

[The prepared statement of Mr. Beuse follows:]

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Mr. {Burgess.} The Chair thanks the gentleman. The Chair recognizes Dr. Sweatman. 5 minutes for a summary of your opening statement, please.

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^STATEMENT OF PETER SWEATMAN

} Mr. {Sweatman.} Chairman Burgess, Ranking Member Schakowsky, and members of the Subcommittee, thank you for the opportunity to testify today about vehicle to vehicle communications, or what--I will just call it V2X. My name is Peter Sweatman, Director of UMTRI. I am a past Board Chair of ITS America, and immediate past Chair of its Leadership Circle. I want to tell you about our experience with V2X for safety. We conducted the USDOT's safety pilot model deployment from August 2012 through August 2014. We deployed 2,843 vehicles, collected 115 billion messages from 35 million miles of driving. The community, including about 2-1/2 thousand volunteers, embraced V2X. Our volunteers reported receiving warnings that prevented crashes. The stoplight application, excuse me, where you are alerted to a vehicle stopping suddenly several vehicles ahead, was extremely popular. And analytics on the system testing data by USDOT confirmed V2X's life saving potential, excuse me, on a large scale, hence NHTSA's decision to proceed with

rulemaking.

This V2X experience compelled us to do more. An incredible 47 companies have come to the table to expand the Ann Arbor mobile deployment and create larger real world deployments. The USDOT is still contributing, but this new ecosystem brings both funding and equipment. It includes automakers, T-1 suppliers, traffic control, and sensor suppliers, aftermarket suppliers, insurance, telecommunications, Big Data, IT, and mobility services. Excuse me, Mr. Chairman.

Mr. {Burgess.} Sure.

Mr. {Sweatman.} We are working with the Michigan Department of Transportation, the City of Ann Arbor, and numerous counties to equip the infrastructure. The UM invested in NTC to deploy a planned 20,000 vehicles over the next 2 years, building on the I-96 smart corridor created by Michigan DOT. This will be the first sustainable, production-ready U.S. V2X deployment. We are currently expanding the Ann Arbor deployment to 9,000 vehicles, and working with the city to make it sustainable, and that is the wish of the city. Our current V2X volunteers, many of whom

are parents in the Ann Arbor public school system, are excited about students being connected into lifesaving V2X via smartphones. Mr. Chairman, we have also found that motorcyclists love the idea that with V2X they are more likely to be detected by other vehicles.

There is no substitute for DSRC, and an entire ecosystem of companies is committed to V2X using 5.9 DSRC. They are all building product strategies around V2X, including automation. DSRC is the only technology that has been successfully tested for saving lives by both automakers and NHTSA. Infrastructure costs are very affordable. At the time of the safety pilot, each set of roadside equipment cost $15,000. We deployed 27 sets to equip roughly a quarter of the city. 3 years later, the cost of the radios is higher, so the current cost for a city of 140,000 people is under a million dollars. For our enlarged deployment, that works out at $90 per vehicle equivalent. Most of the radios are installed at intersections. V2X turns ordinary traffic signals into adaptive traffic signals without additional cost, so services like Greenwave, which provide conspicuous value to consumers on a daily basis, may be provided by the

city.

Initial V2X deployments are being replicated. Our Southeastern Michigan V2X deployment is designed to be sustainable and expandable other locales around the country. V2X also creates innovation beyond its primary mission of safety. All of our automotive partners are developing DSRC products, and our traffic control technology partners are also using DSRC to include maps in traffic signal controllers. This is not about the auto industry or the tech industry. We are seeing what happens when the auto industry, the traffic industry, the infrastructure managers, and broader tech-based and service industries come together.

V2X also supports automated vehicles. Automation will transform our transportation system. From the perspective of an autonomous vehicle, V2X is the most powerful of sensors for a highly affordable cost. For example, it is hard to imagine the automated use case of platooning vehicles without V2X. Federal actions are needed to better define the playing field, and there is an important role in supporting ever larger deployments of V2X.

In a few weeks the University of Michigan will M City, a

safe off-roadway urban test environment for connected and automated vehicles. I invite you to the grand opening, Monday, July 20, on the University of Michigan campus. Thank you once again.

[The prepared statement of Mr. Sweatman follows:]

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Mr. {Burgess.} The Chair thanks the gentleman. Gentleman yields back. We are out of time on our vote. There are 280 members who haven't voted yet. I think I can still move faster than about 100 of them, but, Mr. Lightsey, in order to give you fair consideration, let us go into a recess while we have this series of three votes on the floor, and we will reconvene immediately after the vote series on the floor, if that is satisfactory to you. So the Committee stands in recess, subject to the call of the Chair.

[Recess.]

Mr. {Burgess.} Subcommittee will come to order, and Mr. Lightsey, I think we were at you when we adjourned for votes, so 5--you are recognized for 5 minutes for your opening statement, please.

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^STATEMENT OF HARRY LIGHTSEY

} Mr. {Lightsey.} Thank you, Mr. Chairman, Ranking Member Schakowsky, and members of the Subcommittee. GM appreciates this opportunity to tell you about the progress that is being made with the rollout of vehicle to vehicle, or V2V, on our roads and highways. GM is strongly committed to V2V technology, as we believe it has the potential to revolutionize vehicle safety and intelligent transportation. Indeed, the National Highway Traffic Safety Administration has estimated that V2V could, by itself, impact over 80 percent of the over four million annual unimpaired light vehicle crashes, saving lives, and reducing the $871 billion cost to our nation's economy each year. There simply is no other safety technology available now, or that is on the horizon, that matches the promise of V2V.

GM pioneered connected vehicle technology with its OnStar brand, and is also taking a leadership role with V2V technology. In September of last year our CEO, Mary Barra, announced that GM would be putting V2V in the model year 2017

Cadillac CTS, which will be available in the latter part of next year. GM is not only a preliminary adopter of V2V, but continues to work with the Department of Transportation, and other automakers, to research, develop, and test the technologies that form the basis of V2V. In fact, after years of extensive stakeholder collaboration, research, and development, GM is now substantiating the promise of talking cars, and fully supports the shift from the lab into the real world testing and implementation.

GM is encouraged by the actual road testing that has already taken place, and by the Department of Transportation's recent announcement that it will accelerate the rulemaking process for wide scale V2V implementation. GM seeks to build upon this positive momentum, and is confident that the industry and other stakeholders share our sense of urgency. With so much at stake for vehicle safety, now is the time to advance this technology as quickly as possible.

I am excited for the opportunity to share more about GM's commitment to V2V, and am happy to answer the Committee's questions.

[The prepared statement of Mr. Lightsey follows:]

This is a preliminary, unedited transcript. The statements within may be inaccurate, incomplete, or misattributed to the speaker. A link to the final, official transcript will be posted on the Committee's website as soon as it is available.

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Mr. {Burgess.} The gentleman yields back. The Chair thanks the gentleman. Mr. St. Amant, you are recognized 5 minutes for your opening statement, please.

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^STATEMENT OF DAVID ST. AMANT

} Mr. {St. Amant.} Mr. Chairman and distinguished members of the Subcommittee, it is my privilege to be part of this hearing. Thank you for the opportunity to testify today. My name is David St. Amant. I am the Chief Operating Officer of Econolite Group, Inc., a nationwide company with headquarters in Southern California. I am also a recent past Board Chair of the Intelligent Transportation Society of America, and current member of the ITS America Leadership Circle. We have been in the traffic management business since 1933, developing signalized intersection technology to meet the needs of municipalities throughout the nation. Specifically, during the last 10 plus years, Econolite has focused much of its attention on helping shape industry standards in collaborating with leading technology partners to advance the U.S. Department of Transportation's Vehicle Infrastructure Communication Initiative.

We believe that the connected vehicle technologies we will see when we are able to connect every vehicle,

motorcycle, bicycle, or pedestrian and an intersection, and with that valuable information we will be able to help prevent crashes and move traffic much more efficiently and safely than with today's technology. The main difference between the way we will detect--we actually detect today and how we will process information used in the V2V infrastructure data in the future is that instead of detecting vehicles at a fixed point in the roadway, for the first time the vehicle will be able to send this local--this location information in real time and let us know where it is going, and we can predict where it will be, enable signals to adjust their timing, and warn approaching vehicles when necessary for preventing crashes, and determine by modality why it should be a green light of priority.

This new approach changes everything. Our system will be able to manage all traffic, not just a sampling of traffic. We will know, for example, the actual number of vehicles in the left turn lane queue, not just an estimate, and provide a slightly longer green light to flush traffic through the intersection, thus avoiding long waits and start and stop traffic, which causes traffic congestion, increases

pollution and safety hazards. And most importantly, we can reduce the number of vehicles and pedestrian crashes at intersections, and help emergency vehicles reach the site of a crash faster and safer. We believe in this technology so strongly that we are already building V2I communications into many of our new traffic signal controllers.

As we are implementing this revolutionary technology, we are also working to ensure that a connected vehicle and transportation network is designed to protect privacy and safeguard against cybersecurity threats. It is also critically important that the 5.9 Gigahertz band of spectrum, which was set aside for the V2X communication, be protected from harmful interference that could result if unlicensed devices are allowed to operate in the band. DSRC in the 5.9 Gigahertz band is the only technology currently available that provides the proven high speed reliable communication necessary to support the V2X crash avoidance systems and intersections--at intersections and between vehicles.

We are working closely with ITS America, the USDOT, American Association of State Highway and Transportation officials, and Institute of Transportation Engineers to bring

all stakeholders together through a V2I deployment coalition that will advance the deployment of this critical safety technology. If we are ever going to realize or get close to our goal of zero deaths on America's roads, this is our best opportunity. Thank you very much for allowing me to be at this hearing today, and I look forward to your questions.

[The prepared statement of Mr. St. Amant follows:]

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Mr. {Burgess.} The Chair thanks the gentleman. The Chair recognizes Mr. Einsig. 5 minutes for a summary of your opening statement, please.

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^STATEMENT OF BARRY EINSIG

} Mr. {Einsig.} Thank you, Chairman Burgess, Ranking Member Schakowksy, and the members of the--I thought I was loud enough to begin with--and members of the Committee for your--for the opportunity to testify this morning. Our nation is at the cusp of the next great leap in automotive technology, one of which will revolutionize how we get from place to place, and how we protect ourselves and our children from deadly harm. The next great chapter represents the single greatest transformation since the advent of the assembly line.

Vehicles today are engineering marvels, but their capabilities are not being fully utilized. It is like using a smartphone in airplane mode, amazing devices, but fulfilling only a fraction of their potential. So how do we fulfill the potential of cars coming onto the roads today? We need to ensure that every single new car designed for the U.S. market is equipped with radio technology known as Dedicated Short Range Communications, or DSRC, as we have

heard here earlier. This will take our cars out of airplane mode and open the door to a constant stream of vehicle to vehicle and vehicle to infrastructure communications. That will save lives, reduce cost, improve traffic congestion, and eliminate tons of pollution. In doing so, we will usher in a new era of transportation safety, innovation, new business models and applications.

Why is Cisco involved in this transformation? We are a $47 billion company formed on the simple idea that computer systems should be able to talk to each other. Cisco not only builds equipment solutions that route packets of data, but we provide data storage, cloud, wireless, security, and many other products and solutions that go in to customers around the globe. Our business is focused on developing the Internet of everything. That is the connection of people, process, data, and things, the Internet, and--the vast majority of which has never been connected before, including automobiles.

The scope of this transformation is enormous. Cars, and eventually trucks and all vehicles, will be connected to each other and to the roadside communications network via the

radio through a complex communications network. This network needs interoperability, standards-based technology, as well as tested architectures for delivering a highly secure, mobile, and high availability solution. That is what Cisco does. We will layer on it an advanced, secure IP network on the top of the physical network that consists of the vehicles and the roads. We will use a combination of DSRC and wired and wireless technologies.

Surface transportation will become a connected system generating new data, and what that data can do will amaze you. Most importantly, data will have a dramatic impact on safety. Cars connected to each other will be able to help drivers avoid everything from a fender bender to a deadly crash. Cars will have the capability to warn motorists to brake immediately, or even to take evasive action when accidents are imminent. This will save countless lives, and trillions of dollars in property damage and lost productivity.

Just as importantly, by sending crash data to first responders in real time, we can direct police, fire, and EMS personnel to the scene without delay. We could improve

traffic throw--flow through real time traffic lights and ramp metering systems. American commuters already spend 5 days per year stuck in traffic. This is a congestion penalty we all pay. It costs Americans over $1,400 per year per household, and that amount is expected to rise to $3,000 per year by 2030. We could improve our ability to manage road maintenance and infrastructure systems by collecting and analyzing more specific data on the use of our roadways.

But many of these benefits are today not available, or exist at much reduced levels because most of the vehicles are not yet equipped with DSRC technology. At the moment the private sector is poised to deploy DSRC, not just radios in cars, but the corresponding IP network that will connect our roadways in ways never before possible. Once vehicle to vehicle communications are widely installed in cars and light trucks as a safety measure, the private sector, and our public sector partners, will respond swiftly to bring full sets of DSRC benefits to the American consumers.

The potential of DSRC is not some far off dream. It is within our grasp. This is the time for America to be leading, not to be left behind. Other nations, including

Austria, the Netherlands, Canada are adopting intelligent transportation systems, including DSRC. These technologies should be on American roads. The future of transportation, and the safety of transportation, is bright.

We thank you for your attention to these important developments in road safety, and look forward the NHTSA's future adoption of the final rule for DSRC installation on vehicles. Thank you, and I am happy to answer any questions.

[The prepared statement of Mr. Einsig follows:]

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Mr. {Burgess.} The Chair thanks the gentleman. I thank all the witnesses for their testimony, and we will move now into the question and answer portion of the hearing. And I will begin by recognizing myself for 5 minutes for questions.

And, actually, I want to start, Mr. Beuse, with a public service announcement for people who are watching, in spite of all of our interruptions. If you do not know the Vehicle Identification Number of your car, you need to. It is located at the lower left hand of your windshield, or inside the driver's side door post. You need to go to safercar.gov--correct, Mr. Beuse? You need to go to safercar.gov, put your Vehicle Identification Number into the database, and check it to make certain that you are not subject to an airbag recall, because the accident that could result could be devastating. So am I correct in offering that public service announcement?

Mr. {Beuse.} You are, and I thank you very much.

Mr. {Burgess.} You know, but that actually underscores one of the challenges ahead of us, and--to get people to bring their cars in, or to even acknowledge that there may be

a recall notice out there that might affect them, and to get them to check. When you get to the third or fourth owner on a vehicle, I mean, this--a lot of times attention kind of drops off. So we are talking about some fantastic technology, and I believe we heard in some of the latter testimony that it is going to be--the technology is going to be so smart that if the other car is equipped, that the technology is going to smart enough to detect it, but still it might work better if people had aftermarket items installed. How are we going to get the word out to people that they may need to now consider an additional expense for their car?

Mr. {Beuse.} Mr. Chairman, we are doing a couple of things on that front. When we did the safety pilot in Ann Arbor, Michigan we actually tested aftermarket devices. And the reason that we did that was to see--could the communication protocol work for a device that wasn't basically built into the vehicle, and what benefits would it serve? So we have to address kind of the technical performance first.

The second part of your question has to do with getting

just consumer awareness up in general about crash avoidance technologies. We agree with you that the secondhand market and the third-hand market is an area that needs focus, and, you know, we are working some issues on that front. It will be no different with this particular technology, especially because it is the one crash avoidance technology right now that actually has strong potential in the aftermarket to be deployed.

Mr. {Burgess.} Let me just ask you, as we have heard across the panel this morning, these devices are going to be developed by multiple suppliers. What is the process by which your agency is establishing--is going to go about establishing performance requirements for the devices, and the types of safety messages that they are able to support?

Mr. {Beuse.} In the ANPRM we actually sought comment on how to do that. One of the things we learned, quite surprisingly, I think, in the model deployment was that the performance was actually really good for these aftermarket devices. So going forward in our proposal, that is one thing we will have to specify, is how that performance level should be between aftermarket and sort of built into the vehicle. I

think as proposed--or announced in the ANPRM, there would really be no desire to have a difference in performance between those two devices because, from a vehicle manufacturer standpoint, they have got to be able to know that the message that they are receiving, no matter where it came from, that is it is--and it is--actually has the same performance as they are building into those vehicles themselves.

Mr. {Burgess.} Dr. Sweatman, let me just ask you this, because we do see a lot of promise with these--with the ability for communicating between vehicles, and, you know, we also read about the driverless car. That is a pretty neat thing too. So how are these two technologies, how are they--they going to merge? Are there any issues where we need to be cautious because there can be conflicting constituencies there?

Mr. {Beuse.} So the integration question is very, very real. The way we look at the world is all these technologies will, yes, converge, that V2V, camera, radar sensors, and a whole host of others sensors that--will come about with automated vehicles will all merge together to sort of truly

deliver that full self-driving vehicle that we all imagine, that we get in our car and go in the back seat, or it is a robo-taxi, or whatever the scenario is. There--in our view, there isn't a competing technology. It is not one or the other, it is all of them working in concert together, and it really will be an integration issue on the manufacturing side, how they integrate those various sensors to make sure they are double-checking each other to be able to do the functions that they want to deliver to the American public.

Mr. {Burgess.} And Dr. Sweatman, did you have anything you wanted to add to that?

Mr. {Sweatman.} Yes, thank you, Mr. Chairman. I mean, we are very excited about the convergence of V2X and automation. So we know that autonomous vehicles work, but certain--I think most of us would take the attitude that if you have the V2X available, that adds a--brings a lot to the autonomous vehicle. And in a sense you can think about V2X as being the ultimate sensor, in terms of its capability, per dollar cost, so it is a very affordable cost, compared to radars and equipment like that that needs to be in every vehicle, and really does add a lot to an automated vehicle.

So we are very strong proponents of bringing the two together. If you think about V2X as a sensor, not only is it the equivalent of a visual sensor, that it can see another vehicle, can see whether it is moving closer to your vehicle or further away, but if that other vehicle is broadcasting additional information, such as the anti-lock brakes are being activated in that vehicle, that information can come into your vehicle as well. So, in a sense, you can get information that you would not have in any other way. So by the time you converge all these pieces of information and technologies together, we have a very, very robust automated vehicle.

Mr. {Burgess.} Very well. The Chair thanks the gentleman. The Chair recognize the gentleman from New Jersey, Mr. Pallone. 5 minutes for questions, please.

Mr. {Pallone.} Thank you, Mr. Chairman. While test programs have shown that V2V has great promise in its ability to reduce fatal crashes, I remain very interested in non-V2V crash avoidance and crashworthiness technologies that are available to consumers in many cars today, and have been shown to make driving safer.

So, Mr. Beuse, what, if any, impact with NHTSA's future V2V mandate have on other safety technology, such as airbags, seat belts, and brakes, or other crash avoidance technology, such as rear visibility cameras, and what non-V2V technology is currently being considered by NHTSA that also has the potential to save lives on the road?

Mr. {Beuse.} So we are looking at any technology that can save lives. That is what we do. When you talk about how V2V will be leveraged inside the vehicle, I think it is not clear yet how that will be done by the vehicle manufacturers. Right now we are just focused on making sure that the communication protocol between those devices is secure, and that people can basically understand each other when they are communicating.

As far as crashworthiness, there are lots of ideas floating around about how to further use these crash avoidance sensors to help improve crashworthiness. Think about adaptive restraints. So the vehicle knows it is about to get into a crash, and then leverages that camera and radar information to help prepare the driver for that crash by tuning the system, let us say. So there are opportunities

there that have--haven't been fully explored yet.

Mr. {Pallone.} Okay. I would like to clarify some of the statistics we have heard today. The Department of Transportation estimates that V2V communications could prevent approximately 80 percent of crashes involving non-impaired drivers. So, Mr. Beuse, does this estimate reflect V2V systems that warn drivers of potential dangers and require them to take corrective action behind the wheel, or does it also include autonomous V2V technology, such as automatic braking and lane keeping? Or, put another way, do we see the 80 percent reduction from warnings alone?

Mr. {Beuse.} The 80 percent is the target population. So what is the universe of crashes that this technology can address? One of the things we did in the readiness report is we actually looked at two particular safety applications that have no overlap with existing on board systems, so the ones that you mentioned, lane departure, and things like that. And so, just based on those two applications alone, we estimated half--over a half a million crashes and about 1,000 lives that could be saved just from two singular applications.

To do the detailed math to get down into overlapping technologies and things like that, we have not done that yet. We really just focus--to make it simple, to focus on the two applications that there is no overlap. So one maybe could argue that we are, in a sense, underestimating the potential of the technology by doing that, but that is what we did to make it clear and simple. And just based on those two safety applications alone, the benefits were pretty remarkable.

Mr. {Pallone.} Okay. And NHTSA estimates that approximately 33,000 people were killed in motor vehicle accidents in 2013. Of those, just over 10,000 were killed in crashes resulting from alcohol impairment. That means that 23,000 people were killed in unimpaired crashes, is that correct?

Mr. {Beuse.} It is--yes, and--in a way, but to kind of break down the math to see how it applies to V2V, there is some double counting that happens because there are heavy vehicles in there. There was motorcycles, and things like that, so we haven't done the math yet in the way that they question was phrased, but it is true, about 10,000 or so people die on our nation's roadways every year from drunk

driving.

Mr. {Pallone.} Well, I understand there are many variables that affect the statistics, such as whether a crash involved only one car without another to talk to, but could V2V technology eliminate close to 80 percent of those 23,000 fatalities, or 18,400 deaths every year?

Mr. {Beuse.} Our view is that, if you look at the two applications that have no overlap, it is about half a million crashes and over 1,000 people. There is not a technology that we are looking at right now that even approaches that. Even the automatic braking technologies don't approach those kind of numbers. And so we haven't done the full math to go all the way up to the 80 percent applicable crashes. We really only focused on these kind of very--two narrow scenarios, which is an intersection kind of scenario, where there is no technology right now that can address that particular crash type that is particularly deadly.

Mr. {Pallone.} I am going to try to get one more question in. The Insurance Institute for Highway Safety, which regularly tests and rates autos, considers vehicles equipped with automatic braking superior or advanced in terms

of driver safety. On the other hand, IHS gives--gave systems that merely detect an approaching vehicle, and warn the driver of an imminent crash a basic safety rating.

So the vehicles that IHS looked--I am sorry--yeah, looked at in their ratings used technologies such as lasers, sensors, and radar, but as V2V is introduced in future vehicles, do you believe warning only systems will be sufficient to protect drivers from fatal crashes?

Mr. {Beuse.} It will be all of them. It will be all of them. We too are very, very excited about automatic emergency braking. Just earlier this year we announced our intent to put that into the New Car Assessment Program, otherwise as--known as NCAP, which is a same--similar rating system to the Insurance Institute for Highway Safety. It is a very, very good technology. It gets even better when it has connectivity to other vehicles.

Right now those systems have to make estimates on what the vehicle in front of them is doing. Imagine the power that can be unleashed if they actually know what the vehicle in front of them is doing. So no more do they have to worry about is that a Coke can, or is that really a car? They

actually know that it is a car, and so it is not an either-or. It will be all of those technologies working in concert to really deliver real safety to the American public.

Mr. {Pallone.} All right. Thank you. Thank you, Mr. Chairman.

Mr. {Lance.} Thank you, Congressman Pallone, and I recognize myself for 5 minutes.

Mr. Beuse, in a New York Times article earlier this month, on June 10, a law professor at the University of South Carolina said about V2V that, ``Here is a technology that will significantly reduce the kinds of crashes we know about. But, at the same time, it will lead to different behaviors, and it could lead to new crashes.'' Would you please give us your expert opinion on that type of statement?

Mr. {Beuse.} Sure. The--I think the article is mostly referring to the idea of driver adaptation, and how do drivers adapt to new technology, and do they become too reliant on these new technologies, and do they then end up doing things in the vehicle that they probably normally wouldn't do if they didn't have these new technologies?

Mr. {Lance.} Rather like texting in a vehicle?

Mr. {Beuse.} Correct. We are still studying that. We have not seen it in any of the technologies that we promulgated. I had the opportunity to work on the electronic stability control mandate. There again, in that--context of that rulemaking, there was lots of discussion about--you are giving someone a technology that they can drive as fast as they want, and the vehicle will correct them. How do you think that that is going to work?

And so far we have not seen it in the data where people are doing that, because you are in a near cash event, much like these technologies that we are talking about. Whether they are enabled by V2V, camera, or radar, these are near crash events. You do not want to be in these situations at all. My hope is you never actually even experience the technology, because then that means that you are being a safe driver. And so the driver adaptation issue--question is one that we continue to look at. We actually have a study going on right now looking at it again, but we haven't seen it in the data.

Mr. {Lance.} Thank you very much. Mr. Lightsey, is V2V technology capable of ranking safety messages such that the

most immediate safety risks are provided to the driver first?

Mr. {Lightsey.} Yeah. Well, the--that is the--one of the remarkable things about the V2V technology. It has a very sophisticated set of algorithms and mathematical computations that it works on, and it delivers the most imminent threat alerts to the driver.

Mr. {Lance.} Thank you. Dr. Sweatman, during the safety pilot cars were retrofitted with DSRC devices, even though the devices were not a part of the vehicle's original equipment.

Mr. {Sweatman.} Um-hum.

Mr. {Lance.} Throughout testing did you observe vehicle make or model affecting its ability to use V2V technology, based upon the make or model?

Mr. {Sweatman.} Thank you, Mr. Vice Chairman. We didn't. We--so we had about 2-1/2 thousand vehicles from volunteers, who were parents in the Ann Arbor public school system, or working for the University of Michigan hospital, for example. And--so we--while there was some consideration to the makes and models of the vehicles that we accepted into that program, it was pretty broad, so it covered all the

major makes.

And we--so we fitted the aftermarket technology, and we didn't notice any difference between the makes of vehicles when it came to the effectiveness. One of the things we were very interested in was the reliability over time. So we have been running now--those vehicles for 3 years. A lot of them have been running for 3 years, so we also feel that the reliability is pretty good.

Mr. {Lance.} Thank you very much, and I yield back the remainder of my time, and I recognize the Ranking Member, Ms. Schakowsky.

Ms. {Schakowsky.} Thank you, Mr. Chairman. Recent investigations by 60 Minutes, this is directed to you, Mr. Beuse, have--and Consumer Reports have demonstrated that the threat of 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, the brakes, steering wheel, windshield wipers, and more. And even though these videos were filmed in controlled environments, they highlight the potential dangers that are connected with--from hackers.

So I wanted to know how real is the threat of vehicle hacking generally, not just with regard to V2V. Do you expect the nature of the threat to evolve as technology develops?

Mr. {Beuse.} We agree that cybersecurity is something that we all need to pay attention to. We actually have a very comprehensive program at the agency looking at all--at a layer of protection for vehicles. Harden the vehicle against attacks first. If an attack happens, what is the vehicle supposed to do? You know, store the attack, study it for later. And also to make sure that people are using the kind of latest and greatest in terms of protection, and then have a way to feed back into the system, such that, if an event happens, we understand why it happens, and we can understand whether the protocols that we had in place actually were effective or not.

On the V2V side, it actually has its own unique set of security system, both inside the security management system that is responsible for giving credentials, but also in terms of how that communicates with the vehicle.

Ms. {Schakowsky.} So has NHTSA been evaluating this

threat of vehicle hacking in this V2V space, or more generally regarding connected cars? I mean, it is one thing to say the driver should do everything he or she can to protect the--so that they can protect themselves, but what exactly is NHTSA doing?

Mr. {Beuse.} We are doing a couple things. The Consumer Reports piece that you mentioned was actually filmed at our facility. We have been doing this kind of work before it became kind of in the news, right? It is on the ways that--we get a vehicle to do some things when we want to evaluate the upper limits of performance.

What we are doing right now is kind of a four pronged approach. One is making sure that there is kind of common understanding in the industry. One of the ways that we are doing that is advocating for the formation of an ISAC, an Information, Security Analysis--if there is an event on a vehicle that manufacturers can share that information with each other in nearly real time and help develop solutions. On the vehicle side, we are looking at countermeasures, what I call countermeasures, things--how to harden the vehicle.

So, in a simple way, let us say an attacker is trying to

gain access to the vehicle. Well, one of the things we want to look at is, even if you hard the vehicle initially, the vehicle has to be smart enough that it is being kind of-- trying to get attacked. And so we are looking algorithms that can detect that event, and then take some appropriate action. Should the vehicle go into failsafe, should it take some other action to make it not seem like the vehicle is going out of control into a brick wall, which is everybody's fear?

The other thing we are looking at is best practices and standards. One of the things with cybersecurity is that is an involving area, and it is one that may have to lend itself to more of a best practices approach versus more of a regulatory follow this rule, because the rulemaking process does take time, but best practices are something you can update pretty quickly. And when we are looking at that, we are looking at FDA, FAA, and across government about how other people are dealing with cyber security issues, and it seems to be that is the way that they are going.

Ms. {Schakowsky.} So--explained that the DSRC technology we are discussing today does not go over the

Internet, it is not stored in the cloud, so it isn't at risk for hacking or snooping. However, since most cars contain other electronic systems, like my new car does, does DSRC talk to those systems, and thus make DSCR communications vulnerable, in fact?

Mr. {Beuse.} Thank you for that question, because that is one of the things I should have clarified in my previous response. One of the things we are also looking at is separation of functions. So should the radio talk to the brakes? And one of the ways we are going to look at that is should there be absolute separation, or is there a way that you can have them communicate, but it is through a very controlled gateway? And so we are very much looking at that. Now that gets integrated into the vehicle is something we are actively talking with the manufacturers about. Because right now there is not kind of a harmonious approach to that.

We recognize that, and so we are doing the research now to determine is there a best way to do this? And the science is evolving. I mean, many of the gatekeepers that they have put on vehicles may or may not be effective, and that is one of the things we are looking at.

Ms. {Schakowsky.} Thank you for that, and I yield back.

Mr. {Burgess.} The Chair thanks the gentlelady. The Chair recognizes the gentleman from Texas, Mr. Olson. 5 minutes for questions, please.

Mr. {Olson.} I thank the Chairman for holding this very important hearing, and welcome to all of our witnesses. A few comments before my questions. As a former Naval aviator, I know about a system that is like V2V and V2I in aviation. It is called TCAS, for Traffic Collision Avoidance System. It tells aircraft on a collision course--that course, and B, suggests maneuvers to avoid a collision. It has been online for 21 years now. Last year, on April 4, it avoided a collision 200 miles west of Oahu, way out in the Pacific Ocean, out of range of radars. The system said collision avoidance, the plan pulled up, missed the collision. They saved lives. V2V and V2I promises to do the same thing with cars. And no one in the world wants V2V and V2I to work more than I do, because my life changed forever because of a car crash.

April 1, 1990, Polashis, Texas, my wife and I were hit head on by another vehicle. Three people in that vehicle

died. My first wife, Ellen, died as well. We had been married for less than 3 months. V2V and V2I have the promise to keep people from going through what I went through in 1990. I want these systems to work. But I am concerned that there may be some derailments in the future, particularly with lawyers and lawsuits.

So my first question is for you, Mr. Beuse. Have you considered liability in a crash? I mean, is it the manufacturer, the driver, the V2V, the V2I system? Has that been in your computations going forward here, sir?

Mr. {Beuse.} In the ANPRM we explored that issue very thoroughly, and actually asked comment on it. From our perspective, since this is a warning system, the current liability that exists now on current vehicles is the same. This system doesn't add any new liabilities. We are still exploring the security credentialing management side of the equation, but there again, we don't think that that is a big issue.

Mr. {Olson.} And--comment on liability and concerns about something popping up in the future that may derail this because you are held liable for the V2V, the V2I system being

involved in an actual crash--any comments? I know--maybe--expertise. Going once, going twice, okay, let us move on.

Another question, Mr. Beuse. You guys do a great job--every year you put out these safety standards for our vehicles, the gold standard, but for safety it is about active safety. You know, it is all about barriers, poles, impactors. Have you ever thought about considering passive safety mechanisms, like V2V, V2I is that--in the future, put that in rating systems? Add that, make it more safe, so people know what the vehicle can do to protect them? Instead of just collision, but--hey, guy is coming at you, veer off here.

Mr. {Beuse.} Yeah. We are actually the first program to put crash avoidance technologies into a consumer information program. We did that when we did forward crash warning and lane departure warning. This year we announced a step to do more active safety, and announced that we were going to put automatic emergency braking into the program, and we are close to making a final decision on that. So we are very much focused on that. I can tell you the development of test procedures is a lot more difficult than

it used to be because of these systems, but it is well worth the challenge, given their life saving potential.

Mr. {Olson.} And, Mr. Lightsey, would GM, as a manufacturer, like that on the side of the car? Hey, we have this vehicle--this device in our car. It is a safe car, protect you from a collision. Any concerns about that?

Mr. {Lightsey.} No. I think the more we can inform the customer, the better off we are going to be. I think--of course, our customer is our highest--one of our highest priorities, and we want them to have the best experience that they possibly can.

Mr. {Olson.} Thank you, and one further question. And this one is for you, for GM. What do you think will be the life cycle costs of V2V and V2I in GM vehicles over time? Will that be a big cost, a small cost, no cost? Any idea what the costs will be over time?

Mr. {Lightsey.} Well, we plan for the V2V to be standard equipment on the Cadillac CTS model year set 2017, so the customer won't see that as any cost. We look for the cost of the hardware to come down. As was indicated by the other witnesses here, it is not a significant cost, even at

the beginning of the early rollout, but we certainly expect, as production ramps up, for those costs to come even--to even lower levels.

Mr. {Olson.} Thank you--I am out of my time. Yield back.

Mr. {Burgess.} The Chair thanks the gentleman. The gentleman yields back. The Chair recognizes Mr. Cardenas from California. 5 minutes for your questions, please.

Mr. {Cardenas.} Thank you very much, Mr. Chairman. I appreciate the opportunity for--to be reminded about how serious and how personal these issues are, so thank you for sharing your testimony, Mr.--Congressman Olson.

My first question to the panel is how many of you are engineers or scientists? Okay. All right. There are a few of us in the room. The reason why I ask that question is because I just saw a movie on the plane where it was the scientist who was the good guy, and it was the non-scientist who was the bad guy when it came to, you know, robotics. And in that movie it had to do with robots becoming police officers and stuff, but anyway--so I just thought I would throw that out there.

23 million connected vehicles were on the roads worldwide in 2013. That number is expected to surpass 150 million within the next 5 years. Today each connected car contains about 100 million lines of code, a number that could triple in the coming years. Given the scale and complexity of this market, the rapid expansion of this technology presents a host of new technological challenges.

Mr. Beuse, a consumer streaming a movie at home may be able to wait for a video to load, but they can't avoid delays when two cars are rapidly approaching and attempting to communicate with each other. So what is NHTSA doing to ensure that the V2V standard guarantees zero latency, zero delays?

Mr. {Beuse.} That is a very important issue. The entire body of research that has been done today assumes that there is no interference in that spectrum band. Obviously, if that changes, then we are going to have to re-look at where we are, because our job is safety, and our job is to make sure that consumers get that safety that has been promised. And if, for some reason, the message is delayed, or not even received at all, and that leads to a crash, then

that is not going to be a good situation for anybody. And so one of the things we are looking at is how much interference in that band can you tolerate? Again, the whole body of work, though, today has been done assuming no interference.

Mr. {Cardenas.} Okay. Mr. Beuse, how will NHTSA ensure that different manufacturers' connected car technologies are compatible with each other, and can interact automatically, and without delays?

Mr. {Beuse.} One of the great things about this program is that we have been working collaborative with the manufacturers, with suppliers, and even across the globe. And one of the things right now is the U.S. is kind of leading the--kind of the worldwide deployment of DSRC. And what comes with that is standardized protocols for the communication, so we are working with voluntary consensus groups to make sure that those standards are done in a way that, if they--people use them, and if we codify them in a regulation, that we will have interoperable communications not only between vehicles here in the U.S., but vehicles in Europe, and vehicles in Japan.

Mr. {Cardenas.} Okay. Then, sir--Mr. Einsig, how has

the Dedicated Short Range Communications technology on the V2V technology depend--been deployed successfully elsewhere?

Mr. {Einsig.} So there are a number of test beds going on around the world. Some that we are aware of are in Austria, as well as in the Netherlands. Many countries are looking at this to differentiate themselves from a safety and from a quality of life perspective.

Mr. {Cardenas.} Um-hum. And who is overseeing the results or the validity of those results in those other test cases?

Mr. {Einsig.} I really couldn't comment too far. It is really country by country.

Mr. {Cardenas.} The reason why I ask that question is because, for example, how many people at the witness people are working for government, and how many are working for--government, one? Private industry? And university, so you are kind of neither. Okay. The reason why I wanted to point that out is because I wouldn't want--ever want to see Hollywood play out in real life, where profits, or those motives, override the objective of making sure that we are as safe as possible, as safe as possible.

And I can't pass up the opportunity, Mr. Chairman, to remind the American public who might be viewing this, or individuals who might be--feel this is an important issue to pay attention to, is that when we talk about getting rid of government, when we talk about government being bad, this is a perfect example where, no offense to private industry, we need to have that balance. We need to have certifications. We need to have some checks and balance, where we know that when something comes to market, nothing is ever perfect to the degree that we would all like it to be, but it is as good as humanly possible.

And those of us who are scientists, you learn as a freshman the number one cause of error in any system is the human being. If systems were 100 percent automated, and human beings didn't touch it, that is about as perfect as you can get, and I just want to say thank you for those of you who are involved in making sure that we welcome those checks and balances, and we understand that we need to live with them.

Thank you very much, Mr. Chairman. I yield back the balance of my time.

Mr. {Burgess.} The gentleman yields back. The Chair thanks the gentleman. The Chair recognizes the gentlelady from Indiana, Mrs. Brooks. 5 minutes for questions, please.

Mrs. {Brooks.} Thank you, Mr. Chairman. I am from--I represent Indianapolis, Indiana and counties to the north, and when I tell colleagues in Congress that I am from Indianapolis, or I represent Indianapolis, everyone thinks of one thing, the Indianapolis Motor Speedway, and cars, and automobiles, and trucks. And rightfully so, because automobiles, and the auto industry, and auto racing, have helped define who Indiana who, our Hoosier identity, and a good portion of our economy, actually. And certainly with respect to the greatest spectacle in racing, the Indianapolis 500, much innovation comes from the 500, and so we have--and Indiana actually enjoys the fourth highest number of vehicle miles traveled per capita. So we love our cars and trucks in Indiana.

And so it only makes sense that automobile companies, like yours, Mr. Lightsey, have either started in Indiana or have grown recently, and house a large portion of your truck and car business. And we have become--Indiana actually has

become the second biggest state in terms of automotive GDP, and we are the crossroads of America, with more than $500 billion of freight moving through our state on our highway systems.

So I know and believe in our burgeoning technologies, and it is--important, in fact, the Indiana Department of Transportation already has plans in the works that will allow INDOT to utilize vehicle to infrastructure technology to design better snow routs and decrease congestion. And NHTSA, obviously, has estimated that it could save 1,100 lives every year with this vehicle to vehicle technology.

But I am very concerned--having served on Homeland Security, having been a former United States Attorney, I am very concerned about security. And actually, as you probably know, in February there was--60 Minutes did an episode on hackers with respect to this technology, and I understand part of that has been addressed a bit at this hearing, but I want to talk a little bit more about those vulnerabilities. And, as colleagues have mentioned, it is our role, and NHTSA's role, to ensure that the technology is the safest it can possibly be. And so we need to ensure that it will save

lives, rather than, you know, those who have ulterior motives affecting this technology.

So, Dr. Sweatman, I am curious, did the safety pilot test the security of the vehicle to--V2V system, and what were the results, and what were the vulnerabilities that were detected?

Mr. {Sweatman.} Thank you. So the safety pilot used the prototype security system that was developed by the U.S. Department of Transportation. So we implemented that, and that was a system that--where the vehicles were all loaded with certificates, and the system played out the way it was supposed to. So we didn't have any security issues in the 3 years--we are still operating the test environment in Ann Arbor.

So we have not had any security breaches during that time, but we--now there is a new security system which is being developed by USDOT, and so we are about to implement that in the Ann Arbor test environment. So that will elevate the protection in the system, but we haven't had any problems with the system we started with.

Mrs. {Brooks.} And I know there have been some

questions with respect to hacking, but, Mr. Lightsey, can you talk with respect--from General Motors' perspective, how vulnerable are the cars, are automobiles to the hacking or privacy intrusions, and will that vulnerability, if it exists, increase the implementation? How will it affect the implementation of this technology in our vehicles?

Mr. {Lightsey.} Thank you very much. Yes, well, speaking on behalf of GM, and on behalf of the industry, we take cyber security very seriously. It is certainly something that we are very aware of, and have devoted a lot of resources to that end. We created, in General Motors, just late last year, an organization under a chief product--cyber security officer that is responsible for end to end cyber security of our vehicles, all the way through the telecommunications networks and to the back office systems. And they are constantly working to make our systems better.

As noted earlier, it is a very dynamic area. It changes on a very rapid basis, but we try to stay abreast of it as best we can. And we have a lot of resources devoted to that. I will say that earlier in the week we committed to be a charter member of the auto industry ISAC that Mr. Beuse

referenced earlier. So we look forward to that. I think that will increase communication amongst all the participants in the industry and make us all more aware of what threats are out there, and therefore are able to deal with them better. Thank you.

Mrs. {Brooks.} I think as Americans continue to be concerned about the extensive amount of hacking happening in all systems, this is yet something else we need to make sure the resource's intention is given, so thank you. I yield back.

Mr. {Burgess.} The Chair thanks the gentlelady. The gentlelady yields back. The Chair is going to recognize the Ranking Member for a brief series of follow up, following which I will recognize myself for the same. So the gentlelady from Illinois is recognized.

Ms. {Schakowsky.} Thank you, Mr. Chairman. I would like to first apologize to three of the witnesses. I am sorry that we have so many things at one time that I didn't hear. This question is for Mr. Beuse and for Mr. Lightsey, and that is regarding the timeline for automakers to integrate these kinds of technologies into the vehicles that

are available.

So GM's announcement that its Cadillac CTS will be V2V enabled starting in model year 2017 is a positive sign for the technology, but an effective V2V communication system cannot simply be Cadillacs communicating to Cadillacs. So first, Mr. Beuse, how many vehicles does NHTSA estimate must be equipped with V2V communications systems to see really--to see safety benefits? Is there some sort of critical mass?

Mr. {Beuse.} Yes, there--vehicles can start to see benefits day one. I think, in our analysis that we did, rather than give you a model, you know, a number of vehicles, maybe it is better to think about it in terms of years. So basically 3 years after a final rule, in our analysis we showed you start to see benefits. And the reason why I mentioned you could see benefits day one is because in certain cities you might have a scenario where there are more new vehicles there than other places, and they might start to see some benefits. But on a critical mass, it is--it happens pretty quickly.

I think the unique thing here is the aftermarket that will--we are not sure yet what role that will play, but that

also has a potential to dramatically reduce how long we see benefits starting to occur.

Ms. {Schakowsky.} The average car on the highway right now is 12 years old, so it just seems to me--well, are there any considerations for offering incentives for current car owners to purchase aftermarket DSRC technology?

Mr. {Beuse.} That is a little bit out of NHTSA's purview.

Ms. {Schakowsky.} Okay.

Mr. {Beuse.} There was been, I think, some discussion before about that in the Congress on a variety of factors about crash avoidance technologies in general, but right now there is not a capability for NHTSA to give consumers some sort of money for crash avoidance technologies.

Ms. {Schakowsky.} Okay. Mr. Lightsey?

Mr. {Lightsey.} Yes, thank you, Ranking Member Schakowsky. Yeah, so this is a unique technology in that it is collaborative. And, as you indicated, our cars have to be able to talk to other cars to realize the benefits of the technology, and also to be able to talk to the infrastructure.

As Mr. Beuse indicated, you know, you can start to see benefits day one, if you are in the right place, and you are encountering other folks with the technology. But we also know that the American public has shown a tremendous ability to adapt--adopt any technology very quickly if it sees a benefit. And I come from the telecom industry, and I spent 25 years in that industry during a time of very dynamic change, and I saw a very incredibly quick shift of the ability of the public to take up, like, a smartphone technology. I will assure you, I was AT&T in 2007 when we rolled out the iPhone, and nobody at AT&T or at Apple I think envisioned how quickly that technology would spread, and how pervasive it could become.

So we are very encouraged. We know that other automakers have made plans, and will be rolling out plans to deploy this technology. We are encouraged by that, as Mr. Beuse indicated. We also believe that there is a tremendous potential for an aftermarket for this technology to spread very quickly.

Ms. {Schakowsky.} Thank you, and I yield back.

Mr. {Burgess.} The gentlelady yields back. The Chair

thanks the gentlelady. The Chair recognizes the gentleman from Oklahoma for 5 minutes for your questions, please.

Mr. {Mullin.} Thank you, Mr. Chairman, and thank you guys for being here. It is, you know, technology, sometimes you just want to reach back and scratch your head and think, where does it end? And I don't think it does. Personally, I like the feel of driving the car, and the responsibility that comes with it, but I understand the technology is moving rapidly, and we need to embrace it. In any successful industry you have to embrace the technology. And so thank you for enlightening us. I am not saying I understand it, I don't, but I really appreciate you being here. Mr. Beuse, are--do you know if the state DOTs are playing any role in this?

Mr. {Beuse.} The state DOTs are playing a huge role, and there are certain states that are forward leaning more than others who have been following the development of this technology, and are anxiously waiting for us to get on with the business of standardizing the protocols and communications so they can start making plans to deploy the technology in real time. Mr. Sweatman mentioned that the

State of Michigan, and Ann Arbor in particular, are already deploying V2I infrastructure. The GM announcement, part of that was also on the corridor, on the highway corridor, that they plan to deploy some vehicle to infrastructure technology. So it is happening. States kind of do their planning, their looking at it. And also what has happened is the association--ASHTO has actually already put out--I wouldn't call it a road map, but how states can make plans to deploy this technology.

Mr. {Mullin.} Is there any concern about it being a distraction to the driver, or becoming where they are more dependent on it? I mean, I say that because I recently bought my wife a new vehicle, and it honestly scared me when I got into it because I got a little too close to the lane, and my seat vibrated. And I was kind of shocked, but then you start looking around at all your instrument panels, and you are trying to figure out what just happened, I realized there is a button up there I have got to push to keep my seat from vibrating. Not that it bothered me that much, but there is so much going on in a car now that--is there concern about people being very dependent on the technology keeping them

safe, where they are not actually focusing and doing it themselves?

Mr. {Beuse.} Certainly we want drivers to do the driving task. The information that is coming in through the V2V, in terms of the display, it is kind of invisible to the driver. What the driver will receive, it will be a warning, and it is not going to be a separate warning from what they receive now, let us say from a forward crash warning, would just be integrated into that same warning interface for the driver.

On the distraction side, yes, we are very much concerned about distraction. Last year we put out some guidelines for the manufacturers to kind of provide a box of innovation for them to design these systems a little bit better for the consumer to kind of reduce that rest.

We have not seen where consumers are becoming totally dependent on these crash avoidance technologies. The technology you mentioned is more of a lane departure warning, and yeah, it kind of goes off--you experience it quite a bit. Some of the ones we are talking--

Mr. {Mullin.} No, I am a good driver. I don't--I just

happened to--

Mr. {Beuse.} --you or your wife for a bad driver.

Mr. {Mullin.} Well, she is. No, I am kidding. Babe, I love you, I am just kidding.

Mr. {Beuse.} You do experience that technology quite a bit. I have that same technology as well. But some of these others ones, like forward crash warning, automatic emergency--

Mr. {Mullin.} Um-hum.

Mr. {Beuse.} --braking, this intersection movement stuff, it is--you are in a crash, you don't want to experience that ever again.

Mr. {Mullin.} Sure.

Mr. {Beuse.} And so--

Mr. {Mullin.} Been there.

Mr. {Beuse.} --the reliance, we just haven't seen it on some of these really advanced crash avoidance systems.

Mr. {Mullin.} What about the cost to the states? Is--you mentioned Michigan is deploying some of this. Where is the money coming from?

Mr. {Beuse.} Well, we might have to ask the--maybe Mr.

Sweatman, if he knows where they are getting the money from.

Mr. {Mullin.} Mr. Sweatman, do you want to take that?

Mr. {Sweatman.} Sure. Let me say first that, you know, in Ann Arbor, the deployment we did, for equipping--for putting the infrastructure out throughout the city of Ann Arbor it is about a million dollars. So if we assume a certain number of equipped vehicles in the city of Ann Arbor, which is a city of 140,000 people, that works out equivalent of about $90 per vehicle.

Mr. {Mullin.} Here is my concern with this is--Dr. Sweatman, we see technology change so fast. I mean, Mr. Lightsey, you mentioned the iPhone. I mean, I am on my sixth one--or fifth one, I am losing count. But there--the technology changes all the time. And you see the stakes, and make this investment, then the technology changes, is the technology going to be adoptable as the technology increases? Because obviously, once we go live, there are going to be all types of improvements that are going to be needed, and there are going to be ways that we could make it better.

Mr. {Sweatman.} So as far as the wireless communication is concerned, that is standardized, and has been for quite a

few years. So the so-called DSRC is standardized, that is not going to change. So it is not like bringing out a new iPhone every 6 months--

Mr. {Mullin.} Okay.

Mr. {Sweatman.} --or something. The underlying principles will remain the same.

Mr. {Mullin.} Okay. Thank you. That does answer my question. Thank you so much, and, Mr. Chairman, I yield back.

Mr. {Burgess.} The Chair thanks the gentleman. The Chair is going to recognize himself for a brief series of follow-up questions. And Mr. Olson is no longer here. I do want to thank him for sharing a very personal story with us. Mr. Mullin, with his experience with lane departure, reminded me that my son, when he was 20 years old, and a young airman stationed at Clovis, New Mexico, and burned the candle at both ends, fell asleep at the wheel one night way out in west Texas. And I got that call that, you know, you just always dread as a parent getting. Dad, I fell asleep, I ran off the road, I don't know where I am, and the airbag went off and I can't drive the car. I said, well, stay where you are, I

will come get you. But boy, wouldn't it have been great to have had something that would have perhaps allowed him to avoid that accident. And it just really came home to me as I was hearing the discussion today.

Also occurred to me--and Mr. St. Amant and Mr. Einsig, let me just ask you, because you are probably the ones who would be closest to this, but--I am a physician by trade. I spent a lot of time working in emergency rooms when I was a resident, working big city emergency rooms at Parkland, and boy, we had telemetry, and we had phones, but when you go out into rural Texas, you don't have much. And somebody loads up and comes in, you don't even know they are on the way, let alone any of the data about their accident. But now it seems to me that the possibility is there, that there could be the transference of a great deal of data to a receiving facility after there has been an automobile accident.

Now, obviously, your goal is to avoid any accidents, but if one does occur, you know, we were always left with some pretty rudimentary tools. Did you hit your head? I don't remember. Did you lose consciousness? I don't remember. And, in fact, it became a useful historical note to know that

an airbag had deployed. That kind of gave you an idea of how much kinetic energy had to be absorbed in that accident. So what do you think, in the years to come is there going to be a way of transference of that amount of information to a receiving facility, and what are some of the kind of safeguards we have to think about surrounding that? So who else--Mr. St. Amant and Mr. Einsig, I would be interested in your responses.

Mr. {St. Amant.} Thank you for the question. There has been a lot of work going on to understand how this technology can beast be--can best be deployed in rural areas, and there is a lot of research work. Part of it is being done in Michigan, and other places as well, where we are testing these and using cellular as a means to get that done. So we are--we know that we have to address that rural area. It can't just be in the more urbanized areas.

Mr. {Lightsey.} Yes, thank you, Mr. Chairman. So GM has been a leader in this area. We have had OnStar on our vehicles, standard on all of our vehicles, for over 10 years now. And while that doesn't use DSRC technology, it does use cellular technology. We do provide emergency services. And,

in fact, very recently we are working with the American College of Emergency Physicians under a grant to train them because we now have the capability, if our car is in a crash, to know from the sensors that are on the vehicle, airbag deployment, as you mentioned, whether the vehicle rolled over or not in the crash, and we can relay that information in real time to emergency responders, if they have the ability to receive it.

So we are working with the American College of Emergency Physicians to do training so that they will be in the hospital, they will be ready to receive it. As you know, that first few minutes are the golden 10 minutes, and if you can make getting to the accident quicker, it can save lives. And if you can tell the folks that are on the way in the ambulance that--to expect serious injuries, that can help with their dispatch and what equipment they dispatch out there. It can have an incredible impact.

Mr. {Burgess.} Very good. Mr. Einsig, did you have something to add?

Mr. {Einsig.} I don't think I could have said it any more elegant. Thank you.

Mr. {Burgess.} All right. Well, Mr. Lightsey, let me just ask you one last question. And I am going to ask you to look way over the horizon, but, you know, we hear these tragic stories of the child left in a car on a hot day in Texas, and it happens. And it is terrible when it happens, and frequently there is a loss of life. So is there anything over the horizon that would be able to detect human in the car, temperature reaching a point that is bad? Do you have anything on the drawing board that would look at that?

Mr. {Lightsey.} I think we can talk also to Mr. Beuse about that, but I think the industry is working on several technologies that could help in those situations.

Mr. {Burgess.} Very good. Mr. Beuse?

Mr. {Beuse.} Sure. The--hypothermia is a terrible, terrible thing. If you actually--as you know, how that--how you actually, you know, die in those events. It is a very, very traumatic event. And, as we know all too well, many of these cases are children who are kind of defenseless. We have been working the communications front on this issue for a few years, trying to raise awareness, and I am pleased to say I think we are making progress. The Alliance of

Automobile Manufacturers did a surgery not too long ago showing the difference of opinion. Before, people would walk by a vehicle and see a kid in the back seat and not think anything of it, and keep walking. These days, now people are more apt to call 911, or take some sort of action, so we are making progress. But there is still more to do.

On the technology front, we are getting ready to release sometime this year test procedures. One of the things we saw happening is people having good intentions, developing all sorts of technologies, but missing the mark on how to make them safe. And so, given that that is in our name, we felt we could serve a role there, and--not necessarily prescribing particular technologies, but just say, hey, if you are going to develop a technology, these are some things you should look at, in particular with these devices. You know, things like--should probably be resistant to water. Why? If you have kids, you know that seats get wet, things like that. And so we are going to be producing that report here in the coming months, and we hope that that will help advance the science a little more on the technology front.

Mr. {Burgess.} Thank you. I am encouraged by that. I

want to thank all of our witnesses and our members today, as this has been a very instructive panel. We finished up right on time. That signal was the vote being called, so I achieved my goal of getting us through this before we had to have yet another interrupt. So, seeing no further members wishing to ask questions, I again want to thank all of our witnesses for participating in today's hearing.

Pursuant to Committee rules, I remind members they have 10 business days to submit additional questions for the record, and I ask that the witnesses submit their responses within 10 business days of receipt of the questions. And then, without objection, the Subcommittee is adjourned.

[Whereupon, at 12:15 p.m., the Subcommittee was adjourned.]