TRANSPORTATION INNOVATION: AUTOMATED TRUCKS AND OUR NATION'S HIGHWAYS

HEARING

BEFORE THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

ONE HUNDRED FIFTEENTH CONGRESS

FIRST SESSION

SEPTEMBER 13, 2017

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SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED FIFTEENTH CONGRESS

FIRST SESSION

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TRANSPORTATION INNOVATION: AUTOMATED TRUCKS AND OUR NATION'S HIGHWAYS

WEDNESDAY, SEPTEMBER 13, 2017

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The Committee met, pursuant to notice, at 10:05 a.m. in room SR–253, Russell Senate Office Building, Hon. John Thune, Chairman of the Committee, presiding.

Present: Senators Thune [presiding], Peters, Wicker, Moran, Inhofe, Capito, Lee, Gardner, Young, Cantwell, Duckworth, Blumenthal, Markey, Booker, Hassan, and Cortez Masto.

OPENING STATEMENT OF HON. JOHN THUNE, U.S. SENATOR FROM SOUTH DAKOTA

The CHAIRMAN. Good morning. Before we begin, I certainly want to express our support for and thoughts and prayers for all the victims of the recent hurricanes, and most recently, of course, in the State of Florida. And our colleague and the ranking member on this Committee, Senator Nelson, he and Senator Rubio are there today, as they should be, and looking out for the needs of their constituents. And so, again, we certainly want to express our support and prayers for them and for the people of Florida as they deal with a horrific storm and its aftermath.

This Committee has been working for some time in a bipartisan fashion to address the advancement of autonomous vehicles. And I especially want to thank Senator Peters for partnering with me in this effort. I also appreciate the contributions of Ranking Member Nelson, who, as I said, is unfortunately unable to join us today.

We've put a lot of work into this effort to date, and I look forward to continuing to work with my colleagues to introduce and pass bipartisan legislation.

Given this Committee's broad jurisdiction over transportation, interstate commerce, and vehicle safety, we are well-positioned to oversee and address the emergence of this transformative technology. Beginning last Congress, we've held two hearings and hosted a demonstration of this technology for Committee members. With today's hearing, we'll take a closer look at the promise and implications of the technology for trucks and larger vehicles.

Automated vehicle technology holds great promise to transform transportation in this country: expanding mobility, reducing traffic congestion and related emissions, and increasing productivity, among other benefits. But the most exciting aspect of this trans-

formative advancement is the potential to save thousands of lives every year on our Nation's highways.

In 2015, more than 35,000 people died in major vehicle crashes in the United States. With more than 90 percent of those deaths attributable to human error, automated vehicles have the potential to reduce these tragic numbers dramatically.

Too many lives are lost on our roads, and I look forward to hearing from Ms. Hersman about how automated vehicles, including trucks, can help to reduce this number.

Trucks share our roads, deliver our goods, and keep our economy moving. Including trucks in the conversation about automated vehicles is important as we week to improve safety. It also puts our economy on a level playing field as other countries around the world deploy automated freight trucks.

In 2015, trucks traveled over 280 billion miles to carry over 70 percent of the goods by tonnage on our roadways. A 2017 Energy Information Administration study projected that automated trucks could yield fuel savings between 6.7 and 18.6 percent, improving our economic competitiveness, lowering consumer prices, and supporting job growth. I am glad that Mr. Spear has joined us today to speak to the impacts of trucking on our economy and the role of automated trucks in the future of transportation innovation.

Testing and development is already ongoing as companies in the U.S. have increasingly explored the potential benefits of automated trucks. Companies like Uber, Tesla, Google, Embark, Starsky, and others have invested in automated truck technology.

Truck manufacturers like Navistar are actively pursuing automated technologies in trucks. Colonel Scott Hernandez, Chief of the Colorado State Patrol, who joins us today, has seen this technology firsthand. Last year, he participated in a test of Otto, now Uber's truck startup, which drove 120 miles on Interstate 25 in Colorado.

As other countries devote significant attention and effort to stimulating innovation in this area, strong Federal leadership will be necessary to maintain our position as global leader and ensure that these vehicles are tested and deployed safely.

Just yesterday, Secretary Chao announced the Department of Transportation has updated its policy guidance on automated vehicles. I am pleased to see action from the administration on this transformative technology. DOT's new guidance improves upon similar efforts by the prior administration and takes the same position regarding the inclusion of all motor vehicles, both cars and trucks, from light to heavy duty, under the same regulatory framework. And though their approaches differ, states that have passed automated vehicle legislation similarly cover all motor vehicles, cars and trucks. In doing so, they have recognized the need to address automated motor vehicles cohesively, without leaving out certain vehicle classes.

Of course, it's important to consider all impacts of this new technology. It is crucial that we hear about the potential impact on jobs, and engage in a clear-eyed discussion about how to best prepare for the future. So I am glad that Mr. Hall is able to join us today.

There are over 3 million commercial vehicle drivers in the U.S., and they are the backbone of the economy. Technological advance-

ments have the potential to affect them in very different ways, including in positive ways. Technology should make a driver's life easier and safer, which, in turn, will improve the rest of our transportation system and those who use it every day.

Automation will bring many benefits and many challenges, but they are not entirely new challenges. As former President Johnson said in response to the challenges of automation during his term, and I quote, "Automation is not our enemy. Automation can be the ally of our prosperity if we will just look ahead, if we will understand what is to come, and if we will set our course wisely after proper planning for the future," end quote. I'm glad we are continuing that discussion today. I look forward to hearing from all of our witnesses as we move forward with legislation to address automated vehicles.

And I now want to turn to Senator Peters for his opening statement.

STATEMENT OF HON. GARY PETERS, U.S. SENATOR FROM MICHIGAN

Senator PETERS. Well, thank you, Mr. Chairman, and thank you for calling this very important hearing.

As the Chairman mentioned, I'm in this seat today because Senator Nelson is back home in his great State of Florida helping to begin the very long recovery effort after the devastating Hurricane Irma, and certainly our thoughts and prayers are with Senator Nelson as well as with all of the people of the State of Florida.

As the Chairman mentioned last Friday, he and I released a discussion draft of our self-driving car legislation, which is the result of months of collaborative effort, countless meetings with stakeholders across the spectrum of interests, and further bipartisan work from Senator Nelson. I want to thank Chairman Thune and his staff for the many long hours and effort that have gone into this bipartisan draft.

This legislation will provide the first-ever changes in Federal law targeted at ushering in a new era of mobility and transportation innovation. The bill will facilitate the safe development and adoption of self-driving cars, reduce existing regulatory barriers, and establish a new regulatory framework to support this innovation going forward.

Importantly, it will also ensure that the United States leads the international race to deploy these new technologies. We must develop and build them here in our country, creating new 21st century manufacturing jobs as well.

For the remainder of this month, we will work diligently to resolve and finalize the outstanding issues in this draft legislation, including the topic of today's hearing, whether highly automated trucks and buses should be part of this particular legislation, or addressed in some future piece of legislation.

I will note that while gathering feedback on Chairman Thune's and my draft legislation, many stakeholders were clear that the prospect of self-driving trucks raises a very different set of issues from self-driving cars, and ultimately, those same stakeholders expressed serious concerns with including self-driving trucks in this

bill without a much more robust discussion and evaluation of their impact by industry, academia, and government.

I will also note that our draft legislation was informed by two Commerce Committee hearings, in March of 2016 and June of 2017, and two iterations of NHTSA's Federal automated vehicle policy, all of which were focused on highly automated, lightweight passenger cars, not trucks.

And, finally, I will note that the House recently passed its self-driving vehicle legislation unanimously without the inclusion of self-driving trucks weighing over 10,001 pounds.

It is indisputable that the trucking industry is critically important to our economy and to the day-to-day consumer needs, delivering more than 10 billion tons of freight per year and employing more than 3 million Americans as truck drivers. The same can be said of the bus industry, which provides important transportation options for many Americans, and creates thousands of jobs.

Major changes to these industries, brought on by high levels of automation, will have a major impact on jobs, transportation, and the economy, not to mention roadway safety. And we need to make sure that when we do establish a regulatory framework for self-driving trucks, we get it right, after having considered all of the implications.

For example, we need to be able to answer some fundamental questions. For example, What is the trucking industry's timeline for deployment of highly automated trucks? Will the industry deploy Levels 4 or 5 automated trucks, or will it stick to lower levels of automation? What specific Federal motor vehicle safety standards will highly automated trucks need exemptions from? Do the unique characteristics of the trucking industry require additional safeguards for highly automated trucks, particularly for safety and cybersecurity issues? How will changes to the vehicle safety standards impact operations and enforcement? And should we be considering those impacts now? What are the job impacts of highly automated trucks? And what are the industry's plans for retraining or reassigning the drivers who are in danger of losing their jobs?

But in our discussions to date, we have not gotten as clear of an understanding on issues related to self-driving trucks as we have during our countless discussions on self-driving cars. As a result, I'm of the mind that highly automated trucks are not ripe for inclusion in this bill.

Before I close, I want to be clear that improving safety on our highways is critically important to me. It is one of the reasons why advancing self-driving car legislation is so important to me as well. But I also recognize that in the long term, self-driving trucks and buses are also intended to improve safety on our highways. This is certainly clear. But I question assertions that excluding self-driving cars—or trucks, excuse me—I question assertions that excluding self-driving trucks from this particular bill will result in less safe roads, and that they don't merit special considerations going forward. We cannot allow such premature conclusions to stand in this Committee's way of talking specifics and getting the answers we need to have a more complete understanding of the safety, workforce, and policy implications of highly automated trucks.

Again, I want to thank all of our witnesses for being here today and for helping start this very important conversation, and I look forward to the testimony.

[The prepared statement of Senator Peters follows:]

PREPARED STATEMENT OF HON. GARY PETERS, U.S. SENATOR FROM MICHIGAN

Thank you to the Chairman for calling this important hearing.

I'm in this seat today because Sen. Nelson is back home in his great state of Florida, helping to begin the long recovery effort after the devastating Hurricane Irma, and our thoughts are certainly with him and his constituents this morning.

As the Chairman mentioned, last Friday he and I released a discussion draft of our self-driving car legislation, which is a result of months of collaborative effort, countless meetings with stakeholders across the spectrum of interests, and further bipartisan work with Senator Nelson.

I want to thank Chairman Thune and his staff for the long hours and effort that have gone into our bipartisan draft.

This legislation will provide the first-ever changes in Federal law targeted at ushering in a new era in mobility and transportation innovation.

The bill will facilitate the safe development and adoption of self-driving cars, reduce existing regulatory barriers, and establish a new regulatory framework to support this innovation going forward.

Importantly, it will also ensure that the United States leads the international race to deploy these new technologies. We must develop and build them here, creating new 21st century manufacturing jobs in the United States.

For the remainder of this month, we will work diligently to resolve and finalize the outstanding issues in this draft legislation—including the topic of today's hearing—whether highly-automated trucks and buses should be part of this particular legislation, or addressed in a separate bill.

I will note that while gathering feedback on Chairman Thune's and my draft legislation, many stakeholders were clear that the prospect of self-driving trucks raises a very different set of issues from self-driving cars. And—ultimately—those same stakeholders expressed serious concerns with including self-driving trucks in this bill without a much more robust discussion and evaluation of their impact by industry, academia, and government.

I will also note that our draft legislation was informed by two Commerce Committee hearings—in March 2016 and June 2017—and two iterations of NHTSA's Federal Automated Vehicle Policy. All of which were focused on highly-automated light-weight, passenger cars—not trucks.

And finally, I will note that the House recently passed its self-driving vehicle legislation unanimously, without the inclusion of self-driving trucks weighing over 10,001 pounds.

It is indisputable that the trucking industry is critically important to our economy and to our day-to-day consumer needs, delivering more than 10 billion tons of freight-per-year and employing more than 3 million Americans as truck drivers.

The same can be said of the bus industry, which provides important transportation options for many Americans and creates thousands of jobs.

Major changes to these industries brought on by high levels of automation will have major impacts on jobs, transportation and the economy—not to mention roadway safety.

And we need to make sure that when we do establish a regulatory framework for self-driving trucks—we get it right after having considered all of the implications.

For example, we need to be able to answer fundamental questions like, what is the trucking industry's timeline for deployment of highly-automated trucks?

- Will the industry deploy levels 4 or 5 automated trucks, or will it stick to lower levels of automation?
- What specific Federal motor vehicle safety standards will highly-automated trucks need exemptions from?
- Do the unique characteristics of the trucking industry require additional safeguards for highly-automated trucks, particularly for safety and cybersecurity issues?
- How will changes to the vehicle safety standards impact operations and enforcement? And should we be considering those impacts now?

- What are the job impacts of highly-automated trucks and what are the industry's plans for retraining or reassigning the drivers who are in danger of being out of work?

But in our discussions to date, we have not gotten as clear of an understanding on issues related to self-driving trucks as we have during our countless discussions on self-driving cars. As a result, I am of the mind that highly-automated trucks are not ripe for inclusion in this bill.

Before I close, I want to be clear that improving safety on our highways is critically important to me. It is one of the reasons why advancing this self-driving car legislation is so important to me. And I recognize that in the long-term, self-driving trucks and buses are also intended to improve safety on our highways. That is certainly clear. But I question assertions that excluding self-driving trucks from this particular bill will result in less safe roads and that they don't merit special considerations going forward. We cannot allow such premature conclusions to stand in this Committee's way of talking specifics—and getting the answers we need to have a more complete understanding of the safety, workforce, and policy implications of highly-automated trucks.

I want to thank all of the witnesses for being here today and for helping to start the conversation on this very important topic. I look forward to your testimony.

The CHAIRMAN. Thank you, Senator Peters.

And we'll move now to our panel. We want to thank you all for being here and welcome you, and look forward, obviously, to hearing from you. We would ask, if you can, to confine your oral remarks as close to 5 minutes as possible. Your entire statement will be included as part of the record, but it will maximize the opportunity for members of the Committee to ask questions.

We'll start on my left, and your right, with Colonel Scott Hernandez, who is Chief of Colorado State Patrol, from Lakewood, Colorado. We'll move then to Mr. Troy Clarke, who is Chief Executive Officer of Navistar; Ms. Deborah Hersman, who is the President and Chief Executive Officer of the National Safety Council; Mr. Chris Spear, who is President and Chief Executive Officer of the American Trucking Associations; and Mr. Ken Hall, who is the General Secretary-Treasurer of the International Brotherhood of Teamsters.

So, Colonel Hernandez, if you would proceed.

STATEMENT OF SCOTT G. HERNANDEZ, COLONEL, COLORADO STATE PATROL

Colonel HERNANDEZ. Absolutely. Good morning. Good morning, Chairman Thune, Senator Peters, and members of the Committee. Thank you for holding this important hearing and for inviting me here today to discuss the role automated vehicles will play in the future and how they may improve safety on our Nation's highways.

My name is Scott Hernandez, and I'm the Colonel of the Colorado State Patrol, and I am honored to lead 1,200 members whose primary goal is to save lives on our highways.

This year, 410 people have been killed on Colorado roadways, a staggering number. We are committed to reducing the number of people killed eventually to zero. The enforcement community is excited about the potential improvements to roadway safety that are possible with the deployment of autonomous vehicles. Our commitment is to reduce crashes, injuries, and fatalities on our nation's highways, and we know automated technology has already saved lives through the elimination of human error, such as distracted driving and many other unsafe driving habits.

I am also a member of the Commercial Vehicle Safety Alliance. CVSA, which every state is a member, works to improve commercial motor vehicle safety and uniformity by bringing truck and bus regulatory, safety, and enforcement agencies together with industry representatives to solve highway transportation safety problems. Recognizing the tremendous potential benefits, CVSA has long been a supporter of legislation, regulation, and policies that encourage the deployment of safety technologies, proven through the independent research to improve CMV safety.

Even through preventing crashes or mitigating the severity of crashes, autonomous vehicles are the natural next progression in vehicle safety technology, and the enforcement community stands ready to assist in making sure that these technologies are deployed as seamlessly and as effectively as possible.

In the late summer of 2016, Otto approached the State of Colorado expressing interest in conducting an intrastate delivery in an autonomous commercial vehicle. With consideration of the fact that there are no laws or regulations prohibiting the operation of autonomous vehicles to include this scenario in Colorado, we chose to partner with Otto to ensure safety remains paramount. We also understood the potential for government and enforcement to learn from the process in order to participate in reasonable regulations in the future.

During the early morning hours of October 20, 2016, an autonomous commercial vehicle delivered a product traveling 120 miles from Ft. Collins, Colorado, to Colorado Springs in a Level 4 autonomous demonstration. Soon after entering southbound I–25 from the Ft. Collins Port of Entry, the driver placed the vehicle in autonomous mode and retreated to the space behind and between the driver passenger seat. The commercial vehicle traveled southbound on I–25 again for over 120 miles until the driver took over the controls and exited the interstate toward the terminal. The demonstration highlighted the future possibilities and use of autonomous commercial vehicles.

The Colorado State Patrol and Colorado Department of Transportation took extensive measures to reduce the risk associated with this demonstration. We used NHTSA's "Federal Autonomous Vehicle Policy" and California's autonomous vehicle laws and rules as guidance. Pre-event testing was monitored for consistency and achievement through specific safety performance gates, ranging from off-road testing to extensive on-road testing. The truck was inspected and deemed to be without a violation by CVSA-certified safety inspectors, and the company underwent a safety audit to ensure that it had appropriate level of safety management practices in place to safely operate in commerce.

The State Patrol and Department of Transportation received detailed weekly briefings on performance through required safety and testing protocols, including testing of scenario plans for risk and fallback.

In an effort to ensure the demonstration was completed in a safe manner for all involved, the State Patrol escorted the autonomous vehicle in a similar fashion as a motorcade or rolling special event, consistently monitoring safety protocols and situational assessment. While we will still need to work toward total solutions, the

Colorado State Patrol made progress toward understanding the perspective of other governmental agencies, understanding autonomous vehicle crash investigations, understanding why cybersecurity will be essential as this technology progresses, understanding how the vehicle systems work, and how to begin advancing the process of standardized inspection procedures, understanding the development of a unique regulatory framework, and how to better partner with all stakeholders.

This demonstration illustrated the probability that autonomous commercial motor vehicles, when operated during the right location, time, and situation, could reduce crash risk and traffic congestion. Additionally, the demonstration has provided important information and experience to the Colorado State Patrol and our partners responsible for establishing the necessary legal and regulatory framework for the testing and implementation of autonomous vehicle technologies.

Clearly, technological advances in the past have saved lives, and clearly technology will continue to save lives in the future. Our experience in Colorado makes it clear that it is time to begin planning in earnest for the deployment of semi and fully automated CMVs. As this Committee moves forward with legislation setting the national framework to guide the deployment of autonomous vehicles, we believe that consideration must be given to CMV industry. We all have many questions that need to be addressed as we work toward deployment of these technologies.

Many questions need to be answered before autonomous vehicles can be allowed to enter the driving population. I want to stress that is the purpose of these questions, is not—that the purpose of these questions is not to slow innovation or create roadblocks to the technology. The enforcement community recognizes the safety benefits and welcome the change—any changes that improves roadway safety. However, we must ensure that inspectors, investigators, and industry understand the role of this technology and how it will impact CMV enforcement programs.

We strongly encourage you to consider all facets of this issue, including what to do once the vehicles are on the roads. Doing so will help avoid uncertainty for the motor carrier industry and the enforcement community.

I appreciate this opportunity to participate in this timely discussion on the future of automated commercial vehicles. Thank you very much.

[The prepared statement of Colonel Hernandez follows:]

PREPARED STATEMENT OF SCOTT G. HERNANDEZ, COLONEL, COLORADO STATE PATROL

Introduction

Chairman Thune, Ranking Member Nelson and Members of the Committee, thank you for holding this important hearing and for inviting me here today to discuss the role automated vehicles will play in the future of safety on our Nation's highways.

My name is Scott Hernandez. I am the Colonel of the Colorado State Patrol. As the Colonel, I am responsible for leading approximately 1,200 members whose primary goal is to save lives on our highways. In Colorado to date 247 people have been killed, a staggering number of people. We are committed to driving that number down, eventually to zero.

I am also a member of the Commercial Vehicle Safety Alliance (CVSA), a non-profit association comprised of local, state, provincial, territorial and Federal commercial motor vehicle safety officials and industry representatives. We represent the state agencies tasked with the responsibility for the administration and enforcement of commercial motor carrier safety regulations in the United States (U.S.), Canada and Mexico. We work to improve commercial motor vehicle safety and uniformity by bringing truck and bus regulatory, safety and enforcement agencies together with industry representatives to solve highway transportation safety problems. Every U.S. state, territory and possession, all Canadian provinces and territories, and the country of Mexico are CVSA members.

First, let me say that the enforcement community is excited about the potential improvements to roadway safety that are possible with the deployment of autonomous vehicles. Our commitment is to reduce crashes, injuries and fatalities on our Nation's roadways, and we see great potential in autonomous technology. As we all know, driver behavior is the leading cause of motor vehicle crashes. Technology can help eliminate or reduce the risk of human error and driver distraction. In fact, basic versions of vehicle autonomy are already operating on our roads, preventing crashes. Examples of such technologies include enhanced anti-lock braking system (ABS) monitoring systems, vehicle stability systems, lane departure warning systems and collision warning systems. These systems all improve vehicle safety by helping keep vehicles in their lanes and operating at a safe distance from one another.

The National Transportation Safety Board (NTSB) has repeatedly called for deployment of safety technologies on both commercial and personal vehicles to help reduce crashes and save lives. In fact, NTSB has called on the National Highway Traffic Safety Administration (NHTSA) to establish performance standards and mandate deployment of collision avoidance technologies on commercial motor vehicles in its annual NTSB Most Wanted List. Recognizing the tremendous potential benefits, CVSA has long been a supporter of legislation, regulation and policies that encourage the deployment of safety technologies proven, through independent research, to improve commercial motor vehicle safety, either through preventing crashes or mitigating the severity of crashes. Autonomous vehicles are the natural next progression in vehicle safety technology and the enforcement community stands ready to assist in making sure that the technology is deployed as seamlessly and as effectively as possible.

In the late summer of 2016, OTTO approached the State of Colorado expressing interest in conducting an intrastate delivery using an autonomous commercial motor vehicle. With consideration to the fact that there were no laws or regulations prohibiting the operation of autonomous vehicles to include this scenario in Colorado, we chose to partner with OTTO to ensure safety remained paramount. Colorado policy makers also understood the potential for government and enforcement to learn from the process in order to participate in reasonable regulations in the future.

During the early morning hours of Oct. 20, 2016, an autonomous commercial motor vehicle, specifically a 3-axle truck-tractor and 2-axle semi-trailer vehicle combination, delivered a product traveling 120 miles from Ft. Collins to Colorado Springs, Colorado, in a level 4 autonomous demonstration. Soon after entering southbound on I–25 from the Ft. Collins Port of Entry, the driver placed the commercial motor vehicle in autonomous mode and retreated to the space behind and between the driver and passenger seat. The vehicle traveled southbound on I–25 for over 120 miles until the driver took over the controls and exited the interstate towards the terminal. The demonstration highlighted the future possibilities and use of autonomous commercial motor vehicles.

The Colorado State Patrol and Department of Transportation took extensive measures to reduce the risks associated with this demonstration. We used NTHSA's "Federal Autonomous Vehicle Policy" and California's autonomous vehicle laws and rules as guidance. Pre-event testing was monitored for consistency and achievement through specific safety performance gates, ranging from off-road testing to extensive on-road testing. The truck was inspected and deemed to be without a violation by CVSA-certified roadside safety inspectors and the company underwent a safety audit to ensure it had the appropriate level of safety management practices in place to safely operate in commerce. Two separate rides covering over 200 miles were conducted by a Colorado State Patrol commander to visually confirm the technology. The Colorado State Patrol and the Colorado Department of Transportation received detailed weekly briefings on performance through required safety and testing protocols, including testing of scenario plans for risks and fallback.

OTTO provided certification of safety assessments, vehicle, driver and insurance. The safety assessments certification included system safety, validation and data sharing. Driver certification included lists of all drivers, driver training and overall

experience. Vehicle certification included the Federal Motor Vehicle Safety Standards (FMVSS).

In an effort to ensure the demonstration was completed in a safe manner for all involved, the Colorado State Patrol escorted the autonomous commercial motor vehicle in a similar fashion as a motorcade or rolling special event, constantly monitoring safety protocols and situational assessment. Constant communication throughout the event existed between the driver/passenger, engineers and state troopers.

The demonstration was beneficial for law enforcement, as we were able to learn valuable lessons. While we will still need to work toward total solutions, the Colorado State Patrol made progress toward understanding the perspective of other governmental agencies, autonomous vehicle crash investigations, why cyber security will be essential as this technology progresses, the development of a unique regulatory framework and how to better partner with all stakeholders.

The proof of concept in Colorado indicates that self-driving vehicles will play a critical role in improving traffic safety and may reduce congestion in the future. This demonstration has provided important information and experience to the Colorado State Patrol and our partners responsible for establishing the necessary legal and regulatory framework for the testing and implementation of autonomous vehicle technologies. Technological advances in the past have saved lives and, clearly, technology will continue to save lives in the future as the Colorado State Patrol, the Commercial Vehicle Safety Alliance and the law enforcement community moves toward zero deaths on our roadways.

Our experience in Colorado makes it clear that it's time to begin planning in earnest for the deployment of semi-and fully-automated commercial motor vehicles. As this Committee moves forward with legislation setting a national framework to guide the deployment of autonomous vehicles, we believe that consideration must be given to the commercial motor vehicle industry. How will autonomous vehicles affect enforcement of Federal safety regulations? Which regulations apply to autonomous vehicles and which will have to be modified to adapt to the new technology? Are there regulations that autonomous vehicles should be exempted from entirely? For example, how will Federal hours-of-service requirements apply? If there is a person in the cab while the vehicle is operating autonomously, does that person need to maintain their record of duty status? If so, how should that time be recorded? On duty, driving? On duty, not driving? Off duty?

We also have questions regarding the maintenance or mechanical fitness of the underlying components of the autonomous vehicle system; such as, ABS monitoring systems, vehicle stability systems, lane departure warning systems, collision warning systems, etc. If the underlying systems are not functioning properly, then the autonomous system will not work either. We will need to review current inspection procedures and regulatory requirements to ensure that inspectors know how to verify that a system is functional and what to do if it is not. If an autonomous vehicle is placed out of service for critical safety violations, how will the motor carrier be notified?

Autonomous vehicles will also have an impact on the roadside enforcement program. How will an inspector stop an autonomous vehicle for inspection? Will these vehicles be able to recognize and yield to emergency vehicle signals? Further, currently, the driver plays an integral role in the inspection process, working with the inspector to verify that critical vehicle mechanical components and systems are functioning properly. How will this change once inspectors begin encountering driver-less vehicles?

These are just a few of the many questions that will need to be answered before autonomous vehicles can be allowed to enter the driving population. I want to stress that the purpose of these questions is not to slow innovation or create roadblocks to the technology. The enforcement community recognizes the safety benefits and welcome any change that improves roadway safety. However, we must ensure that inspectors and industry understand the role this technology will play and how it will impact commercial motor vehicle enforcement programs. We strongly encourage you to consider all facets of the issue, including what to do once the vehicles are on the roads. Doing so will help avoid uncertainty for the motor carrier industry and the enforcement community.

I appreciate the opportunity to participate in this timely discussion on the future of automated commercial motor vehicles.

The CHAIRMAN. Thank you, Colonel Hernandez.
Mr. Clarke.

STATEMENT OF TROY CLARKE, CHAIRMAN, PRESIDENT, AND CHIEF EXECUTIVE OFFICER, NAVISTAR, INC.

Mr. CLARKE. Good morning, Chairman Thune, Senator Peters, and members of the Committee. I am honored to be here this morning to discuss an important topic in our industry, autonomous technology applications in commercial trucks.

I am Troy Clarke, and I currently serve as the Chairman, President, and Chief Executive Officer of Navistar, Incorporated, the manufacturer of International trucks, IC school buses, diesel engines, and military vehicles. Navistar is headquartered in Lisle, Illinois, just outside of Chicago, and has over 12,000 employees worldwide.

If I may, I would first like to provide a quick overview of our industry. There are four major commercial truck manufacturers in our country today. Ours is a small, highly competitive industry which expects to produce around 325,000 vehicles this year—a small fraction compared to the passenger car and light-truck market.

Our customers range from large fleets, like J.B. Hunt and Penske with thousands of vehicles, to independent drivers operating only one truck. We build trucks and buses via mass customization, each one tailored to meet the specific needs of a particular customer. Reliability and upfront costs all impact purchase decisions. And a new truck ranges in price from $60,000 to $150,000. In other words, they represent major capital investments. And they only generate revenue for our customers when they're up and running.

Given all this, our customers invest significantly in the latest safety technology to protect their valuable capital asset as well as their most important human capital, the driver. This explains why market penetration rates for technologies like electronic stability control, radar-following cruise control, cameras for object detection, lane departure warning systems, and collision mitigation systems have been increasing every year. We call these advanced driver-assistance systems, or ADAS, and they offer quantum leaps of safety, productivity, and environmental benefits. Many of them also serve as the building blocks to greater automation.

Navistar sees autonomous technology as an extension of the safety technology already in place, and we believe that these greater levels of self-driving technology will help reduce human error, which accounts for approximately 94 percent of all motor vehicle accidents.

Before we arrive at the future, however, our customers tell me that they have much more immediate needs. They already have driverless trucks, but that's because they have trouble recruiting and retaining drivers. As truck makers, we don't hire or train drivers; our customers do. But as we continue to develop the technologies that could lead to autonomous vehicles, we will make much of that available to provide today's drivers with greater ease of use, comfort, safety, productivity, and efficiency, factors that I believe will attract more people to this important and noble profession.

Personally, I believe drivers will become more like airline pilots, even more highly trained and skilled than they are today. They

will be employed to manage multiple vehicle assets for optimized safety and efficiency. For example, an autonomous vehicle may be deployed on a highway while the driver sitting in his or her seat is managing controls and monitoring several platooning trucks, ensuring the safe and secure operation of the trucks under their care.

Autonomous technology is not being created in a vacuum. Our industry is developing vehicle-to-vehicle, or V2V, systems to allow cars and trucks to talk to one another. As Federal regulations are being drafted and implemented, we want to ensure that passenger and commercial vehicles are following similar safety and design standards for optimal compatibility on the highway. Otherwise, passenger cars equipped with V2V technology may not be able to communicate effectively with large commercial vehicles, and could create blind spots in the transportation network that could create inadvertent hazards.

Ours is an industry of business-to-business transactions. Development and validation cycles are long, and penetration and adoption rates take more time than in the light-vehicle industry. When we test on the road, we have to match the conditions our customers face, so we test trucks in many different states and climates. Trucks cross multiple state lines daily and sometimes traverse the same state multiple times in one day. It's important for our industry to participate in the creation of advanced driving technologies now. Providing clarity on the legislative and regulatory front will allow us, truck manufacturers, to design and validate systems that meet the future needs of our customers while minimally disrupting the industry.

Advanced driving and autonomous technologies will come to our industry. Large-scale displacement of drivers is not likely to happen, especially in the short and medium term. We believe these technologies will improve safety, improve productivity, and lower cost, as well as lead to more efficient use of the existing infrastructure.

In the commercial vehicle industry, we have proven that regulations and technology can work together to advance the interests of all stakeholders. The time for these discussions is now. And I applaud the Committee on holding this hearing so that we can begin the dialogue on this issue. I welcome any questions at the right time.

[The prepared statement of Mr. Clarke follows:]

PREPARED STATEMENT OF TROY CLARKE, CHAIRMAN, PRESIDENT, AND CHIEF EXECUTIVE OFFICER, NAVISTAR, INC.

Good morning Chairman Thune, Ranking Member Nelson and members of the Committee. I am honored to be here this morning to discuss an important topic in our industry . . . autonomous technology applications in commercial trucks.

I am Troy Clarke, and I currently serve as the Chairman, President and Chief Executive Officer at Navistar, Inc., the manufacturer of International trucks, IC school buses, diesel engines and military vehicles. Navistar is headquartered in Lisle, Illinois just outside of Chicago and has over 12,000 employees worldwide.

I would like to first provide a quick overview of our industry.

There are four major commercial truck manufacturers in the country today. Ours is a small, highly competitive industry which expects to produce around 325,000 vehicles this year—a small fraction compared to the passenger car and light truck market.

Our customers range from large fleets like JB Hunt and Penske with thousands of vehicles to independent drivers operating one truck. We build our trucks and

buses via mass customization . . . each one tailored to meet the specific needs of a particular customer. Reliability, upfront costs and the vehicles' residual value all impact purchasing decisions. A new truck ranges in price from $60,000 to $150,000 . . . in other words, they represent major capital investments. And they only generate revenue for our customers when they are up and running. Given all of this, our customers invest significantly in the latest safety technology to protect this valuable capital asset as well as their most important human capital—the driver.

This explains why market penetration rates for technologies like electronic stability control, radar and cameras for object detection, lane departure warning systems, and collision mitigation systems have been increasing every year. We call these advance driver assistance systems or ADAS, and they offer quantum leaps of safety, productivity and environmental benefits. Many of them also serve as the building blocks to greater automation. An example of early automation in our industry is adaptive cruise control.

Navistar sees autonomous technology as an extension of the safety technology already in place and we believe that these greater levels of self-driving technology will help reduce human error, which accounts for approximately 94 percent of all motor vehicle accidents.

Before we arrive at that future, however, our customers tell me that they have much more immediate needs—they already have driverless trucks, but that's because they have trouble recruiting and retaining drivers.

As truck makers, we don't hire or train drivers. Our customers do. But as we continue to develop technologies that could lead to completely autonomous vehicles, we will make many of them available to provide today's drivers with greater ease of use, comfort, safety, productivity and efficiency—factors that, I believe, will attract more people to this important and noble profession.

Personally, I believe drivers will become more like airline pilots—even more highly trained and skilled than they are today. They will be employed to manage multiple vehicle assets, for optimized safety and efficiency. For example, an autonomous vehicle may be deployed on a straight highway with mixed vehicles, while the driver sitting in his or her seat is managing the controls and monitoring several platooning trucks, and ensuring the safe and secure operation of the trucks under their care.

Autonomous technology is not being created in a vacuum. Our industry is developing Vehicle to Vehicle (V to V) systems to allow cars and trucks to "talk" to one another. As Federal regulations are being drafted and implemented, we want to ensure that passenger and commercial vehicles are following similar safety and design standards for optimal compatibility. Otherwise, passenger cars equipped with V to V may not be able to communicate with large commercial vehicles which will create enormous blind spots in the transportation network and potentially create inadvertent hazards.

Ours is an industry of business to business transactions. Development and validation cycles are long, and penetration and adoption rates take more time than in the light vehicle industry. When we test on the road we have to match the conditions our customers face so we test trucks in many different states and climates. Trucks cross multiple state lines daily and sometimes traverse the same state multiple times in one day. It's important for industry to participate in the creation of advanced driving technologies now. Providing clarity on the legislative and regulatory front will allow us, truck manufacturers, to design and validate systems that meet the future needs of our customers while minimally disrupting the industry.

Advanced driving and autonomous technologies will come to our industry. Large scale displacement of drivers is not likely to happen, especially in the short and medium term. We believe these technologies will improve safety, improve productivity and lower cost, as well as lead to more efficient use of existing infrastructure. The commercial vehicle industry has proven that regulations and technology have worked together to advance the interests of all stakeholders.

The time for these discussions is now and I applaud the Committee on holding this hearing so that we can begin the dialogue on this issue. I welcome any questions that you might have.

The CHAIRMAN. Thank you, Mr. Clarke.
Ms. Hersman, welcome back to this Committee.

STATEMENT OF DEBORAH A.P. HERSMAN, PRESIDENT AND CHIEF EXECUTIVE OFFICER, NATIONAL SAFETY COUNCIL

Ms. HERSMAN. Thank you. Thank you, Chairman Thune, Ranking Member Peters, and members of the Committee. As President

and CEO of the National Safety Council, I strive every day to realize our mission of eliminating preventable deaths, and we believe that all vehicle crash fatalities are preventable. Yet today, over 100 people die on our roadways every day in our vehicles and in crashes involving our vehicles—all vehicles. We can help reduce these statistics with technology.

In 2004, I had the privilege to serve as a Member and then Chairman of the National Transportation Safety Board. During my 10 years there, I saw too many commercial motor vehicle crashes that could have been prevented, and they could have been prevented by advanced technology.

The NTSB first called on putting advanced technology in commercial vehicles back in 1995, and it is an issue that is on their Most Wanted List today. Today, we've certainly gone beyond the Level 2 technology that they had hoped for and envisioned back in 1995, and are talking about fully automated vehicles.

I know that you all have read all of our testimony. There are a lot of facts and figures in my long written testimony, so I would like to actually take my time with you this morning to share a personal story.

Last year, I came home from a trip, and my 10-year-old son met me at the door and he said, "Mommy, did you see your car?" That's not a good thing when you walk in the door from a trip. And I said, "What happened to my car?" And he took me out in the garage and he showed me. And this picture up here on the screen is my car. And, yes, it's ironic, the license plate says "BESAFER" on it.

My husband was coming home to our house on a lower speed roadway, and he was rear-ended by another vehicle as he slowed to allow an emergency vehicle to turn into the firehouse in front of him. And being a former investigator, my first questions to my husband were, "What happened? What was going on? What was the situation? What were the circumstances? What was the driver doing?" And unfortunately, he didn't have a lot of good answers for me. He told me the gentleman was a little bit older and that there was a dog in the car.

For the next couple of days, I spent, you know, kind of my time thinking, "What happened? How did this happen? Could it have been prevented? Did it involve distraction? Did it involve fatigue? Could it have been prevented?"

About 3 weeks later, I came home, and my husband was in a pretty somber mood, and he told me he had received a call from the insurance adjuster who was managing our claim. And the insurance adjuster had just called the gentleman who was the driver of the Jeep Liberty who had hit our car. Mr. Norton had called his house, and his son answered the phone, and when he asked to speak to Mr. Norton, his son said that he had been killed in a crash. And the insurance adjuster said, "I thought there were no injuries in the crash." And he said, "My dad was killed on Friday."

And because we knew the information about the driver, we went to Google, like many of us do when we're trying to find something out, and we found that Mr. Norton had been in an intersection crash in his Jeep Liberty just shortly before. And this picture up on the screen is the picture that was in the newspaper.

And again the same questions started to run through my head, "What happened? How did this happen? Who was at fault? Could this have been prevented? Did it have something to do with what had happened 3 weeks before?"

And as a safety professional who has spent decades working on how to prevent transportation events and incidents, I realized that while it's important for us to understand why something happened, what's most important is to understand how we can prevent these things from occurring again. And we have the ability to prevent these fatalities that occur on our roads every day.

A hundred people every day. Mr. Norton was a father, he was a member of a community, probably a church community. He had an extended network. That happens 100 times every day. And we can do more, we can do better, we can address this issue, and we can save lives. If we are going to get to zero, we have to do it by looking at all of the fatalities and all of the things that we can do to prevent them. This conversation here today begins that discussion. Thank you.

[The prepared statement of Ms. Hersman follows:]

PREPARED STATEMENT OF DEBORAH A.P. HERSMAN, PRESIDENT
AND CHIEF EXECUTIVE OFFICER, NATIONAL SAFETY COUNCIL

Chairman Thune, Ranking Member Nelson and members of the Committee, thank you for inviting me to testify today on proposed legislation to create a framework to save lives on our roadways. The National Safety Council (NSC) believes that in order for our nation to receive the biggest benefit from this technology, all motor vehicles—both personal and commercial—must be included in this legislative proposal.

The National Safety Council is a 100-year-old nonprofit committed to eliminating preventable deaths in our lifetime by focusing on reducing fatalities and injuries in workplaces, on the road and in homes and communities. Our more than 13,500 member companies represent employees at more than 50,000 U.S. worksites. Not only do we work with companies but also with organized labor, who share our dedication to keeping workers safe on and off the job. With almost 40 percent of workplace fatalities involving motor vehicles, accelerating the availability and adoption of crash reduction and mitigation technology is crucial to that vision.

In 2015, there were 4,067 fatalities in large truck crashes and 667 were occupants of large trucks. Fatalities on our roadways are trending in the wrong direction and technology can help reverse the death toll. However, to achieve maximum benefit and save the most lives, we must do so holistically by applying technological advances to all vehicles. After all, roads are built for both cars.

NSC commends Commerce Committee leaders for offering a framework to increase transparency around the technology in advanced driver assistance systems (ADAS)-equipped vehicles and prioritizing safety in the process. As a nation, there are more vehicles on the road today traveling more miles, and yet the most dangerous factors in roadway travel continue to be human factors. According to the National Highway Traffic Safety Administration (NHTSA), 94 percent of investigated crashes can be attributed to driver error. The top four reasons for crashes are caused by human behavior or choices: alcohol, speed, fatigue and distraction, giving ADAS systems and automated vehicles the potential to reduce preventable crashes and deaths in an unprecedented way.

Critical reasons for crashes investigated in the National Motor Vehicle Crash Causation Survey, United States, 2005–2007

Source: NHTSA (DOT HS 812 115)
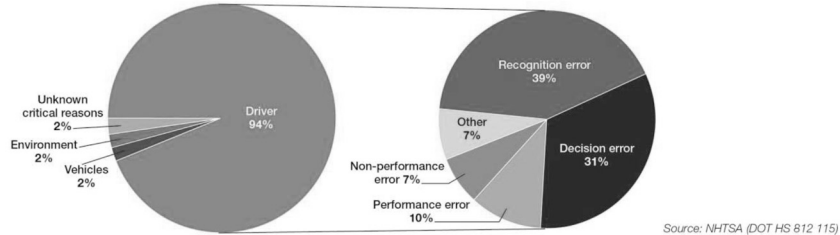
® National Safety Council: Injury Facts 2017 Edition

NSC[1] estimates that 40,200 people lost their lives on our Nation's roadways in 2016, a 14 percent increase from where we were just two years ago. Over 100 people die each day in motor vehicle crashes, and another 4 million people are injured severely enough to consult a medical professional every year. Beyond the human toll, these deaths and injuries cost society over $385 billion, including productivity losses, medical expenses, motor vehicle property damages and employer costs.[2]

Each of these numbers represent a person who leaves behind loved ones. NSC believes advanced vehicle technology, up to and including fully automated vehicles, can provide many benefits to society, but the most important contribution will be the potential to greatly reduce the number of fatal crashes on our roadways.

Motor-Vehicle Deaths and Rates, U.S., 1993-2016
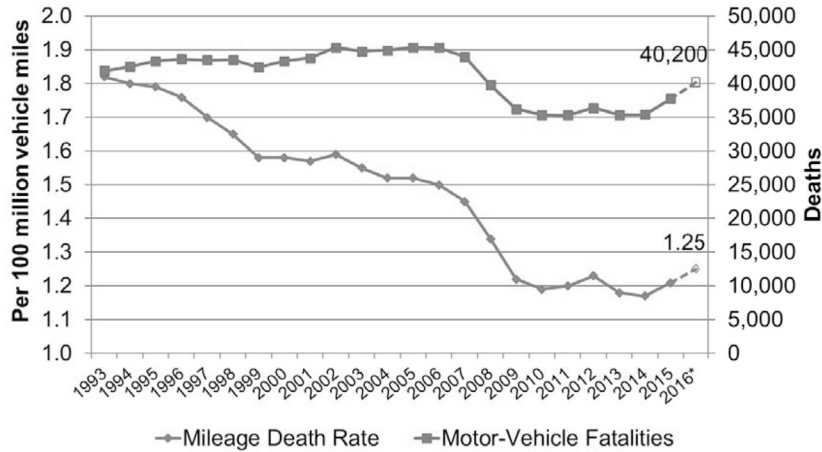
These trends are not improving. NSC data reveal that the 18,680 roadway fatalities during the first six months of 2017 are 1 percent lower than the same period in 2016, but still 8 percent higher than the same period two years ago. Our complacency is killing us. If we are to redirect this trend in a positive direction, we must adopt a sense of urgency coupled with large, near term gains to save lives on our roadways.

So that we all know where we stand, in 2015:

- 10,265 people were killed in alcohol-impaired driving crashes, an increase of almost 300 from 2014,[3]

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[1] Decision errors include driving too fast for conditions, too fast for the curve, false assumption of others' actions, illegal maneuver and misjudgment of gap or others' speed. Performance errors include factors such as overcompensation and poor directional control. Non-performance error is most commonly sleeping.

[2] National Safety Council *Injury Facts 2017*

[3] *https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812350*

- 3,477 people were killed in distraction related crashes, an increase of almost 300 from 2014,[4] and
- 9,874 people were killed while unrestrained, an increase of over 400 from 2014.[5]

The maps below tell the story of the national trends in roadway fatalities.

NSC Preliminary Fatality Estimates
2016 Percent change from 2015

US Overall = +6%

No change or decreased
Increased 1% to 6%
Increased 7% to 12%
Increased > 12%

NSC Preliminary Fatality Estimates
2016 Percent change from 2014

US Overall = +14%

No change or decreased
Increased 1% to 14%
Increased 15% to 25%
Increased > 25%
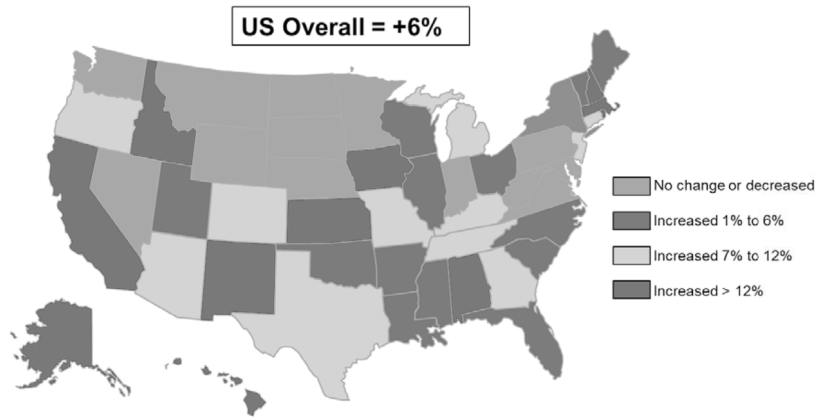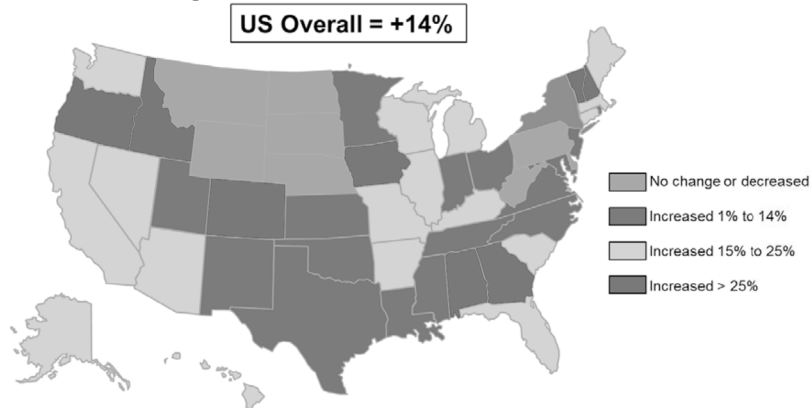
These statistics are not isolated to passenger vehicles, and in the same way, policy options should not be limited to passenger vehicles. Commercial motor vehicles (CMVs) represent 4 percent of vehicles on the roadways but are involved in 11 percent of fatal crashes. That translates to over 4,000 people being killed in crashes with CMVs annually. The large mass, increased time and space required for braking and incompatibility in structures (front, rear and side design of the vehicles) tell part of the story of why these vehicles are involved in so many fatal crashes, but human factors, like speeding, fatigue and distraction also contribute. Rear-end collisions represent 10 percent of fatal commercial vehicle crashes—three times more fatalities than rear-end collisions involving passenger cars. By not deploying ADAS

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[4] *https://www.nhtsa.gov/risky-driving/distracted-driving*
[5] *https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812374*

technologies such as forward collision warning or automatic emergency braking, thousands of preventable fatalities and injuries are occurring every year.[6]

Fatalities in crashes involving large trucks, United States, 2015

Non-occupants 10%

Occupants of large trucks 16%

Occupants of other vehicles 74%
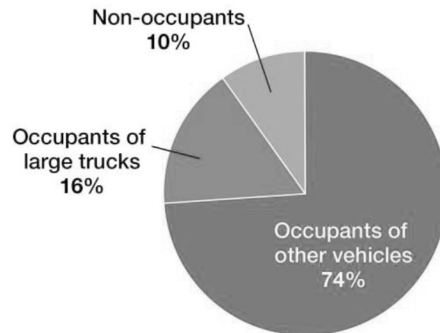
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Safety Evaluation Report and Data Recorders

The proposed legislation is intended to set the framework to aid the inevitable transition to ADAS technologies and fully automated vehicles. Our roadways were not made for passenger and commercial vehicles to operate independently of each other, and both types of vehicles are being tested at this time. Therefore, the policies outlined in this legislation should apply to all vehicles.

The current draft legislation establishes greater transparency around the development of ADAS and automated vehicles by mandating the safety evaluation report (SER) that outlines reporting requirements for manufacturers. The bill also includes the use of a data recording device, something which is already widely used in the automotive industry today and yields valuable data in crash reconstruction efforts.

Electronic logging devices (ELDs) and electronic data recorders (EDRs) provide a window into the human-machine interface with advanced vehicles. The knowledge gained from these devices allows manufacturers to be nimbler and make adjustments in near real-time to improve safety based on what is actually occurring in operation, rather than making changes based on assumptions and estimations that must be accommodated in a later model year. To this end, Congress should facilitate data sharing as widely as possible by requiring that manufacturers provide accessible, standardized data to law enforcement, state highway safety offices, investigators, insurers, and/or other relevant stakeholders. Collecting and sharing de-identified data about near misses and other relevant problems would also help to aggregate vital performance information for the motor vehicle industry, allowing it to take proactive steps based on leading indicators rather than waiting for a crash or a series of crashes to occur. Leading indicators are "proactive, preventative and predictive measures that monitor and provide current information about the effective performance, activities and processes of a . . . system that drive the identification and eliminate or control of risks."[7] The NSC Campbell Institute, a leader in environmental, health and safety, states that tracking leading indicators allows world-class safety organizations to make further improvements to their safety records.[8]

Acquiring an understanding of what happens when systems perform as intended, fail as expected, or fail in unexpected ways yields is valuable information for manufacturers—some of whom have common suppliers—and researchers and the safety community in analyzing the safety benefits and potential limitations of these technologies as they continue to mature. Further, in-service data, as well as near miss and post-crash information sharing, can help civil engineers and planners design better and safer roadways, as well as help safety and health professionals design better interventions to discourage risky driving or affect the behaviors of other roadway users.

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[6] Federal Motor Carrier Safety Administration
[7] *http://www.thecampbellinstitute.org/file/download.php?id=20130925358263a8956de938e7c0 0a2bbbb8413d*
[8] *http://www.thecampbellinstitute.org/file/download.php?id=2015092336b107f72d10a379134a f9249d3457ab*

De-identified data sharing has existed in the aviation industry for many years and proven highly successful. The Aviation Safety Information Analysis and Sharing (ASIAS) system allows for sharing of de-identified data across the industry, making it possible for manufacturers, operators, researchers, regulators and other stakeholders to identify trends and act on them. Similarly, analysis of de-identified data in the vehicle industry will provide windows into leading indicators, increasing the potential to save lives.

While there are competing priorities regarding protecting personal privacy and proprietary systems or designs, NSC believes that safety should be the ultimate priority. Requiring the SER and data sharing will aid in improving safety.

Education and Training

Another encouraging component in the draft legislation is the creation of the consumer education workgroup focused on new safety technologies. With nearly 17.4 million new passenger cars and trucks sold in 2015,[9] understanding the technology on these vehicles is necessary, yet a University of Iowa survey found that 40 percent of respondents reported they had experienced a situation in which their vehicle acted in an unexpected way. When this occurs in a real-life driving situation, among multiple drivers and a variety of vehicles, it can lead to disastrous outcomes.

The National Safety Council and our research partners at the University of Iowa are focused on educating consumers about in-vehicle safety technology through our MyCarDoesWhat campaign.[10] This brand agnostic education campaign informs drivers about how safety technologies work, how to best interact with them, and how to identify situations when the technology may not perform optimally and should not be relied upon. Because of the need for continued human involvement in the operation of many of these features, the campaign tagline is, "You are your car's best safety feature." Too often, marketing and media reports using terms such as "autopilot" and "autonomous" only confuse consumers about the capabilities of their vehicles and contribute to losses of situational awareness around the driving task.

Drivers cannot effectively use these life-saving technologies if they do not understand both their functions and limitations, and these education efforts should be extended to the safe use of automated commercial vehicles. The AV policy proposes that this education be delivered in multiple ways, including computer based, hands-on and virtual reality training, and other innovative approaches. The MyCarDoesWhat education campaign follows that approach and has developed a virtual reality module. Further, we recommend ongoing evaluation to determine the effectiveness of the various messages, methods of delivery and media so they can be improved over time. NSC appreciates the recognition by the Senate that education is a necessity if we are to realize the life-saving effects of these vehicles.

The AV START Act

As previously mentioned, there are several good provisions in the draft bill that the National Safety Council would like to highlight.

- Including whether a vehicle in a crash is equipped with some automation on post-crash investigation reports. NSC called this out in our report "*Undercounted is Underinvested: How Incomplete Crash Reports Impact Efforts to Save Lives*" earlier this year. This data can be vital to improve safety systems.
- Improving research on the human machine interface to ensure drivers remain engaged in the driving task before full automation. In too many other modes of transportation, users have become confused about what technology is "saying" to them and results have been fatal. Standardizing these alerts (visual, aural, haptic) could decrease this confusion.

I offer some additional provisions for your consideration to include in the legislation.

- Reporting of certain types of crashes, such as fatal and serious injury crashes, to a Department of Transportation database can help ensure correct information is disseminated about these events. We have already seen the overwhelming media attention on automated vehicle crashes. By creating a database, one place would exist for locating common and accurate information.
- Testing on public roads should be reported to the states in which tests occur. Adding this level of transparency can help states be more involved, especially if they must send resources to respond to a testing event.

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[9] *http://www.autoalliance.org/auto-marketplace/sales-data*
[10] *www.mycardoeswhat.org*

- Encouraging the designation of a common nomenclature and performance standard for each safety feature or system so drivers can better understand and compare performance.
- Tying ADAS and automation components to vehicle identification numbers (VIN) so that more complete crash reporting and analysis can be completed.
- Requiring rulemaking to mandate safety technology with proven results to require it on all vehicles.

Technology in Transportation

Improvements in technology and safety in transportation have historically gone hand-in-hand. During my decade at the National Transportation Safety Board, the NTSB called for many safety improvements that would reduce or mitigate fatal transportation incidents, some of which were at least partially attributable to predictable and preventable human behavior. Technology like auto-pilot features in aviation control airspeed and heading, leaving human operators free to monitor larger systems and issues to ensure safe flight. Similarly, positive train control is still being implemented on passenger and freight railroads but will certainly prevent numerous collisions. Electronic charts standardize routes and transponders in the maritime industry projecting the routes other vessels will travel. This Committee oversees all of these industries and these very technologies are ones you have debated and mandated. You know that each advancement in technology has impacts, some of which are known while others may result in unintended outcomes.

At this point in the deployment of vehicle safety technology, human drivers are still ultimately responsible for the safe operation of their vehicle and often need to intervene in certain conditions. We can expect this intervention will continue to be necessary as technologies mature. However, we also fully understand that this may not always be the case. At some point drivers, including those who may be impaired, may do more harm than good.

Currently, vehicle manufacturers are making different choices about how to develop fully automated vehicles. Some manufacturers believe that human drivers will always be required behind the wheel and that highly or fully automated features will serve to assist the human or take over when the driver fails to take corrective action. Others see the role of the traditional driver disappearing entirely, with vehicles providing safe transportation and mobility through artificial intelligence—all by themselves. NSC believes that both should be seen as viable courses of action and thus addressed in any new policies.

There is real debate today as to whether fully self-driving vehicles will actually achieve widespread acceptance in the coming decades. Some people believe that American drivers, while willing to embrace systems that provide them assistance, will always want the option of hands-on driving. Other people believe that it may actually be safer for humans to simply be passengers in fully automated vehicles.

Regardless of the level of autonomy, we know that active safety system integration into the U.S. fleet will be more robust in years to come, and as these features continue to penetrate the driving world, we can expect to see changes in the very definition of the word "driver." In the last few years, NHTSA offered that there may be a day when "driver" may refer to an automated system rather than a human being. Today, some states are contemplating this same idea, especially those who run the licensing systems and law enforcement charged with enforcing state regulations. These state leaders, along with other Federal and state entities, should cooperate and collaborate, moving beyond their traditional roles to respond to the new questions rather than addressing them on a piecemeal basis.

Finally, one of the biggest challenges in moving from level 1 to level 4/5 vehicles is successfully identifying the challenges and improvements needed for the human-machine interface to be successful. In other industries, such as aviation, there have been many lessons learned regarding mode confusion and overreliance on automation. We must recognize that the most dangerous environment will exist when both the human and machine are involved in the safe operation of a vehicle. The greatest risks are not when one or the other has sole responsibility for the vehicle, but when the control is shared. A "driver" whose role is primarily to serve as a safety monitor, always on-guard in case of a system malfunction or other emergency, will be susceptible to boredom, fatigue, and/or distraction, all of which may contribute to a more dangerous situation.

In order to save lives on our roadways—the most dangerous way to travel in this country—all options should be at the disposal of policy makers. If necessary, NHTSA must use its authority to address defects quickly and effectively, sharing as much information with the public as possible.

NTSB–NSC Roundtable on Safety Technologies in Large Trucks

On July 24, NSC and the National Transportation Safety Board (NTSB) co-hosted a roundtable discussion with nearly two-dozen fleet managers, vehicle manufacturers, government officials, researchers, software experts, safety advocates and more. The panel discussed strategies to increase adoption of ADAS in commercial motor vehicles.[11] NTSB has recommended advanced technology on CMVs since 1995 because of the life-saving potential of this technology, and this issue is currently on its Most Wanted List of transportation safety improvements.[12]

The NTSB–NSC roundtable discussion provided three key takeaways.[13] First, technologies exist today that can reduce both the frequency and severity of crashes involving large trucks, saving lives and preventing injuries. Some of the lifesaving technologies available for large trucks include automatic emergency braking, forward collision warning, lane departure warning and blind spot monitoring. These technologies assist—but do not replace—the driver. Roundtable participants who had investigated fatal crashes said many of those tragedies could have been mitigated or prevented entirely by collision avoidance technologies. However, the penetration rate of these technologies in large trucks is less than 10 percent.[14]

A second takeaway from the discussion centered on the importance of proper training for drivers. Drivers must use new technologies appropriately, and the threat of overreliance on new technologies is legitimate and must be addressed in training sessions. For example, a truck equipped with electronic stability control does not give a driver freedom to go faster around curves. Likewise, a truck that features collision avoidance technologies does not clear the way for a driver to be drowsy or distracted behind the wheel. Drivers must remain alert and attentive at all times even with new ADAS features in place.

The third and final takeaway was that manufacturers, carriers and others who work in the trucking industry can take the lead in this life-saving mission. There is power in partnerships. Regulations could speed the adoption of ADAS in large trucks, but nothing is preventing fleets from equipping new vehicles and retrofitting old vehicles with some of these technologies. There is a cost component to this investment, but one trucking company at the roundtable reported a significant return on investment.[15] After installing collision avoidance technologies, the company recorded a 70 percent reduction in frequency and a 95 percent reduction in severity of crashes. Not only did this keep both its employees and the public safer, but also cut down drastically on the legal, health care, insurance and operational costs associated with crashes. Another participant noted that costs associated with a single crash can destroy a small fleet or an owner-operator.[16]

NTSB Commercial Motor Vehicle Crash Investigations

As mentioned earlier, NTSB first recommended advanced technology in vehicles over 20 years ago in 1995, calling on U.S. Department of Transportation to test collision warning systems in commercial fleets.[17] NTSB specifically singled out commercial operations in this initial recommendation, and since that time, NTSB has expanded its recommendation to include passenger vehicles.

While at NTSB, I was the unfortunate witness to many crashes that could have been prevented by advanced technology that has been available for years. The crashes cited below represent just a few involving commercial vehicles.

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[11] *https://www.ntsb.gov/news/events/Pages/2017-adas-rt.aspx*
[12] *https://www.ntsb.gov/safety/mwl/Pages/default.aspx*
[13] *https://www.youtube.com/watch?v=vCeGam2RNfE*
[14] *https://www.ntsb.gov/safety/safety-studies/Pages/SIR1501.aspx*
[15] *https://www.youtube.com/watch?v=vCeGam2RNfE*
[16] *Ibid.*
[17] *https://www.ntsb.gov/safety/safety-studies/Documents/SIR1501.pdf*

Bronx, New York: 15 dead and 18 injured. This crash could have been prevented or mitigated by lane departure warning, adaptive cruise control (ACC), and a speed limiter. The driver was operating at 14 mph over speed limit and run off the road due to fatigue.

Osseo, Wisconsin: 4 dead and 36 injured. This crash could have been prevented or mitigated by AEB, ACC and lane departure warning (LDW). This was a high school band returning from a band competition.

Munfordville, Kentucky: 11 dead and 2 injured. This crash could have been pre-vented or mitigated by AEB and LDW. The truck crashed into a church van on the way to a wedding, and the two surviving passengers were children restrained in car seats pictured below.

Miami, Oklahoma: 10 dead and 6 injured. This crash could have been prevented or mitigated by AEB. The truck did not react to stopped vehicles ahead and struck the end of a passenger vehicle, resulting in a multiple vehicle collision.

Grey Summit, Missouri: 2 dead and 38 injured. This crash could have been prevented or mitigated by AEB.

If this bill is moving forward, it should do so including all motor vehicles.

Road to Zero

On October 5, 2016, NSC, NHTSA, the Federal Highway Administration (FHWA), and the Federal Motor Carrier Safety Administration (FMCSA) announced the *Road to Zero* (RTZ) Coalition. RTZ is an initiative focused on identifying new ways to look at the persistent problem of roadway fatalities. Today, nearly one year later, there are over 350 unique organizations that have joined the coalition that I am honored to lead with a number of Steering Group members (listed below). Our shared vision of a future with no roadway fatalities cannot be realized unless we redouble efforts on existing solutions and accelerate implementation of new measures like ADAS and automated vehicles.

In early 2018, the Road to Zero coalition will produce a vision for reaching zero fatalities on our roadways by 2050. I look forward to sharing this document with you, as I know it will be an important addition to the discussion of roadway safety policy development.

NSC is joined on the Steering Group for the Road to Zero Coalition by the following organizations: AAA, Advocates for Highway and Auto Safety, American Association of Motor Vehicle Administrators (AAMVA), American Association of State Highway and Transportation Officials (AASHTO), Association of Global Automakers, Commercial Vehicle Safety Alliance (CVSA), Governors Highway Safety Association (GHSA), Institute of Transportation Engineers (ITE), Insurance Institute for Highway Safety (IIHS), Intelligent Car Coalition, International Association of Chiefs of Police (IACP), Mothers Against Drunk Driving (MADD), National Association of State Emergency Medical Services Officials (NASEMSO), National Association of City Transportation Officials (NACTO), National Association of County Engineers (NACE), and the Vision Zero Network.

Conclusion

We cannot continue to do things the same way and expect different results. When it comes to saving lives on our roadways, this means implementing a legislative framework for advancing safety technology on ALL motor vehicles. By advancing safety technology in trucks and buses, as well as passenger cars, the bill before you today represents a step in that direction to move us closer to a goal of zero fatalities on the roadways.

The National Safety Council is committed to working with you to advance safety, up to and including automated vehicles. Doing this well is essential. Lives depend on it.

The CHAIRMAN. Thank you, Ms. Hersman.
Mr. Spear.

STATEMENT OF CHRIS SPEAR, PRESIDENT
AND CHIEF EXECUTIVE OFFICER,
AMERICAN TRUCKING ASSOCIATIONS, INC. (ATA)

Mr. SPEAR. Thank you, Chairman Thune, Senator Peters, and members of the Committee, for the opportunity to testify today. I think Debbie's testimony really captures the importance of this issue well, and she is a great contribution to the safety story.

The American Trucking Associations' federation has more than 30,000 member companies spanning all parts of the trucking industry, from every size, type, and class of motor carrier operation, to truck makers, tech companies, as well as insurers. That diverse membership is important for discussions like this one, where the trucking industry's key role in our economy meets rapidly developing technology. There are more than 7 million people employed in the trucking industry and in trucking-related jobs in the U.S., including 3.5 million truck drivers. One in 16 jobs in the U.S. are trucking related where truck-driving jobs are the top job in 29 states.

Truck drivers, who ATA is celebrating this week as part of National Truck Driver Appreciation Week, move more than 70 percent of our Nation's freight tonnage. They help deliver products to communities in every corner of the country every day—stores, factories, schools, hospitals—and as you're seeing today, they're on the front lines of disaster response delivering supplies to help the people of Texas and Florida live and rebuild after two historic storms.

Those same drivers, we believe, will be a part of our industry for the long haul. While some people use the terms "autonomous" and "driverless" interchangeably, ATA believes the world of automated vehicles will still have an important role for the drivers. Just as pilots play a key role in our airline industry, truck drivers will do the same on the ground by leveraging the benefits of automated technology while navigating the cityscapes and handling the customer pickups and deliveries. The trucking industry spends over $9 billion annually on safety, including technology enhancements, to help ensure that drivers and passengers of all vehicles make it safely to their destination.

The technology we're discussing today is the next step in the evolution of the types of safety technology the trucking industry is already investing in. This technology is becoming more robust in both commercial and passenger vehicles. To fully maximize the safety of other benefits of automated driving technology, it makes sense to provide protections and incentives for innovation in commercial vehicles, not just passenger vehicles. This includes Federal preemption to ensure that State and Federal regulations do not impede interstate commerce. It also includes the ability to receive exemptions from existing Federal regulations so that new technology can be developed and tested both in commercial and non-commercial vehicles.

We are at a critical moment in the development of autonomous technology. There are many questions to be answered, including those about cybersecurity, about the impact on trucking operations,

and how vehicles will interact with one another, as well as infrastructure. What is clear is that those questions should be answered for commercial and passenger vehicles at the same time. As you draft legislation intended to address many of these questions, I'd respectfully ask that the Committee consider the following points.

First, ensure that the Federal Government has the sole authority to regulate automated vehicle technology. As an industry that routinely crosses state lines, the rules of the road must be the same across the country in order to maintain a free flow of goods. Our industry cannot be subject to a patchwork of conflicting state rules. We service the entire country, and the trucking industry needs uniform rules to effectively do that.

Second, we believe Federal agencies and state governments must commit to supporting innovation for both commercial and passenger vehicles, using existing regulatory exemptions to allow manufacturers and technology companies to test and develop new systems.

Third, Federal agencies must coordinate their own missions with respect to automated vehicles. We believe the benefits of automated vehicles would be greatly enhanced, for instance, by vehicle connectivity, using the 5.9 GHz safety spectrum. The use of this communications channel for vehicle-to-vehicle and vehicle-to-infrastructure systems will fully unlock the potential of automated vehicles to improve safety, reduce traffic congestion, and decrease emissions. We encourage the Federal Communications Commission to preserve all seven channels of 5.9 GHz spectrum for safety and to take no action that could harm the initiatives the Department of Transportation is pursuing with this spectrum.

Finally, we urge the Federal Government to consider the existing slate of Federal Motor Carrier Safety Regulations and how they might be impacted by increased automation as well as how regulations can accommodate this new technology and improve safety, productivity, and the environment. This should include the impact of automated vehicle use on CSA scores, liability, and insurance regulations, speed limiters, and hours-of-service rules. This isn't to say these regulations should be changed. The DOT should first determine how a more automated environment will impact the industry it regulates in order to minimize disruption and confusion as this technology becomes more robust and widely available.

This concludes my testimony. Chairman Thune, Senator Peters, members of the Committee, I thank you again for the opportunity to testify on this important subject, and I look forward to questions.

[The prepared statement of Mr. Spear follows:]

PREPARED STATEMENT OF CHRIS SPEAR, PRESIDENT AND CHIEF EXECUTIVE OFFICER, AMERICAN TRUCKING ASSOCIATIONS, INC. (ATA)

Introduction

Chairman Thune, Ranking Member Nelson, and distinguished members of the Committee, thank you for the opportunity to testify in today's hearing on Transportation Innovation: Automated Trucks and Our Nation's Highways. My name is Chris Spear, and I am the President and CEO of the American Trucking Associations (ATA). Founded in 1933, ATA is the Nation's preeminent organization representing the interests of the U.S. trucking industry. Directly and through its affiliated organizations, ATA encompasses more than 30,000 companies and every type and class of motor carrier operation.

The trucking industry is an integral component of our Nation's economy, and a significant contributor to the highway trust fund. Despite being less than 13 per cent of the vehicles on the road, trucking pays nearly half of the money that goes into the highway trust fund[1] each year. That's more than $18 billion that goes toward the construction, operation and maintenance of the roads that all vehicles share. Trucking transports more than 70 percent of our Nation's freight tonnage and employs 7.4 million workers in trucking-related jobs across many sectors of the economy, including over 3.5 million commercial drivers[2]. These drivers are on the road every single day moving the economy. Approximately 80 percent of all U.S. communities depend solely on trucks to deliver and supply their essential commodities.[3]

Today's hearing coincides with National Truck Driver Appreciation Week, when America takes the time to honor all professional truck drivers for their hard work and commitment in tackling one of our economy's most demanding and important jobs. These 3.5 million professional men and women not only deliver our goods safely, securely and on time, they also keep our highways safe and serve as role models in their communities. During this hurricane season, we should also recognize these drivers for overcoming the challenges of roadways and communities devastated by natural disasters to bring in critical goods to aid in the recovery efforts. We know there are concerns about the elimination of drivers or a change in their role from automation. We continue to believe that the automated technologies being developed today will assist drivers, improving safety and productivity, and that the job of truck driver will be with us for the foreseeable future. However, we do not dismiss the importance of considering the potential impacts on the workforce and the need to develop programs that will help prepare workers with the skills needed for the jobs of the future.

The trucking industry has a substantial stake in the success of safe automated and connected vehicle technology. The roads are the workplace of the truck driver, and safety is of paramount importance. There were 33.8 million commercial trucks of all classes (including 3.63 million Class 8 trucks) registered in the U.S. in 2015[4]. That same year, medium and heavy duty trucks accounted for 7.9 percent of the vehicle miles traveled[5]. Safety gains achievable by removing human error, which is a factor in 87 percent of large truck crashes[6] and 94 percent of all vehicle crashes[7], and the additional economic and societal benefits, are very enticing to an industry that already spends over $9 billion annually on safety, including technology enhancements, to help ensure that drivers and passengers of all vehicles make it safely to their destination.[8] Additionally, the preponderance of research studies find that car drivers are principally at fault in approximately three-quarters (70–75 percent) of fatal car-truck crashes[9]. Connectivity and automated technology can work together to reduce or eliminate these crashes. With these technologies, we can not only improve safety, but lower fuel burn and emissions, and help reduce traffic congestion, which costs the trucking industry $63.4 billion a year—the time lost to traffic is equivalent to having 362,000 drivers sitting idle for an entire year.[10]

Automated driving technology is the next step in the evolution of the safety technology currently available, and it is critical that Federal policies developed for this new technology include all vehicles that operate on our nations roadways. While self-driving vehicle demonstrations are exciting to watch, automated technology comes in many levels that will assist the driver and in some cases, handle the driving task. Some may predict the elimination of all driving jobs, including both drivers

[1] Highway Statistics 2015, Federal Highway Administration, U.S. Department of Transportation, and American Trucking Associations, Trucking Trends 2017 (August 2017)

[2] American Trucking Associations, American Trucking Trends 2017 (August 2017)

[3] ATA staff, developed the 80 percent figure by using the Rand McNally Commercial & Marketing Guide (2001) numbers for rail service to communities and calculating the inverse, ultimately deriving the number of communities serviced by truck.

[4] American Trucking Associations, Trucking Trends 2017 (August 2017)

[5] Federal Highway Administration, Highway Statistics, 2015, Table VM–1, accessed online at https://www.fhwa.dot.gov/policyinformation/statistics/2015/pdf/vm1.pdf.

[6] Large Truck Crash Causation Study, Federal Highway Administration, July 2007

[7] Singh, S. (2015, February). Critical reasons for crashes investigated in the National Motor Vehicle Crash Causation Survey. (Traffic Safety Facts Crash Stats. Report No. DOT HS 812 115). Washington, D.C.: National Highway Traffic Safety Administration

[8] American Trucking Associations, (2016, June 26). Trucking Industry Spends $9.5 Billion In Safety Annually. Retrieved from: http://www.trucking.org/ATA%20Docs/News%20and%20Information/Reports%20Trends%20and%20Statistics/06%2028%2016%20-%20Trucking%20Industry%20Invests%20$9%205%20Billion%20in%20Safety%20Annually.pdf

[9] Relative Contribution/Fault in Car-Truck Crashes, February 2013, http://www.trucking.org/

[10] Cost of Congestion to the Trucking Industry: 2017 Update, American Transportation Research Institute, Arlington, VA, May 2017

of passenger vehicles and commercial vehicles, but that future, if it exists at all, is too far into the future to see. Realistically, what we are talking about now is fostering the development of all levels of automated technology, so that those levels of technology which provide improved safety and productivity can be tested, proven, and deployed to benefit all road users. We need to think about how this innovation can solve problems like crashes, congestion, and emissions, and let that guide policy and drive outcomes. In short, this innovation and its benefits, centers on solutions in which their remains a role for drivers, rather than a driverless approach.

As you well know, passenger cars and commercial vehicles operate on the same roads, making it critically important that both benefit from innovation in safety technology. While there are differences between passenger and commercial vehicles, it makes sense to provide protections and incentives for innovation in commercial vehicles as well as passenger vehicles—things like Federal preemption to ensure that state and Federal regulations do not conflict or impede interstate commerce, and the ability to receive exemptions from existing Federal regulations so that new technology can be developed and tested—these should apply to both commercial and non-commercial vehicles.

Automated Technology in Trucking

Automated vehicle technologies have the potential to dramatically impact nearly all aspects of the trucking industry. These technologies can bring benefits in the areas of safety, environment, productivity, efficiency, and driver health and wellness. Although some people use the terms "autonomous" and "driverless" interchangeably, ATA believes that the driver will retain an important role in trucking, even with automated trucks. In addition to monitoring the automated driving systems and manually driving in the cityscape and at loading docks, drivers will retain their current responsibilities for securing the cargo, particularly hazardous cargo, as well as for customer interaction with the shipper and receiver.

In the trucking industry, you have a business-to-business relationship between the fleets purchasing the vehicles and the companies offering the technology. How individual carriers choose to incorporate automated technologies in their fleets will likely not be a "one size fits all" application, but rather will depend on each carrier's operations and anticipated return on investment for the technology. Trucking companies will want to see convincing data before they invest in changing their operations to incorporate the new technology. Trucking is also a highly regulated industry. Regulations from the Federal Motor Carrier Safety Administration (FMCSA) and the National Highway Traffic Safety Administration (NHTSA), as well as the Federal Communications Commission (FCC), Environmental Protection Agency (EPA), Department of Homeland Security (DHS) and others affect both the vehicle technology and the driver's responsibilities, which will also have an impact on a company's decision on whether and how to deploy automated technology.

The bottom line is that the trucking industry is vitally interested in automated vehicle technologies and the safety and efficiency promise they hold. The safety gains achievable by removing human error, a factor in 94 percent of all vehicle crashes,[11] could be transformative in reducing fatalities and injuries on our roadways, as well as in preventing even minor crashes, which would reduce traffic congestion and pollution, providing additional economic and societal benefits.

Automated Driving Technology and Jobs

The development of automated technology for vehicles does not mean that all vehicles will become "driverless vehicles" and that every kind of driving job will be eliminated. The reality is much more complex. While there may be applications where an automated system can take over the driving task, this is unlikely to replace commercial vehicle drivers altogether, just as in the airline industry pilots are still in the cockpit and responsible for the safe operation of their vehicle. As with any technology that increases productivity, there is a likelihood that there will be a decrease in the number of people needed to do the same amount of work. Right now, we are facing a shortage of drivers, particularly for long-distance drivers, around 50,000. If these trends continue, the shortage could hit over 150,000 in a decade. And as the shortage becomes more acute, it will begin to affect the ability of goods to be delivered on time, which is becoming more important in today's on-demand economy. Projections are that we'll need to hire about 890,000 truck drivers over the next 10 years.[12] The American Transportation Research Institute, the not-

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[11] Singh, S. (2015, February). Critical reasons for crashes investigated in the National Motor Vehicle Crash Causation Survey. (Traffic Safety Facts Crash Stats. Report No. DOT HS 812 115). Washington, D.C.: National Highway Traffic Safety Administration

[12] American Trucking Associations, Truck Driver Shortage Analysis (October 2015)

for-profit research arm of the trucking industry, recently released a report on how autonomous technologies will impact the trucking industry. That assessment found that highly automated trucks will likely draw new, younger drivers into the trucking industry by better meeting the job expectations of millennial workers.[13] Making our drivers more productive may also be an important element in addressing this shortage and avoiding shipping delays. Additionally, as we have seen with other new technologies, there are new jobs created as well, which in the case of automated trucks could include new categories of maintenance technicians and new jobs that will develop along with business models that take advantage of the new capabilities this technology brings.

As the automated technology is still developing, it is difficult to make any projections on how driving jobs will ultimately be affected without gathering more data. As I pointed out earlier, there is a business-to-business relationship between the fleets purchasing the vehicles and the companies offering the technology in the trucking industry. Fleet owners will want information on what the new technology can do and what it will cost before they can make decisions on how it would impact their operations. For example, will it operate only on open highway or only in traffic jams? Will it operate under all weather conditions? Can the technology operate when it gets off the main roads and navigate to a customer's delivery location, which may involve driving on private roads? Will the system need frequent calibration or have other special maintenance requirements? With this type of information, companies can then determine how the role of the driver would change. This information may help inform future regulatory policy as well. However, in order to answer these and other questions, there will need to be more data gathered in real-world testing and demonstration projects, which could be stalled if companies have to work through a maze of disparate state regulations or are unable to put sufficient vehicles on the road to collect the necessary data.

While no one can predict the distant future—I still haven't seen the Jetson's flying car on the road or in the air yet—I can tell you this: Trucking companies rely on good, safe drivers. As an industry, we are working hard to recruit new drivers and retain the excellent drivers we have now. Automated technology has the promise of keeping these drivers safer on the roads, and making them more productive. As automated technology changes the role of the driver, trucking companies will work to retrain drivers as needed to operate with the new technology. We need to embrace this innovation and shape policies that are sensible for all vehicles that share the road, while reflecting the unique aspects of the trucking industry's role in our economy that allows businesses and private citizens to confidently ship goods across state lines and throughout America. Right now, trucks move more than 10 billion tons of freight—nearly 71 percent of all U.S. domestic freight tonnage—and those figures are only expected to grow as our economy and population also grow.[14] We will continue to need human beings in the cabs of our trucks for some time. In addition to the anticipated safety benefits, what these technologies may do is make those drivers more efficient, make driving a more attractive career choice, and attract new people to our industry.

Cybersecurity

As with passenger vehicles, cybersecurity is an important consideration for commercial vehicles. ATA has taken steps to help ensure a robust cybersecurity environment for motor carriers. ATA is developing a motor carrier-based program for sharing information about emerging cyber threats and attacks. This program will focus on the unique threats to truck fleets, and will coordinate with the Auto-ISAC, which has recently opened its membership to truck manufacturers and equipment suppliers. ATA has also been working with the Federal Bureau of Investigation (FBI), DHS, and intelligence sharing and analysis groups including the National Motor Freight Traffic Association Heavy Vehicle Cybersecurity Working Group, and the U.S. Department of Transportation (DOT) Volpe Center Commercial Truck Cyber Working Group. ATA also has a seat on the U.S. Chamber of Commerce Cyber Leadership Council. ATA's Technical Advisory Group and Technology & Engineering Policy Committee have been working with our members to provide industry thought leadership and to raise awareness of motor carrier and supply chain risk and cybercrime prevention.

In June, the U.S. Army's Tank Automotive Research, Development & Engineering Center (TARDEC) held a CyberTruck Challenge where truck OEM engineers and

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[13] *Identifying Autonomous Vehicle Technology Impacts on the Trucking Industry,* American Transportation Research Institute, Arlington, VA, November 2016.

[14] U.S. Freight Transportation Forecast to . . . 2028, produced by IHS Global Insight, Inc. for American Trucking Associations.

university students attempted to hack into trucks to identify potential vulnerabilities. Later this month, ATA's Technology & Maintenance Council will host its first CyberTech challenge at our National Technician Skills Competition which will help technicians diagnose and detect cyber attacks.

All of these initiatives are working to keep trucking safe as it moves toward connected and automated driving.

Policy Recommendations to Support Safety Innovations

The trucking industry relies on an interstate highway system that facilitates the free flow of goods between the states. As automated truck technology is developed, tested, and commercialized, it is critical that federal, state and local laws do not create disparities that limit commerce and obstruct the successful adoption of these potentially safety- and productivity-boosting technologies. The regulation of performance and technical specifications of automated and connected truck technology should be solely the responsibility of the Federal Government. States should maintain their existing responsibilities that do not interfere with the flow of interstate commerce. In the absence of Federal regulation, states should support operations of commercial motor vehicle automated and connected technologies within their rights of intrastate jurisdiction. However, conflicting requirements among Federal and State agencies will create roadblocks to deployment of automated technology, delaying the safety benefits, fuel savings, emissions reductions, and potential efficiency improvements to our country's transportation system. The Federal Government must take a clear leadership role and, where necessary, exercise Federal preemption to ensure that there is no conflict between Federal and state regulations. It is critically important to provide certainty to the developers of automated technology for all vehicles that there will not be a disparate set of state laws, now or in the future, that unnecessarily impede the ability of a company to test and operate vehicles with their technology across state lines and in interstate commerce. Without this certainty, innovation will be slowed as companies divert resources to addressing a patchwork of state policies, or find that the vehicles they developed in Nevada cannot be operated in California and they need to make changes to their designs.

As automated vehicle technology is rapidly developing, it is important that government policy and regulations support innovation and do not inhibit the flexibility of carriers to choose automated technologies best suited to their individual needs. Federal agencies and state governments should be fully committed to encouraging innovation in both commercial and passenger vehicles to bring safety and other benefits to all road users. Exemptions from existing Federal regulations that will allow new technology to be developed and tested is one way to help support innovation while also gathering data that could inform future standards and policies. NHTSA already has authority in this area, but exemptions are now limited to 2,500 vehicles per manufacturer per year, with each exemption lasting for a period of two years. Expanding the number and duration of exemptions from standards that prevent new safety technology from being put on the road will allow more real-world data to be collected more quickly, which will lead to improved system design and better information for making both regulatory and business decisions. To be clear, the exemption process does not automatically provide a manufacturer with the ability to avoid any or all safety standards. It is a rigorous process which requires a manufacturer to apply for the exemption and provide information that will allow NHTSA to make its determination based on, among other things, equivalent or better safety levels and the overall public interest. Increasing the number and duration of the exemptions would not relax safety, but rather provide a faster path to achieving higher levels of safety and updated regulations.

It is important to note, too, that the Federal preemption and exemption changes we are recommending support not only innovation of fully automated vehicles, but also the levels of partial automation that will bring safety benefits as well.

Coordination among Federal agencies is another way to remove barriers and more fully realize benefits that can come from automation. ATA sees great potential for vehicle connectivity using the 5.9 GHz Safety Spectrum to improve the performance of automated vehicles. Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication using the Safety Spectrum can save lives and reduce traffic congestion and vehicle emissions. The benefits of V2V/V2I technology will grow when coupled with automated vehicle technology, and vice versa. As the Federal Communications Commission (FCC) considers action that would allow other uses of the 5.9 GHz spectrum that was allocated for V2V and V2I communication, we believe it is important that any decisions over sharing the Safety Spectrum should be driven first and foremost by public safety, preserving all 7 channels of spectrum for safety. The FCC should take no action that could jeopardize the vehicle safety initiatives that the DOT is pursuing with this spectrum.

Federal agencies should also begin the work of evaluating the benefits of connected and automated technology on public safety and the economy, considering both passenger and commercial vehicles. A better understanding of how these technologies may benefit the public along with consideration of how regulations can be changed to take advantage of the capabilities that this new technology provides will lead to better policy decisions and the development of a regulatory framework that help to realize these benefits. For example, in the commercial sector, FMCSA should begin to review Federal Motor Carrier Safety Regulations and see what might be changed to account for the new driving environment with automated technology where the driver may be in the seat but not operating the controls. Perhaps there can be changes made in hours of service that would improve productivity without reducing safety? How should speeds be managed with connected and automated technology? What will be the impact of connected and automated technology on CSA scores, liability, and insurance? These are questions that should be considered by DOT along with an examination of the impact on interstate commerce of conflicting state laws and the importance of preserving a seamless set of safety standards to minimize disruptions to the economy and the national supply chain. A thorough examination of these issues will help insure that the future regulatory framework is correct, not flawed.

Conclusion

ATA supports the development of automated vehicle technology for all vehicle types. This technology has the potential for improving safety, the environment, reducing congestion, and saving fuel. While there are concerns about the impact automated technologies will have on the future of work, affected stakeholders should embrace this coming innovation and work together to prepare the workforce to operate with the new technology. Some may see a driverless future, but with the complexity and diversity of the trucking industry, we expect the driver will retain an important role in trucking for a long time to come, with automated truck technology that will improve safety and productivity.

To prepare for the future, Federal agencies should begin the work of evaluating the benefits of connected and automated technology on public safety and the economy, and reviewing regulations to see what changes could be made to take advantage of the capabilities that this new technology provides. Preserving a seamless set of safety standards across the country will help to minimize disruptions to the economy and the national supply chain, and support the development of new technology.

Trucking plays a critical role in our economy—keeping the shelves of our local supermarkets fully stocked; delivering life-saving medical supplies to hospitals and clinics; and delivering goods at every stage of production from raw materials to the store shelf—and it should not be left out of any legislation that supports innovation in automated vehicle technology.

The CHAIRMAN. Thank you, Mr. Spear.
Mr. Hall.

STATEMENT OF KEN HALL,
GENERAL SECRETARY TREASURER,
INTERNATIONAL BROTHERHOOD OF TEAMSTERS

Mr. HALL. Chairman Thune, Senator Peters, members of the Committee, thank you for the opportunity to testify before you today on an issue that is of vital importance to American workers.

I'm the General Secretary-Treasurer of the Teamsters union, the Nation's largest transportation union, representing workers in almost every transportation industry. Teamsters members could be delivering anything from bakery goods to concrete, palletized material, to your latest online package, or getting you to work on time and safely transporting your kids to school.

While nearly 600,000 of our 1.4 million members turn a key in a truck to start their workday, the issues that we will be discussing today don't just impact those who drive vehicles for a living. A future that includes partial and fully autonomous vehicles could also change the nature of work for those in nearly every part of the transportation industry in our country.

Planning for the future and incorporating new technologies into our members' daily lives is not new to me or to my union. In addition to my duties as General Secretary Treasurer, for over 20 years I also served as Director of the Union's Package Division, and in this position, I ran the Teamsters daily interactions with UPS, under the single largest collective bargaining agreement in North America.

The issues facing the 250,000 Teamsters who work for UPS are inextricably tied to the incorporation of new technology. The logistics industry as a whole has changed extraordinarily over time, and Teamsters have been in the thick of it. We have strived to balance the incorporation of countless pieces of new technology into the workplace while ensuring that workers are guaranteed a right to avoid harassment and to always feel safe on the job. My career has shown me that new technologies can exist in an environment where workers are still taken care of. But it takes strong and aggressive action from those workers to make sure that happens.

Self-driving vehicles have the potential to change the transportation industry as we know it. That can be for the better or for the worse, depending on the actions of this Committee, workers, and others take in guiding their implementation onto our roads. It is incumbent upon the members of this Committee to help ensure that workers are not left behind in this process. It is essential that American workers are not treated as guinea pigs for unproven technologies that could put their lives at risk.

The issues facing autonomous commercial trucks are fundamentally different and potentially more calamitous than those facing passenger cars and warrant their own careful consideration. The consequences for getting this wrong could be deadly both for workers and other drivers on the roads. The public discussion in Congress on autonomous vehicles has tended to focus on the impact of small personal cars on our daily lives, increasing mobility for the disabled, and alleviating congestion in our cities. These are all important topics. But taking a cookie-cutter approach in dealing with those issues and applying it to heavy vehicles is reckless.

For instance, I have yet to hear a serious discussion about how we will make sure an 80,000-pound automated truck will be able to maneuver around a warehouse or drop yard and not injure the countless workers also occupying that same space, or how we would make sure that the rules governing a driver's training requirements would be updated the moment one of those new vehicles is put on the road. And we haven't gotten to the largest issue of them all, the potential impact on the livelihoods and wages of millions of your constituents. These issues should be considered carefully and deliberately at the outset of this discussion, not after the fact.

For all the discussion here about the potential benefits that may accompany this technology, I urge you to consider these possibilities with a healthy dose of realism. When you hear manufacturers tell you that a list of strong safety metrics will translate into effortless deployment on the roads, I urge you to recall some of the other issues that this Committee has so furiously worked on this year.

This Committee has spearheaded investigations into Volkswagen knowingly cheating its customers out of emission benefits. The airbag manufacturer Takata knowingly sold defective airbags that

have claimed the lives of American citizens. Market forces did not convince these companies not to cheat and push the envelope past what was safe, and that same mentality is a constant factor in the trucking space where margins are consistently tight and competition is fierce. The fear of many transportation workers is that, absent strong action and guidance from this Committee and others, a new generation of autonomous vehicles will provide limitless opportunity for this same pattern of reckless behavior.

There are so many impacts to consider. Unchecked, this new technology could open up our citizens to having their privacy breached and personal data sold. Issues such as worker harassment and tracking would be intertwined with existing collective bargaining agreements and workplace policies. A truck driver will have to think about having his rig hacked and used as the next weapon in a Nice or Barcelona-style attack, and millions of Americans could have their paychecks decreased because half of their job has now been automated away and their employer thinks that it can get away with no longer paying them the full wage they once did.

I applaud you for having this hearing with the Teamsters' voice at the table. I look forward to working with the Committee to ensure the priorities and concerns of working families remain at the center of this debate. In all aspects of automation, but especially when we're considering commercial motor vehicles, it is more important to get it done correctly rather than just get done quickly.

Thank you, and I look forward to your questions.

[The prepared statement of Mr. Hall follows:]

PREPARED STATEMENT OF KEN HALL, GENERAL SECRETARY TREASURER, INTERNATIONAL BROTHERHOOD OF TEAMSTERS

Chairman Thune, Ranking Member Nelson, Senator Peters, members of the Committee, thank you for the opportunity to testify before you today on an issue that is of vital importance to American workers.

My name is Ken Hall. I am the General Secretary Treasurer of the International Brotherhood of Teamsters. The Teamsters Union is the Nation's largest transportation union, representing workers in almost every transportation industry. Teamster members could be delivering anything from bakery goods to concrete, palletized material to your latest online package—or getting you to work on time and safely transporting your kids to school.

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Self-driving vehicles have the potential to change the transportation industry as we know it. That can be for the better or for the worse depending on the actions that this committee, workers, and others take in guiding their implementation onto

our roads. It is incumbent upon the members of this committee to help ensure that workers are not left behind in this process. It is essential that American workers are not treated as guinea pigs for unproven technologies that could put their lives at risk.

The issues facing autonomous commercial trucks are fundamentally different, and potentially more calamitous than those facing passenger cars, and warrant their own careful consideration. The consequences for getting this wrong could be deadly both for workers and other drivers on the roads. The public discussion in Congress on autonomous vehicles has tended to focus on the impact of small personal cars on our daily lives—increasing mobility for the disabled, and alleviating congestion in our cities. These are all important topics. But taking a cookie cutter approach in dealing with those issues and applying it to heavy vehicles is reckless.

For instance, I have yet to hear a serious discussion about how we will make sure an 80,000 pound automated truck will be able to maneuver around a warehouse or drop yard and not injure the countless workers also occupying that same space. Or how we would make sure that the rules governing a driver's training requirements would be updated the moment one of these new vehicles is put on the road. And we haven't gotten to the largest issue of them all, the potential impact on the livelihoods and wages of millions of your constituents. These issues should be considered carefully and deliberately at the outset of this discussion, not after the fact.

For all of the discussion here about the potential benefits that may accompany this technology, I urge you to consider these possibilities with a healthy dose of realism. When you hear manufacturers tell you that a list of strong safety metrics will translate into effortless deployment on the roads, I urge you to recall some of the other issues that this committee has so furiously worked on this year.

This committee has spearheaded investigations into VW knowingly cheating its customers out of emission benefits. The airbag manufacturer Takata knowingly sold defective airbags that have claimed the lives of American citizens. Market forces did not convince these companies not to cheat and push the envelope past what was safe. And that same mentality is a constant factor in the trucking space where margins are consistently tight and competition is fierce. The fear of many transportation workers is that absent strong action and guidance from this committee and others, a new generation of autonomous vehicles will provide limitless opportunity for this same pattern of reckless behavior.

There are so many impacts to consider. Unchecked, this new technology could open our citizens up to having their privacy breached and personal data sold. Issues such as worker harassment and tracking would be intertwined with existing collective bargaining agreements and workplace policies. A truck driver will have to think about having his rig hacked and used as the next weapon in a Nice or Barcelona-style attack, and millions of Americans could have their paychecks decreased because half of their job has now been automated away and their employer thinks that it can get away with no longer paying them the full wage they once did.

I applaud you for having this hearing with the Teamsters' voice at the table. I look forward to working with the Committee to ensure that the priorities and concerns of working families remain at the center of this debate. In all aspects of automation, but especially when we are considering commercial motor vehicles, it is more important to get it done correctly rather than just done quickly.

Thank you and I look forward to your questions.

The CHAIRMAN. Thank you, Mr. Hall.

And thanks again to all of you for your testimony. And we'll have an opportunity to have members of the Committee to ask some questions. And I'll start with Colonel Hernandez.

Based on your years of experience, do you think that autonomous vehicle technology can advance safety for trucks?

Colonel HERNANDEZ. Absolutely. I think that, as we've heard, it already has in many ways. But witnessing what happened on October 20 of last year, it was clear that there are some advantages. And a couple of those that I probably didn't capture in my initial testimony was the hours, and the demonstration was at night when there was reduced traffic. And so that was both for safety concerns, and will be for safety concerns in the future. So just the timing possibilities. And it was, like I said, a Level 4 demonstration. And what that meant was that there was still a driver there to get that

vehicle onto the highway and then into the terminal area. So that driver was involved in that process.

But without a doubt, I believe that there are some advantages. I think the key is, is that we're all at the table to discuss with them, to discuss this together, through the process and make sure that commercial vehicles are not left out. I think the fact that they've already demonstrated this puts us behind, and I think that it shouldn't be left further behind in the process. Thank you.

The CHAIRMAN. Ms. Hersman, the crashes that you highlighted in your testimony are horrible, and yet could have been prevented or mitigated with crash-avoidance technology. And you mentioned that we cannot continue to do things the same way. Since trucks are involved in some of the most jarring examples that you've cited, would you say that accelerating the deployment of automated vehicles or automated trucks should provide significant safety benefits?

Ms. HERSMAN. Yes. With proper testing and controls, I think this is the game changer when it comes to highway fatalities. Advanced technology can solve many problems that we've struggled with for decades. And I think it's important to have the conversations and the issues that you've outlined in your bill. Whether it's data sharing, testing protocols, engagement of all of the right stakeholders, these are all things we need to begin to discuss.

The CHAIRMAN. Thanks.

Mr. Clarke, is there any reason to think that when it comes to automated vehicles, that Federal safety standards governing core automated technologies, things like sensors and radar, should be fundamentally different for trucks and cars and develop at different speeds?

Mr. CLARKE. The fact of the matter is, is that the basic sensor technology and some of that type of componentry which are put on the truck is very similar to what is in cars. However, our heavy vehicles are much different than cars. They weigh more, they take longer to stop, they have high centers of gravity. In fact, one of the reasons why we need to advance at the rate we are is because of the fact that some of the solutions that allow the heavy vehicle to perform in a similar manner to a light vehicle have yet to be engineered.

We need the data from real-life, in-hands use by real customers to understand what the proper validation processes and practices, you know, will be, or what the engineering problems are that we need to solve. We see no reason why commercial trucks should move forward in this area at a different speed or under a different timetable than light vehicles.

The CHAIRMAN. Mr. Spear, this appears to be an instance in which many trucking companies and manufacturers are actually pushing for more Federal regulation of the industry. Could you explain the reasons why you think more leadership from the Federal Government will accelerate the safety benefits of this new technology?

Mr. SPEAR. I wouldn't say that it's more regulation, but at least one standard, one seamless Federal standard, and that comes from Federal leadership. So we would push and advocate heavily for that as opposed to 50 different state regulatory regimes. We're interstate commerce. We move the economy. Seventy percent of the

freight was in your opening remarks. That's no small figure. And we cross state lines every day. And it's a reality that our drivers face every day, and, you know, compliance with multiple state regimes would be very disruptive to the economy, to these companies, and I think it would be a jobs issue over time if we're not able to move freight in a productive way, in a safe way, and obviously in a profitable way.

So having one seamless standard at the Federal level is what we would advocate, and it's certainly a much better approach in our view than a patchwork of state laws, conflicting state laws.

The CHAIRMAN. OK. Thank you.

Senator Peters.

Senator PETERS. Thank you, Mr. Chairman. And thank you to each of our witnesses for outstanding testimony here today as we begin this very important discussion about trucks and autonomy.

Mr. Hall, I couldn't agree with you more that we need to get this right, that there is a great deal of potential in this technology. We have to do it right and we have to be thoughtful about it, and that's certainly why we have spent so much time on this issue related to automobiles. As I mentioned in my opening comments, hours and hours of conversations with all stakeholders.

It has been a very comprehensive program as we've focused on automobiles. But as everyone has said, trucks are different than automobiles, and one of those differences deals with the employment impact, which I think you stated very clearly.

And I think, Mr. Spear, you mentioned it's the top job in over 20 states.

So folks who we represent in our communities, it could potentially have a significant impact, and one that we have to think very carefully about, the impact that it's going to have on our communities in our state.

Mr. Spear, in your testimony, you said that the ATA believes that the driver will retain an important role in trucking even in automated vehicles, or if I may paraphrase, I think that's in your written testimony. And I think we all could agree that we don't want to see large-scale job losses. But I didn't see in your testimony any data, studies, best practices, or business plans that address how a company operating today is prepared to address driver displacement.

Now, Mr. Clarke mentioned that drivers would still have a role in platooning, as an example of how a driver would be in that business model, but even that means a displacement of drivers. If you are platooning trucks, that means you have several trucks driving together, and normally you have each of those trucks with a driver in the front, and now you may just have one driver in front of a platoon. So there are differences.

So my question to you, Mr. Spear, and certainly to Mr. Clarke as well, What are you doing internally to prepare for possible driver displacement as a result of highly automated trucks?

Mr. SPEAR. Quite frankly, we don't view it as a displacement issue because we don't believe Level 5, no steering wheel, no pedals, is imminent. What we're really focused on is driver-assist technologies, not driverless. And if that's acceptable in this Committee, then we're really talking about, How do we enable drivers to be

safer, more productive, equipment more environmentally friendly, less congestion? These are all measurable returns that our fleets will invest in and are good for drivers as well. We'd like them to be less fatigued, better rested. And if technology can play a role in that, that's good for the entire motoring public.

But in terms of driver displacement, we already have a $50,000—50,000-driver shortage as it stands, and if that trend continues, it will be double in 5 years. We have to hire 960,000 employees over the next decade into this industry. So we're pushing hard to bring more talent into the industry. That's what our fleets are preparing for, not for displacement.

And to the degree that it is driver-assist technology, we welcome that. And ways that we can measure better productivity and safety, lower emissions, less congestion, those are all things that we'd be very interested, and that's why we feel trucks need to be part of this legislation.

Driverless, Level 5, that's decades away, and it's just not even in the scope of our fleets' vision at this point, but I think Level 2 and 3 are. So with that, I think driver-assist is much more reasonable and why we're not concerned about displacement at this time.

Senator PETERS. When you say that driverless technology for trucks is decades away, and yet for automobiles, it's just a few years away, why the difference?

Mr. SPEAR. Well, I think I would agree with my colleague Mr. Hall. He is struggling to find an argument where you are going to have a driverless truck navigate in a scenario where it's going to do a dropoff or a pickup. We wouldn't argue with that because we think the driver is still going to be in the seat. It's really the long haul where you're going to see a lot of the value come from driver-assist technology, Levels 2 and 3.

So we don't believe that that's going to be a threat. We think drivers are going to play an intricate role in the cityscapes, the pickups, the deliveries, but in terms of the long haul where you can see efficiencies to lowering fuel burn, lowering emissions, better safety by having connectivity between trucks, cars, infrastructure, those are all good things that are going to really improve safety in our opinion. So we don't look at it as a threat, certainly not in the near term.

Senator PETERS. Mr. Hall, you obviously have a different perspective, and I would like you to have an opportunity to hear a little bit more about your perspective after Mr. Spear's testimony.

Mr. HALL. Well, I was certainly happy to hear his testimony, but, you know, we look at this as—first of all, let me be clear. Our union has always been willing to talk about new technology. If you look at the workplaces that we represent, they look very unsimilar to warehousing and all these other different aspects of industries that we represent. They're much different than they were when I began as a Teamster. But there is very much of a difference here when we're talking about having an 80,000-pound vehicle barreling down the road.

We are not opposed to looking at some of the changes that we have heard here, but to have a tractor-trailer going down the road without a driver, which is what I believe is coming, then I think

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there are lots of reasons why we should be concerned about that, and not the least of which is cybersecurity.

I mean, we—no matter what technology you put into these trucks, we've seen already in areas around the world where large trucks have been used to essentially attack the citizens of those particular areas. And so that's one of the things that I think we have a lot of work to do before we can go to this—before we can advance with the larger trucks.

Senator PETERS. Thank you.

The CHAIRMAN. Thank you, Senator Peters.

Senator Wicker.

STATEMENT OF HON. ROGER F. WICKER, U.S. SENATOR FROM MISSISSIPPI

Senator WICKER. Mr. Spear, what do you say to that cyber threat argument that Mr. Hall raised?

Mr. SPEAR. Well, I think it's a serious issue, and I think the auto industry and the trucking industry are very committed to ensuring—there is nobody out there that wants their equipment to be compromised. So I think putting together very strong protocols in concert with Federal policies. We work very regularly not only with DOT and NHTSA, but also with DHS. I would agree with Mr. Hall, I don't think you want a tank truck that's driverless in an ISIS world. That is not something we're advocating.

So going back to the earlier discussion about driver displacement, that is not something that we believe is in the foreseeable future, but where we can use technology to enhance, you know, the safety and the productivity of the fleets and the driver, we're all in on that.

Senator WICKER. So just as we guard against cyber threats with airlines and other aspects of our economy, we can answer that question with the trucking question. Is that your position?

Mr. SPEAR. Yes, I think so. We work very closely with DHS, FBI, Volpe.

Senator WICKER. OK.

Mr. SPEAR. We've been working with DOD on testing. Trucks have been a very integral part of cybersecurity testing protocols, and now with the ISAC at the auto industry, the Information Sharing Advisory Committee, they are now accepting our companies to be a participant in that realm. So now you're going to have the auto industry and the trucking industry comparing best practice to make certain there's a seamless protocol that's——

Senator WICKER. Well, let me get to another couple of topics.

Mr. Spear and Mr. Hall, do you agree that we do have an impending truck driver shortage?

Is that your position, Mr. Spear?

And is that your position, Mr. Hall?

Mr. HALL. It is.

Mr. SPEAR. It is.

Senator WICKER. OK. Well, Mr. Spear, it seems to me, based on your testimony, that actually going to a Level 2 or 3, really you're saying that's really not going to be an answer to the trucker shortage because we're still going to need basically the same number of truck drivers. Is that correct?

Mr. SPEAR. Well, it's not a clearly defined answer. However, I like to use the analogy of generational gaps. I can usually fix a lot of things on my phone and laptop, but it's easier to hand them to my kids. I can get it done a heck of a lot quicker than I can. And what we would like to see in terms of the new generation of drivers and technicians is to speak to that generation. This technology does that. And to make trucking cool, to make trucking attractive, tech-savvy in this generation, I think is a good fit.

And I think we're ushering in a lot of new talent that's going to be able to really cope with this technology and make it work to the benefit of society. So we believe in that. It may be more indirect, but we think that that is an attractive element in terms of bringing new talent into our industry——

Senator WICKER. OK, I see. So we can add to the workforce. Let me ask you about your statement on the 5.9 GHz safety spectrum. If we don't get that and we don't get the exclusive use of that, as your testimony advocates, what would that mean?

Mr. SPEAR. I think it would be a huge setback. I'm a bit more bullish on this issue than others. We do work closely with the National Safety Council on this issue and feel that having connectivity between cars, trucks, and infrastructure is, in my opinion, the secret sauce because now you don't have cars cutting off trucks. And two-thirds of the accidents that involve trucks are caused by passenger vehicles, driver behavior, speeding, texting.

So connectivity plays a key role as that becomes more of a problem, eliminating congestion. These are huge issues that gain from connectivity through that 5.9. If we don't have that, you're simply going to be working off of other applications. Bluetooth, for instance. We look a lot at platooning in our industry, trucks trailing trucks. That's done basically on a Bluetooth platform. I'm not saying that's a bad platform to work from, but a much more robust and safer platform would certainly be a 5.9, and preserving that for safety would be something that we would advocate.

Senator WICKER. Thank you.

Mr. Clarke, we have information in our Committee brief about advances in our competitor countries in this regard. Germany, United Kingdom, South Korea, even China, are working hard at this. Who's ahead of whom in this area? And what can we learn from the experiences of the other countries? And if you can, touch on the connectivity issue that Mr. Spear touched on.

Mr. CLARKE. Yes, thank you, Senator. Actually, on the connectivity issue, you know, I would endorse comments of Mr. Spear. Look, connected vehicles see much further than any driver. Connected vehicles can be prepared to avoid circumstances, and certainly engage the driver in ways that are not possible today, seeing miles ahead to weather, road conditions, congestion, other type of circumstances. It is the secret sauce, I think, and really is one of the keys to unlocking the potential of this technology.

Senator WICKER. How are our global competitors doing?

Mr. CLARKE. You know, this is—you know, in some of the trade journals you may have read, you know, this is the space race of our industry basically. There are a number of technologies that are coming together, and very interestingly, a number of those technology leads come out of the United States. And, you know, the

sensor technology, the AI and machine learning technology that's necessary to take advantage of this, the very sophisticated digital 3-dimensional LIDAR maps that are running in the background and supporting this software, these are all areas where we have the edge.

Senator WICKER. We're ahead of Germany, United Kingdom, and South Korea, and China in the basic regard.

Mr. CLARKE. Yes, sir, in the basics, we are.

Senator WICKER. And that's a good thing.

Mr. CLARKE. It is. What we need to do is to continue to press forward with the integration of these into real platforms, putting them into real service so that we can collect the data to allow us to do the analytics to bring forward the right type of regulations and applications.

Senator WICKER. Thank you.

The CHAIRMAN. Thank you, Senator Wicker. And I would agree. I think in terms of the transformative effects and impacts of this technology, the closest thing in recent memory would be the Internet. I just think this is going to transform the way we do things. And I would concur with the statement that has been made about truckers. Just anecdotally, trucking companies in my state cannot find enough drivers, and there is a real shortage out there.

So thank you, Senator Wicker.

Next up is Senator Young.

STATEMENT OF HON. TODD YOUNG,
U.S. SENATOR FROM INDIANA

Senator YOUNG. Thank you, Chairman. Well, I've really enjoyed this conversation. It's very important to my home State of Indiana, where we have a robust logistics industry, and a very serious shortage of truck drivers to keep that industry going. So I think we might have a big part of the solution being presented today.

So in 2015, there were over 35,000 lives taken for one reason or another on our Nation's highways. Over 800 of those fatalities were on highways in my home State of Indiana. NHTSA estimates that as many as 94 percent of crashes can be attributed to human driver error, so you can see the potential AVs bring simply in terms of lives saved. So another big benefit to Hoosiers.

That's not the complete story. AVs could change the lives of individuals who today rely on friends, family, and others to drive themselves around, to drive them around our communities. You think of the blind, the disabled, the elderly, and others who could have a far greater quality of life when AVs allow them to become more independent, but also more integrated into the day-to-day lives of our communities.

The National Council on Disability noted in a previous hearing that we held that automated vehicles hold great promise to advance social inclusion by offering people with disabilities independent mobility to get to schools, jobs, and all places that Americans go each day. To get to a point where AVs can provide such a societal benefit, Congress will have to allow the technology to advance for both vehicles below 10,000 pounds and most likely for vehicles above 10,000 pounds. I'm afraid if we bifurcate the regulatory environments for small and large vehicles, we're going to

delay these life-saving and life-changing benefits that AV technology can bring to all Americans.

Mr. Spear, regarding the threat of AI or automation becoming net job losses for our economy, you predicted that truckers will be more like airline pilots. That's sort of a compelling thought. I think it offers promise to our future truck drivers or operators to work in a profession where they add more value or earn higher wages, and so forth, at least as you've styled it.

Could you expand on that? Because I think the popular perception is that when you get on a commercial airline, the pilot is controlling the plane the entire time, and we know that's not the case. So what would the role of the trucker be as we look into the future?

Mr. SPEAR. I think it would be very similar. I know this plays a little bit off of Mr. Hall's testimony, too, because we share that concern. What many people don't see are the pickups, the deliveries, the navigating of the cityscapes. There is some really complex maneuvering with this equipment that takes a lot of talent behind the wheel to make that happen. And with all the variables that they're dealing with, they're not automated, they're not Level 5.

So unless we're going to remove all human error from all vehicles on the road, you're going to need drivers in the seat handling 80,000-pound vehicles, in our opinion. Very similar concept to airline pilots. It's the takeoffs, the taxiways, the landings, they're all handled by the pilot in control. It's really the long haul, and where that automatic pilot comes on where you see some of the values of that technology take over. The pilot is always there, can take over if conditions arise that warrant that. The same stands true for drivers and trucks.

Senator YOUNG. And I haven't heard the airline industry discuss eliminating pilots and going fully automated.

Mr. SPEAR. And they could right now. I don't want to put in a plug for my former employer, but working with Honeywell for 8 years, you all fly, there are pilots in the cockpit——

Senator YOUNG. Right.

Mr. SPEAR.—those cockpits, the automation that's in these planes can take off, fly, and land all on their own.

Senator YOUNG. And over the years, I would say we've had an increase in the number of pilots. And so our airline industry used to involve more pilot sort of intervention along the way. I would also indicate we saw an increase, at least for a period of time, in membership in their unions as well. So that's notable.

What is—could you discuss platooning? Because I'm not entirely sure what the role of the operator would be in the platooning process.

Mr. SPEAR. Well, the platooning, it would involve a concept where a driver would be in the lead truck, and that pursuant trucks would follow possibly without a driver eventually, but up to two, three trailer trucks would follow the lead driver and they would be connected. Right now that's being tested, as I said earlier, through Bluetooth technology. It's why we feel the 5.9 would be a much greater platform, better platform, to connect vehicles because then you can include connecting cars. And so the accident that Ms.

Hersman put up on the slide there, if you have cars and trucks talking to one another, you really start to mitigate risk.

Senator YOUNG. Well, this strikes me as really meaningful work as you think about the future of trucking, and one where we might attract more people into the labor market. So thank you so much.

The CHAIRMAN. Thank you, Senator Young.

Senator Blumenthal.

STATEMENT OF HON. RICHARD BLUMENTHAL, U.S. SENATOR FROM CONNECTICUT

Senator BLUMENTHAL. Thanks, Mr. Chairman, and thank you and Senator Peters for your work on the legislation that raises some of the issues that bring us here today.

I think we need rules and regulations in this area, rules that will guarantee safety. I was deeply disappointed by the guidance issued yesterday by NHTSA, which struck me as anemic, in effect, a give-away to the industry, and it could result in lives lost unless we have enforceable rules and regulations that protect the traveling public, not just the folks who may be behind the wheel, but also passengers in vehicles out on the roads today. And driving continues to be one of the deadliest activities, as you observed, Ms. Hersman, and thank you for all your work in this area.

The reason the framework issued yesterday concerned me so greatly is that it depends on voluntary self-assessments by the industry as opposed to mandatory rules. It was termed by one report "even less burdensome," quote, "even less burdensome," than the voluntary one issued under the Obama administration. And the net effect would be to leave enforcement virtually toothless.

So I am putting to you the question, to all of the witnesses here today, Isn't it necessary to have mandatory rules and regulations enforced by the government, by the Department of Transportation, or some enforcer to protect the traveling public?

Mr. HALL. Well, I think it's absolutely true. There has to be—we've seen too many examples of—and that's one of our concerns, is whether or not there is going to be the kind of oversight that's necessary to protect the American public. I mean, we have seen too many cases, where, for example, in the case of Volkswagen, where everyone assumed that they were doing the right things. And while it's a different issue with emissions, it is still the same issue that if a company is allowed to produce vehicles, whether it is automobiles or, in particular, when it's 80,000-pound rigs, then there must be oversight. And that's why I think it's premature to think that these commercial vehicles should be included at this time.

That is not to say that—and you know I want to—I am hopeful that we're all willing to guarantee that we're going to protect all those drivers' jobs, but we're certainly open to talking about anything that improves safety. But I am concerned when I know about the issues that have happened where the driver was killed that we just saw a report yesterday about, when Uber spent lots of money in the City of Pittsburgh in making sure that they measured down to the centimeter every street in that city, but yet one of the vehicles went the wrong way down a one-way street. That is—you know, on a one-way street, maybe there's a way to control that.

We've got to be—we've got to have more thought, not that there's not going to be a time, as I have listened here and agreed with some of my colleagues here, I understand that we are going to see some changes, but there has to be a lot more work done——

Senator BLUMENTHAL. Does anyone on this panel think that the NHTSA guidance offers an adequate basis to go forward?

Mr. SPEAR. I wouldn't say, Senator, that it's an end-all, you know, issuance of guidance. I think we're heading down the path where you're going to have that framework.

Senator BLUMENTHAL. It's hardly a robust first step. Would you agree?

Mr. SPEAR. I would say that it is a first step, and that's better than nothing.

Senator BLUMENTHAL. But it ought to be a lot more robust?

Mr. SPEAR. It will be a lot more. We are going to have a framework. We are moving in that direction. But I think at the same time, the only reason we're having this discussion today is because innovation is driving this outcome, not regulations. So——

Senator BLUMENTHAL. The rules are as important as the technology, would you agree?

Mr. SPEAR. I agree. And I think it's getting the Federal Government on a good foundation to where it has great understanding and visibility where this technology is going to take us. You know, in my testimony, we advocate a Federal role——

Senator BLUMENTHAL. And the rules have to be enforceable.

Mr. SPEAR. Absolutely.

Senator BLUMENTHAL. And they should be enforced.

Mr. SPEAR. And I think that's the direction we're going, and that's why we believe trucks need to be part of it, but right——

Senator BLUMENTHAL. But the rules have to keep pace with the technology, correct?

Mr. SPEAR. I think eventually they will, but, yes, you're correct.

Senator BLUMENTHAL. Well, the "eventually" part is what concerns me because in the meantime, there will be a lot more deaths and injuries if the rules and enforceability of those rules fail to keep pace, correct?

Mr. SPEAR. And I also think the same is true if you get the rules wrong. I think excluding the commercial industry would be a very big detriment to safety. I think inclusivity and getting this right from the start—we all share the road, and I think having a Federal role, sole authority, overseeing it, not a patchwork of state laws, that deals with all motors on the road, motors on the road, commercial or passenger, would be the best approach.

Senator BLUMENTHAL. But relying on voluntary self-assessments and foregoing public oversight and enforcement I think is a mistake that would discredit the goal that we share of making technology available and accessible to as many people as possible and increasing safety through the use of technology. I think that revisiting this guidance is something that has to be done, and I hope it will be done.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Senator Blumenthal.

Senator Lee.

STATEMENT OF HON. MIKE LEE,
U.S. SENATOR FROM UTAH

Senator LEE. Thank you very much, Mr. Chairman.

Thanks to all of you who have joined us today as witnesses.

As we consider the issue of autonomous vehicles this month, it's becoming more and more clear that the future of American transportation is inextricably intertwined with the advent of automated technology, and I think it's therefore really important that we think about this issue a lot and we move forward with it with an eye toward advancing it and allowing it to be developed.

Automation is inevitable, and I think it would be neither wise nor appropriate nor necessary for Congress to stifle the advancement of this technology. At issue in this debate is not whether Congress should restrict or block or slow down the development of this technology, but it's, rather, how Congress can best establish a regulatory framework, one that encourages and facilitates the development of life-saving technology, technology that will make the American people safer and more productive.

The research and development of autonomous commercial motor vehicles is, I think, critical to this type of innovation, and should, therefore, be included in any legislation that we put forward this month.

Now, according to the U.S. Department of Labor's Bureau of Labor Statistics, trucking transportation occupations account for more work-related fatalities than perhaps any other profession. And it's my understanding that 87 percent of truck-related collisions are caused by human error, not because people who are driving them are bad; they are, to the contrary, well trained and everything. But human beings make mistakes, and human error can inevitably lead to fatalities.

So I have a question. I'll start with Ms. Hersman. Given that trucks are involved in a disproportionate share of fatal vehicle crashes, wouldn't automated trucking technology make sense and have the potential to have kind of an outsized benefit for American drivers?

Ms. HERSMAN. Yes, technology has the potential to be that game changer when it comes to reducing fatalities. There is technology available today that we see can do this. Rear-end collisions are a great example, three times more fatal if you're involved in a rear-end collision with a truck, with a commercial vehicle, than a passenger car. We can all understand the physics of that. Automatic emergency braking, vehicle-to-vehicle technology can help with that. Automated vehicles are an extension of some of those technologies.

Senator LEE. So in light of that fact, why would it make sense for us to put them on two different tracks, one in which we facilitate and promote and allow for the development in the case of passenger vehicles, but not in the area of commercial vehicles?

Ms. HERSMAN. We don't think it does make sense because in situations where we have put passenger cars on a fast track and we haven't addressed commercial vehicles, electronic stability control is a good example. After there were some issues with rollovers involving Ford Explorers' Bridgestone/Firestone tires, this Committee required that electronic stability control be mandated on passenger

vehicles. That occurred in the 2012 model year. We're looking at not having that on commercial vehicles for many more years. That doesn't make sense. We need one level of safety for everyone who's on the roadways.

Senator LEE. Colonel Hernandez, the House's autonomous vehicle legislation is clearly limited to addressing vehicle design standards that will be administered by NHTSA, just as they've always done for both cars and for CMVs. I realize there's a lot of interest and debate over the ultimate operations of autonomous CMVs, but the current bills simply don't address that, and they're assuring everyone's safety during R&D. That being said, Colonel, would there be any reason to delay the fundamental safety framework for automated CMV design?

Colonel HERNANDEZ. No, not at all. I think that we already saw a live example in Colorado where it's jumped out in front. And it would be a lot better for us in the enforcement community to be able to be united and ahead of it as it relates to commercial motor vehicles.

You know, we have many questions that are the same in the enforcement community, such as how to investigate a crash. And that—the advantage for us to understand how these technologies work, and work with the industry to learn how to better and reasonably regulate and enforce laws will have a much better advantage than separating the two, in my opinion.

Senator LEE. It sounds like a considerable public safety gain. Thank you, sir.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Senator Lee.

And I would point out for those who think that the NHTSA guidance isn't strong enough, that would argue to me for why we ought to have all these covered by the legislation.

Senator Markey.

STATEMENT OF HON. EDWARD MARKEY,
U.S. SENATOR FROM MASSACHUSETTS

Senator MARKEY. Thank you, Mr. Chairman.

For all of the witnesses, just please answer yes or no. Do you believe that this Committee, as it actively works on legislation to promote the deployment of autonomous vehicles, that we should also create policies to help those working Americans who will lose their jobs because of these emerging technologies?

Colonel Hernandez.

Colonel HERNANDEZ. Yes, I believe that should be considered.

Mr. CLARKE. Yes.

Ms. HERSMAN. Yes.

Mr. SPEAR. No.

Senator MARKEY. Mr. Hall.

Mr. HALL. Yes, except that hopefully we're going to have a situation where we're not going to lose jobs, as I have listened to various speakers talk about here today.

Senator MARKEY. There is always destruction. You know, when they invented the "talkies," all the piano players in the silent movie theaters all lost their jobs. OK? So you just think time moves

on and you have to just make sure that you've got a plan in place to ensure that that kind of protection is there.

These vehicles are obviously already computers on wheels, and they're going to continue to accelerate in that direction as the technology deploys. But obviously there are going to be vast opportunities for cyber threats to be launched against these vehicles since they'll just be computers for all intents and purposes.

Mr. Hall, do you believe that we should proactively develop robust mandatory regulations so that these vehicles are protected against cyber attacks as they are moving down the streets of our country?

Mr. HALL. Oh, I absolutely do, and that's one of the biggest concerns that I have. As I said earlier, the Teamsters union has worked with companies and industries around all over this country on innovation and to make companies more competitive. But in this case, and particularly the case of the cybersecurity, it is terrifying to me to think that we've got tractor-trailers rolling down the road that can be hacked, and to say that they can't be in today's world— and that's one of the things that I think there has to be more— there has to be more information, more studies, to ensure that we're not going to have that issue because, you know, no one thought we would have the credit card issue we've had in the past week where millions of people's information has been—has been made—or become public. We didn't think——

Senator MARKEY. I agree with you 100 percent, but, in fact, we were warned about all these things, that they can happen. It's not so Equifax didn't know that it could happen. It's not as though the auto industry right now doesn't know that these vehicles can be hacked. It's all there, and I think the warnings are there. And I agree with you, Mr. Hall, we need those.

Do you agree with that, Mr. Spear, that we need mandatory robust protections that are built in as rules of the road going forward?

Mr. SPEAR. I think that's where we're headed. As we just got done discussing with Senator Blumenthal, I think the guidance, in his opinion, may be deficient, but it's a first step toward something much more robust. This legislation that you're now considering is a remarkable significant step toward formalizing the Federal role. So I think that's exactly where we're headed, and we know this is reality, it's not just cars and trucks, it's across the board.

Senator MARKEY. I appreciate it. And that's why I've introduced the legislation the SPY Car Act, that directs NHTSA to establish cybersecurity protections for all vehicles. I've introduced that with Senator Blumenthal and others on the Committee. And I just think that we should be considering that at the same time we're talking about this new era unfolding.

And, finally, on the issue of privacy, obviously, since they are computers on wheels, there's going to be a vast amount of information about all Americans that's going to be gathered as they are moving around this country. Do you think that we should be ensuring that this information which is gathered by the auto companies or by others about all of our individual habits, where we go, what we do, all the information that can be gathered as these computers

are being used, that they should be able to be reused and resold as information without the permission of the family?

Colonel Hernandez.

Colonel HERNANDEZ. You know, I really don't know that I'm qualified to answer that question. I think that perhaps that information may be out there with cell phones and others now, but I think that that's something that perhaps——

Senator MARKEY. OK.

Colonel HERNANDEZ. Yes. Yes.

Senator MARKEY. Do you have a view, Mr. Hall, whether or not we should be providing privacy protections for people to make sure that information is protected?

Mr. HALL. Well, I do think that. I mean, I think there's no question that we continue to see—I mean, we're talking about protecting people's privacy involves a lot of things including getting involved in their—when you're talking about getting into someone's personal life, you're talking about their personal finances, you're talking about a lot of issues that we have seen just recently that is major problems that we have to protect against.

Senator MARKEY. Thank you.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Senator Markey.

Senator Gardner.

STATEMENT OF HON. CORY GARDNER, U.S. SENATOR FROM COLORADO

Senator GARDNER. Thank you, Mr. Chairman.

And thank you to the witnesses today.

Colonel Hernandez, welcome to the Committee. I know you've served Colorado State Patrol over 30 years, and we're grateful for your service and leadership, so thank you.

Colonel HERNANDEZ. Thank you very much.

Senator GARDNER. Thank you. Colonel Hernandez, I don't know if you've marked the calendar yet or not, but February 19 is an important day in Colorado. It's Presidents' Day. It's a Monday. It's also a great ski weekend. Monday night, you know what happens, everybody is coming back to the airport, they're coming back home, they're going back to the Front Range. How many new tunnels through the Eisenhower Tunnel do you think it would take for us to adequately provide capacity for the number of vehicles that we'd see? You don't have to answer that question.

Colonel Hernandez: Yes, it would take many new tunnels.

Senator GARDNER. Many, many tunnels. And we're just simply not going to do it. I mean, do you see autonomous vehicle technology, vehicle-to-vehicle technology, as a way to manage traffic through those chokepoints like that Presidents' Day ski traffic through the Eisenhower Tunnel?

Colonel HERNANDEZ. I believe that it might be the only way to manage that type of traffic.

Senator GARDNER. I agree with you, too. And I also want to commend you and your leadership again and talk about some of the toughest things that we've seen over the past several years. Trooper Cody Donahue was killed on I–25 by a vehicle that didn't move over when he was assisting another crash on the side of the road.

Vehicle-to-vehicle technology, autonomous vehicles, could be used to assist in this type of a situation perhaps to avoid that type of accident. Could it be used that way?

Colonel HERNANDEZ. Absolutely. The technology is there to be able to do that, and I believe that in that case, very hard—hard on the agency and hard on me and hard on the family. And it could have been avoided. And I think that through this technology, it absolutely could have been avoided because there was a prior crash. And so often these are secondary crashes. And that takes the lives of many people, is that secondary crash. And I think that's one of the huge advantages to this type of technology both in cars and commercial vehicles.

Senator GARDNER. Yes. And so I think one of the challenges we have is not just, you know, whether we get there, if we get there, but it's how we do it in a way that manages safety, how we do it in a way that answers a very uncertain question for people of this country. One out of every 20 jobs in Colorado is a truck-driving job.

And I grew up in a small town in the Eastern Plains of Colorado, and we have a lot of truck drivers there. And one of them came up to me one day and said, "Did you see the truck delivery from Ft. Collins to Colorado Springs?" that you talked about in your opening comments. And I said, "Yes. Wasn't it great?" And his response to me, a gentleman I've known my entire life said, "Yes. What's going to happen to me?" He's a truck driver.

And I think we, as policymakers, we, in industry, we have to figure out how we're going to be able to answer that question of, What's going to happen to them? Because the answer isn't going to be, well, there are going to be fewer jobs and fewer opportunities; the answer is always, with the innovations that we have been able to achieve in this country, we're going to have progress, innovation, and more jobs than we've ever had before.

But we've got to be able to figure out how to say that in a way that is helping people see that, understand that, and know that they're going to be OK, because until we can answer that question, "You know what? You're going to be OK, and here's how," there is going to be an uncertainty, and it's going to be an unsettling part of people's lives and families.

So we need help in being able to answer that question because the answer isn't, "There is going to be less," the answer is, "There is going to be more, and we're going to create more jobs as a result." The secondary impacts are going to be phenomenal, but how do we make sure that we can articulate it to a very uncertain American populace going forward? I'm excited about the future that we have here.

Mr. Spear, one of the questions I have for you, though, is yesterday I had a hearing with the National Laboratory system, National Renewable Energy Laboratory, it's in Denver, and some of the other laboratory systems around the country, and we talked about the 11 million miles of high resolution data that fleet partners across the country have been able to help work with them and provide them.

How do we get the information we need using some of the national assets we have, like the labs and others, to really move for-

ward on a system of autonomous vehicles and the information, the safety information, we need to make this work?

Mr. SPEAR. Well, I alluded to it a bit in my testimony, and I used FCC as a primary example. It's not just DOT and NHTSA, it's FCC, it's DHS on cyber, it's also EPA on emissions. There are a whole host of benefactor agencies at the Federal level that really need to be more squarely at the table on this, labs included. We work a lot with DoD, not just on cyber, but logistics and testing. There are a lot of good things that can be done on military bases to advance this technology as they can in states and localities where they have proving grounds.

So we don't discriminate between either one of them, but we welcome everybody to the table because I think the more inclusivity that you have, the more robust this platform is going to be and easier to understand, not only from a legislative point of view, but from a regulatory point of view.

So I think the inclusivity of the labs and the agencies, not just DOT, need to be squarely at the table and drive the outcome, and if the legislation can speak to that, I think that would be a very good thing.

Senator GARDNER. Yes. Well, thank you very much for all of your time and testimony today.

Colonel Hernandez, again thank you.

The CHAIRMAN. Thank you, Senator Gardner.

Senator Cortez Masto.

STATEMENT OF HON. CATHERINE CORTEZ MASTO, U.S. SENATOR FROM NEVADA

Senator CORTEZ MASTO. Thank you, Mr. Chair, and thank you to the panelists. Very engaging important discussion today.

So, Mr. Spear, let me start with you and make sure I understand what I'm hearing today, is that you would be comfortable if we passed Federal legislation that only went to a Level 2 authority. In other words, what I mean by that is it limited any type of future technology for specifically to driver-assisted technology Level 2, and we didn't open the door to a Level 5, a driverless technology, for commercial trucks. Is that correct?

Mr. SPEAR. Well, Senator, let me stipulate that I'm not suggesting the Committee, you know, earmark at the Level 2 or 3. That's the reality of where we see things for the foreseeable future, driver-assist; not Level 5, driverless. So if that's acceptable, that reality, that, to us, is not a threat not only to driver displacement, but it's actually a catalyst to a lot of beneficial things, to safety, productivity.

But Levels 2 and 3 are really where we see the technology for the foreseeable future. If the legislation speaks to that, I mean, that's a decision you all make, but we just don't believe displacement or Level 5, no steering wheel, no pedals, is in the foreseeable future. So that's kind of the world and the perspective that we're approaching this.

Senator CORTEZ MASTO. So if we were to limit it to Level 2 and Level 3 because you don't see that in the foreseeable future as driverless, and we want to make sure that we're addressing that worker displacement, but also the cybersecurity issues that we all have

concerns about and understanding it, as well as addressing the safety on the roads, you would be comfortable with that Federal legislation.

Mr. SPEAR. Absolutely.

Senator CORTEZ MASTO. And, Mr. Hall, would you be comfortable with that Federal legislation if we were to limit it, particularly when it comes to commercial trucks, to just driver-assisted technology and understanding the evolution of that driver-assisted technology for commercial trucks?

Mr. HALL. Well, I certainly would be. I would be happy to see that type of limitation on it. But by the same token, I also think that we have to address the many safety concerns before we make any of these changes.

Senator CORTEZ MASTO. And so when you talk about the many safety concerns, that is including the worker safety concerns as well as the discussion we've had today, correct?

Mr. HALL. Correct.

Senator CORTEZ MASTO. OK. So let me just say this is an important discussion, and I think for all of us, the challenge is going to be how we balance the emergence of this new technology that that, Mr. Spear, you said is happening, there's a demand for it, and it is going to happen whether we are part of this discussion or not. And then how we balance that with worker protections and worker placement because the last thing that—I can't speak for all of my colleagues, but I would imagine is that worker displacement. I mean, it would harm our economy, it would harm our workers, it would harm our jobs. That's not what we're trying to do here. So there has to be a balance that we find. And that's what I'm hoping everybody will come to the table and help us at a Federal level find that balance to work together to have not only the ability to embrace this new technology, but address the worker issue and worker displacement to make sure that does not happen. So do you think there is an ability to work together to do that, Mr. Hall and Mr. Spear?

Mr. HALL. Absolutely. I think there's an ability to do that.

Mr. SPEAR. Yes, I do.

Senator CORTEZ MASTO. Thank you. Thank you. And so the reason why I am really excited and interested in this space is because there is a lot of work that is happening in Nevada right now, as you well know, with this new technology both for autonomous vehicles as well as for driver-assisted trucks. I think it is the future and we need to embrace it, but we need to put those guardrails in place for protections that we've all talked about today.

I know just in Nevada, the Regional Transportation Commission of Washoe County right now is currently testing and taking data on autonomous bus that will move many of my constituents back and forth throughout the region. And anyone that's followed this issue knows that autonomous vehicles and the future of transportation relies on technology and connectivity. That's why I am excited to be able to be introducing legislation to promote smart cities and communities.

My bill will ensure that the Federal Government provides the seed money for public-private partnerships to implement integrated transportation systems in cities and rural communities throughout

the country. My colleague, Senator Burr, is lead sponsor on this. I'm very excited to work with him. That is our future, the Internet connectivity of things, and I want to make sure we're in that space of that innovation.

I think we can address the security issues, Ms. Hersman, that you've talked about, and the safety on our roads, Mr. Hernandez, as well, but at the same time, make sure we're training that work-force for the future, we're involving them in this discussion when we're talking about the new technology.

So thank you for the conversations today. I really appreciate it.

The CHAIRMAN. Thank you, Senator Cortez Masto.

Senator Inhofe.

STATEMENT OF HON. JIM INHOFE, U.S. SENATOR FROM OKLAHOMA

Senator INHOFE. Thank you, Mr. Chairman.

The reason you're experiencing some redundance in the questions that are coming is that we have about 50 percent of the members of this Committee are also on the Committee called the Environment and Public Works Committee, and so we find ourselves having to go back and forth, and it's very difficult.

The question that was asked—and, Mr. Clarke, let me first of all say how much we enjoy you as citizens of my city of Tulsa. And I've been in your operation many times, and it's a great benefit to us, and I appreciate your presence and all the contributions you've made to our local communities very much.

When you were asked by Senator Wicker some things I think are kind of interesting, that is, where are we—now, if it's a difficult question to answer, I'll only ask you and not the rest of you, but the rest of you, there's an assumption by the American people that we're always number one, we're always the first there, and I know I served as Ranking Member of the Senate Armed Services Committee.

We know that there are many countries out there that are developing missile technology and other things that we're really not always number one. But in this, this is something that's new, and I'd like to know if it's—I think it's appropriate to ask each one of you, where are we right now in terms of other countries? We've heard Germany, Japan, China, other countries that are advancing. Where are we in the midst right now?

You've already answered that, Mr. Clarke, but some of the rest of you.

Ms. HERSMAN. When it comes to fatalities, we're trailing. The rest of the industrialized countries have made more progress in the last 2 decades——

Senator INHOFE. No, no, I'm talking about this technology, the subject of this meeting today, where we are.

Ms. HERSMAN. Right. So the other countries have made more progress, and some of that is because they have embraced technology. So things like automatic emergency braking, not required here on trucks. Looking at that in Europe, so they have that in Europe. When we look at automated enforcement, again, other countries are embracing some of these technologies at a more rapid clip than the United States.

Senator INHOFE. Yes. Anybody else, any thoughts on that? That explains the European. And anything else? I'd like to know because we get asked these questions. What are the other countries doing?

Mr. SPEAR. Well, we do benchmarks, Senator, with what our colleagues in Europe are doing. We think the proving grounds and the development at the local and state level here in the United States is a bit more advanced. And I think that's in large part to the environment. We're seeing multiple states and communities stepping up to really attract innovators to their state and cities.

So I think smart cities were mentioned as well. We're creating those environments where technology can be tested in a safe way. That's a good thing. And I think those things, those investments, are going to accelerate the adoption of the technology.

Senator INHOFE. That's fine. I understand that. Now, when Senator Markey asked the question, it was kind of presumed that this mass exodus of jobs in America, and so it's a difficult question for you just to answer yes or no to. So I guess I would like to have a comment from each one of you because I've heard from this Committee that there are some arguments that we're actually going to be employing more people, we're getting into other technology. But how do you see us? And when this washes out, are we going to have the massive job declines that were kind of assumed in the question that was asked you? Would you comment to that?

Colonel HERNANDEZ. I think I struggled with that straight-forward question just because I start thinking about the number of lives that we've lost on our roadways and our highways and how to reduce that. And then just that I'm not the subject matter expert on that key point, but primarily driven by our goal to get to zero and what that will look like.

I will tell you from a law enforcement perspective, I've been involved for 30 years, like the Senator said, and every time we get more technology, it seems—it definitely seems to take more people than less to manage those technology systems.

Senator INHOFE. Yes. Any other comments on that?

Mr. Spear?

Mr. SPEAR. I would say that, you know, the type of job description that we're going to see in the next 20 years for drivers and technicians is arguably going to make, you know, these employees more marketable. They're going to be better skilled. They're going to be better trained. Employers are going to be investing a lot more in their capabilities to make certain that this equipment is up and running and done in a safe way. So we're already facing a shortage. The reason I answered no to that is because we simply don't believe that this is a displacement issue.

Senator INHOFE. Yes. Yes. Well, from your perspective, the last thing I wanted to ask is, do you believe that heavy trucks should be included in the drafting of the legislation?

Mr. SPEAR. Absolutely, Senator.

Senator INHOFE. OK. Does anyone not believe that, that want to speak out on that issue?

Mr. HALL. I don't believe that it should be part of this current legislation because—and I don't want to oversimplify this, but, you know, all the discussion has been about passenger vehicles, and I

think we have to recognize that there is a vast difference between a 4,000-pound car and an 80,000-pound vehicle.

Senator INHOFE. Yes, you made that point, and I appreciate that very much. Do the other three of you somewhat agree with—mostly agree with Mr. Spear?

[No audible response.]

Senator INHOFE. Yes. All right.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Senator Inhofe.

Senator Hassan.

STATEMENT OF HON. MAGGIE HASSAN, U.S. SENATOR FROM NEW HAMPSHIRE

Senator HASSAN. Well, thank you, Mr. Chairman, and thanks to you and Senator Peters for all your work on this issue.

And thank you to the panelists for being here today.

There is no doubt that automated vehicles have tremendous potential to save lives and reduce the nearly 4,000 deaths caused by large truck accidents each year and the over 30,000 annual vehicle fatalities on our nation's highways. But what's less clear to me, and I think what you're hearing some questions about, is how we can guard against potential harms of this technology from in- and out-of-state actors who are looking to harm us. I don't want to trade one set of harms for another.

And I will tell you, I spent some of my homework period visiting summer camps in New Hampshire, and I was visiting one a couple of weeks ago, and it was for a group of adolescents. And they wanted to know what a Senator does. And I talked a little bit about the work of this Committee and said that this Committee had jurisdiction over automated vehicles, for instance, some legislation around it, and described what the future technology looks like. And within seconds there were kids, 13, 14 years old, raising their hands going, "Do you know how easy it would be to hack those?" And since they're the digital natives among us, I tend to listen to young people when they talk to us about technology.

So I am very concerned that we're all assuming that there are going to be levels of cybersecurity built into this technology when, to Senator Markey's point, we've seen in all various industry sectors that sometimes we think about cybersecurity after the harm is done. And given the lives at stake and the potential of out-of-state actors who want to use vehicles now for a different purpose, I am very concerned that we get the cybersecurity right at the frontend and not wait for something bad to happen.

We also know that there are critical thinking components to operating a vehicle that I'm not sure translate to automated machinery just yet, which I think is why we're seeing the different levels of automation described in this legislation.

But to all of you, if trucks are added to this bill, what more could be done beyond the bill to guard against potential cybersecurity risks of automation?

Colonel HERNANDEZ. I'm not a cybersecurity expert, but I would just say that it makes a lot more sense to me to make sure that it's incorporated so that autonomous vehicles are secure, whether it's a car or a commercial vehicle.

Senator HASSAN. Thank you.

Mr. Clarke.

Mr. CLARKE. Actually, Senator, a great question and great topic. It is—this whole issue around cybersecurity is an immediate issue and it is an issue now in our industry. Both Navistar as well as all of my competitors and the people in the industry currently have some number of connected vehicles. Probably in the neighborhood of 40 percent of the vehicles that are on the road today are connected telematically. And we do different things. We offer services. We provide updates to some of the control software. So this is an immediate need for us today.

I would say the recognition of these needs has energized our industry to work together like few things that I have seen. We are committed to get it right, and we will not go to market nor test without the proper—without the proper safeguards. We welcome the oversight of the regulatory bodies in that particular space. We would say it is a rapidly changing area. We don't believe that the right thing is to mandate the technology, but certainly we stand ready and willing to participate in the regulatory process to provide the right safeguards.

Senator HASSAN. Well, and because my time is running low, I'll ask the rest of the group to address it, but just would it make sense to have a set of standards that everybody had to meet in place?

Ms. Hersman?

Mr. SPEAR. Senator, I think that's what we're trying to work toward even without legislation. The commercial sector as well as the automotive ISAC, which is up and running for a couple years now, really developing protocols that are seamless across both autos and commercial vehicles, and I think it really, you know, speaks to why trucks being part of this legislation is important, so that you get that seamless protocol.

Senator HASSAN. Ms. Hersman?

Ms. HERSMAN. I would say there were earlier questions about the voluntary nature of what's going on now. This is exactly why this body needs to get involved. If we don't like what's happening out there, it's because people don't feel like they have the authority or the direction. And I think it's really important for you all to set at least some of those high bars, set that floor and say where you want folks to go. They can figure out how to do it. But we don't have anything now. And so it is a bit of the Wild West out there, and there needs to be a sheriff. And I think the opportunity to do that is through having these conversations and this legislation, not putting it off.

Senator HASSAN. Thank you. And with the Chair's indulgence, Mr. Hall, quickly.

Mr. HALL. Absolutely I think there needs to be regulations, and I think there needs to be strong regulation, because while there are certainly reputable companies, including people who are represented here in this hearing today, there are bad actors out there, and we have repeatedly seen that, where, you know, with the Volkswagen scandal. If that happens with cybersecurity, we have got a huge problem. And I guess the thing that I see is perhaps,

as they say in West Virginia, we've got to make sure we're not getting the cart before the horse.

Senator HASSAN. Yes.

Mr. HALL. We need to ensure the stability and safety of these vehicles before we start rolling them out and approving legislation to put them on the road.

Senator HASSAN. Well, thank you.

And thank you for your indulgence, Mr. Chair. I'll put some questions into the record about workforce training. Thanks.

The CHAIRMAN. Thank you, Senator Hassan.

Senator Capito.

STATEMENT OF HON. SHELLEY MOORE CAPITO, U.S. SENATOR FROM WEST VIRGINIA

Senator CAPITO. Thank you, Mr. Chairman. And thank you for the hearing. I haven't been in the entire time, but you've got a great panel because you've got two West Virginians on the panel, Ms. Hersman and Mr. Hall.

[Laughter.]

Senator CAPITO. So I know we're in good hands.

I just recently returned from a trip to Israel, and when the question was asked, "What countries are really at the cutting edge?" they talked a lot in Israel about self-driving and automated vehicles, and I think they have—they have a very small, very flat country as well, but I think they're really working on the technologies there. So I wanted to bring that up.

I have a question, and it may be that I'm off kind of on how these things really work. So, Mr. Clarke, this is directed at you. We live in a state that has spotty connectivity, even on our main arteries, through even our wireless on our interstates, you know, it cuts in and out. And I have some concerns that if we move forward on this or as the technology moves forward, how much connectivity in all the different areas plays into being able to run this efficiently and safely. Could you speak to that, please?

Mr. CLARKE. Yes. Thank you, Senator, for the question. The basic autonomous system on a vehicle is intended to, in fact, drive in a very autonomous way. It does not have to be a connected vehicle to be an autonomous vehicle. It operates with a very detailed 3D map. It's looking and comparing using cameras and LIDAR detectors and making constant comparisons to what's in its memory, looking for things that aren't there, and then making decisions, are those objects moving or are those objects fixed? And then what decisions should be taken, not the least of which is, "I think I don't understand, I'm just going to pull over."

And so even in a non-connected environment, the vehicles can operate autonomously. Their safety efficacy is significantly enhanced when they do operate in a connected fashion, either connected to other vehicles or connected to portions of the infrastructure, or, in many cases, for our testing purposes, connected back to us, so that we can collect that data that can be used by regulators and analyzed for future purposes.

Senator CAPITO. Well, you mentioned in your previous question that 40 percent of your trucks were connected telematically. What is—when you say "telematically," what are we——

Mr. CLARKE. Yes. So I'd like you think about it that the truck itself has a cell phone, you know, and like every couple of seconds, it's sending us a message on the condition of all the mechanical systems on the vehicle.

Senator CAPITO. OK. So through the wireless.

Mr. CLARKE. Yes.

Senator CAPITO. Yes. OK. Thank you.

Mr. Hall, on the concerns about the workforce impacts, obviously in West Virginia, we have a lot of trucker drivers. It's a great occupation. I notice as we're looking at the different levels, in the, I don't know, Level 1 to Level 4, there is somebody in the car that's being—or in the truck. But I started thinking, so why is Mr. Hall worried about if you're going to have a Teamster in the truck anyway? Do you envision that it's a lower paying, lower type job, it doesn't have maybe the same beginning salaries that somebody who's a member of the Teamsters might have? I mean, is that your concern? Because it looks as though, at least from the very beginning, and except in very urban situations, there is somebody in the vehicle.

Mr. HALL. Well, that's obviously one of my concerns. I mean, first, yes, we don't want to see—just, you know, it has been mentioned here today that some comparison to we still have pilots in airplanes even though they're very much automated.

Senator CAPITO. Right.

Mr. HALL. And so certainly it's a concern of ours because people make a good living doing that. But also our concern is the safety of the drivers as well as the general public in saying that it shouldn't be—we don't believe that you should just include 80,000-pound trucks without further study. I mean, I don't think you can say because we've been talking about automobiles that then it just makes sense.

I mean, it's no more than—you know, I bought my grandson a BB gun, but I don't think that means that I should give him a high-powered rifle because he's learned to shoot a BB gun. We need to make sure that we're taking the time to look at some of the aspects that are so much different about trucks than they are automobiles.

But you are right. I mean, one of my concerns is that there be regulations so that we don't have those bad actors who—I mean, most of the companies that we deal with are up front and do the right thing. We don't want bad actors who are putting people on the road at the low end, the lowest cost, at the risk of safety for the general public.

Senator CAPITO. OK. You know, it's hard to imagine living in the terrain that we live in that an autonomous vehicle—there are certain places I am not getting in an autonomous vehicle to go up to my house, I can tell you that. It's a pretty windy, windy road. So there are lots of areas where this is not going to work.

But, Ms. Hersman, let's just take I–81. I don't know what the percentage of truck traffic is on that piece of highway, but it's enormous. How do you see this technology evolving in terms of safety on a very crowded highway like that that's pretty high speed?

Ms. HERSMAN. So I think that's a great example because that's exactly the kind of corridor where I think this technology could

work the best: very predictable, repeatable, you've got good coverage, you've mapped it out, it's not unknown. And those are the kinds of spaces where I think vehicles can talk to each other. It's a very controlled environment. You've got widely spaced lanes. You've got shoulders where people can pull over. That environment I think is probably one of the spaces where we're talking about using technology like this first.

It could control speeds. I'm sure if you drive on 81, there are some speed racers on that road. In addition to it being a truck alley, there are a lot of people moving really quickly. We can look at a lot of safety issues that can be addressed through this technology, traffic flow management, but safety is the first and most important thing.

Senator CAPITO. Thank you.

Thank you, Mr. Chair.

The CHAIRMAN. Thank you, Senator Capito.

Senator Duckworth.

STATEMENT OF HON. TAMMY DUCKWORTH, U.S. SENATOR FROM ILLINOIS

Senator DUCKWORTH. Thank you, Mr. Chairman.

I would like to quickly recognize our two Illinois natives. So good panel. Ms. Hersman and Mr. Clarke, welcome to the panel.

And just briefly touching on what Mr. Hall just said, I think the name "Captain Sully Sullenberger" and the "Miracle on the Hudson" is a great example of the importance of a human being decisionmaker at the controls of any type of large vehicle.

With the advent of Level 3, 4, and 5 technologies, I think we face a truly game-changing opportunity and associated challenges as well. You know, in my own lifetime, there have been few technologies with more potential to improve the mobility and independence for individuals with disabilities than autonomous vehicles. It would be freeing for those with visual impairments, for those that are unable to drive, to be able to actually leave their homes and gain mobility. Clearly, the potential to greatly reduce the 30,000 annual roadway fatalities is also truly exciting. I do know that we should expect growing pains and unintended consequences.

What I'd like to focus my discussion on is on how autonomous vehicles would challenge our existing transportation infrastructure and what that means for our local municipalities and states, and also the future of labor.

So, Mr. Clarke, what existing and future infrastructure considerations should manufacturers take into account when designing vehicles at Level 3 and above?

Mr. CLARKE. Yes. That's a great question, Senator, and it certainly reflects your understanding that commercial vehicles actually operate in a system or an environment that includes the infrastructure, things such as not just the highways, but entrants and exits, you know, toll plazas, even something as simple as, where can a vehicle pull over during an application?

What's exciting about this opportunity is that we can concurrently discover, as we're validating the technologies, those cost effective or the most cost-effective methods to get at what will ultimately be some infrastructure needs. As the point has already been

made, autonomous vehicles, even the most sophisticated, if everything were perfect, are probably just not suited to some roads in America or some circumstances, but, you know, they are suited to a number of other places as well. Things like, you know, we've already talked about vehicle-to-vehicle communications, but we can talk about vehicle-to-infrastructure communication where the road itself—OK?—and its condition can talk to the vehicle for incidents that maybe are miles and miles in advance.

And last but not least, look, these technologies, you would only think of deploying these technologies in the immediate term in a place where the vehicle always has available to it the ability to pull itself over and stop, which kind of dictates it's riding in the right-hand lane. And so now we have to reassess the capacity of, you know, that particular thoroughfare because all of the trucks will be in the right-hand lane. They will be traffic and speed controlled, but it always needs the ability to pull itself off. Or in the case of platooning, which we talked about previously, "decel" lanes on freeways or limited access highways may need to be extended so that entire pelotons of vehicles could pull over and still leave room for passenger vehicles to navigate their way off the highway as well.

And then last but not least, another very simple example would be the vehicle needs to be driven once it gets off the highway, and perhaps at that point in time, there will be the need for marshalling areas or cross-docking facilities or the ability to pull the vehicle over very close to an entrance or an exit to make the right inspections, to create the right certifications, so that we know that the vehicle is capable of performing the next challenge, so to speak, in its task.

So the opportunity to bring this technology in a very controlled manner for the purpose of developing data that will fuel regulations and infrastructure research is the exact opportunity we look forward to. I think I speak for our entire industry.

Senator DUCKWORTH. Thank you. And I think it's important to talk about the point beyond getting off of the interstate, off of the major roadways as well, because in many of our municipalities, the roads through cities and towns into the industrial areas, into those loading docks, are, you know, 1960s and 1970s era, very narrow. There is simply—there is nothing to replace a human being to negotiate through those.

And, Ms. Hersman, I think everyone agrees that the safety potential of AV technology is enormous. And from a safety perspective, could you speak to this infrastructure challenge for states and municipalities in terms of accommodating future AV technologies?

Ms. HERSMAN. I think on this issue it's really important for states and municipalities, oversight agencies, licensing agencies, all of them need to have a seat at the table. When we look at what's happening now, it's happening in controlled environments. They need to be notified of testing that's going on in their states so they know how to respond. But there may also be changes in design that we need to do going forward.

We talked about V2I, vehicle-to-infrastructure. We have a lot of grade crossings in Illinois. That's a great opportunity to kind of connect industries. And so how do we keep from having grade crossing fatalities? Likewise, we've seen pedestrian and cyclist fa-

talities going up very significantly. How do we ensure that we're thinking about all road users and not just—we're talking about trucks and cars today, but there are a lot of other fatalities that occur on our roadways.

I think states and municipalities have to be at the table, whether we're talking about lane markings and how we have systems that interact with each other, or about the rules of the road that we set.

No one has really talked about consumer education. One of the biggest challenges that we have is, how do people understand how these vehicles are behaving? Whether it's a large truck or whether it's a car, really important to bring people in the loop, and I think the state and local leaders have a role in that.

Senator DUCKWORTH. Thank you.

I yield back, Mr. Chairman. Thank you.

The CHAIRMAN. Thank you, Senator Duckworth.

Senator Cantwell.

STATEMENT OF HON. MARIA CANTWELL, U.S. SENATOR FROM WASHINGTON

Senator CANTWELL. Thank you, Mr. Chairman, and thanks for this hearing.

I wanted to ask Mr. Clarke, you know, obviously the SuperTruck program, which is both about moving forward, you know, more from an efficiency perspective. I know PACCAR, in our state, was awarded one of the DOE for developing more fuel-efficient engines. How do you see these two things working together in the challenges we face on competitiveness of moving U.S. products and keeping costs down? How is increasing fuel efficiency and automation going hand-in-hand?

Mr. CLARKE. Yes, Senator, thank you so much. Boy, I couldn't have asked for a better setup. You know, all of the major truck manufacturers in America participated in the DOE SuperTruck program. And as a program itself, the SuperTruck program, how it was managed, it was managed in an outstanding way that created the very technologies that we're putting on our vehicles today to improve not only their efficiency and operation and how clean they are in the environment, OK, but it really gave us a test bed to test many of these connected technologies and many of the— well, for instance, many of these ADAS technologies that, you know, are, in fact, the basis of autonomous vehicles going forward.

So, for instance, in our SuperTruck program, we had such a successful experience with collision mitigation and avoidance that in the middle of the program, we decided to put it on our brand-new tractor, called the LT, and we made it standard. So collision mitigation is standard. You can delete the option if you so choose, but surprising to us, the take rate on that has been 35 percent. And, in fact, those vehicles who are equipped with collision mitigation and mitigation style braking, already proven that they would suggest 24 percent reduction in those type of accidents, the very accidents that it was intended, you know, to avoid.

So it does—it did give us confidence to move forward with that technology in a test platform where we could do it outside of the commercial venue. And I would highlight that the SuperTrucks were all tested on highways. And so we were able to test it with—

in multiple customer environments all across the United States, and, again, it gave us this rapid validation and feedback that let us do something really good, not just commercially for us, but, you know, we think for the drivers as well.

Senator CANTWELL. Well, it's kind of hand-in-glove, right?

Mr. CLARKE. Yes.

Senator CANTWELL. I mean, it's not just, you know, are you going to have automated trucks? It's, what are the efficiencies you are going to drive into trucks for reducing costs? And when we see this from the aerospace industry, huge wins in the marketplace because the customer wants a more fuel-efficient plane. And I would just assume driving down the cost in these fuel areas and efficiency areas also give you a more competitive advantage when you're out there marketing cost of moving product.

Mr. CLARKE. Yes, Senator. This is a—you know, ours is a highly regulated business environment, you know, that is aimed at safety, efficiency, and, you know, basically clean products in the environment. There are no better safety regulators in the world than NHTSA and the Federal Motor Carrier Safety Administration. We have historically worked together to not only bring products to the market that improve safety, reduce operating costs, but create a cleaner environment.

Senator CANTWELL. Thank you.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Senator Cantwell.

Senator Peters.

Senator PETERS. Well, thank you, Mr. Chairman. Thank you for letting me have another round here. I appreciate your indulgence.

And again thank you to our witnesses here today.

Ms. Hersman, the Advocates for Highway and Auto Safety have expressed concerns to my office about including trucks in this legislation, and they have recommended several ways that Congress, the DOT, NHTSA, FMCSA can ensure safety of highly automated trucks. So they have a little different perspective or at least are raising a number of I think are important issues. And I would certainly welcome your thoughts on some of the issues that they have raised.

The Advocates for Highway and Auto Safety believe that automated trucks that do not comply with Federal Motor Vehicle Safety Standards should not be subject to exemptions. Would you agree with that?

Ms. HERSMAN. Are you talking about for testing environments? I think that if we have very specific geofenced testing environments, we want to think about how we're—what we're testing, what equipment we're testing. But I do think if they're operating out on the roads with the public, they need to be subjected to the same standards as other vehicles out there.

Senator PETERS. So I guess that's in agreement with that stand.

Ms. HERSMAN. Yes. But I would say, you know, certainly when we look at test environments, I mean, we talked about a situation where we had a unique test, and they created specific parameters around it. So I would say we have to sometimes put technologies and systems out there if we're testing them to understand what it's like in the real world. It's important not to say we wouldn't want

to allow anything, but I think we have to have major controls around those things.

Senator PETERS. Fair enough. Have you considered what would be an appropriate number of exemptions for highly automated trucks going forward?

Ms. HERSMAN. I think that it's possible. I know the Committee has a number. And I really think you could think about a pro rata share based on the number of vehicles that are out there, passenger vehicles versus commercial vehicles. I think certainly it's in the purview of the Committee to put that out there. But what we're talking about as far as fully automated vehicles, we're just not seeing those numbers now.

Senator PETERS. Well, under current law, current law allows 2,500. Would 2,500 be sufficient for trucks? And I guess my understanding is there are about 300,000 produced in the country versus 17 million automobiles. Is 2,500 sufficient?

Ms. HERSMAN. I'm not sure that 2,500 is the right number. I might defer to some of my colleagues who have more real experience with respect to putting vehicles out on the roads. But I think it's really important for this Committee to engage in this issue and set some guidelines and some escalation for how that could occur in a thoughtful way because right now there are none.

Senator PETERS. Right. We allow the 2,500 under current, but if we change that, we obviously need some thoughtful consideration of that, and get some data and evidence to determine that. I appreciate that answer.

The Advocates for Highway and Auto Safety also believe that automated trucks must have an operator with a valid commercial driver's license while in the vehicle at all times, and are advocating for the Secretary to issue a standard for driver engagement. Does the National Safety Council have recommendations for ensuring that an operator is behind the wheel?

Ms. HERSMAN. So I would say—you're asking me about other folks' recommendations? I can absolutely share with you what some of our recommendations are.

Senator PETERS. Is that one of your recommendations?

Ms. HERSMAN. I think for us, we do feel, depending on the level of automation, there absolutely needs to be a qualified driver behind the wheel. And one of the things that we haven't talked about that this issue goes to, that the Advocates are raising, is I know we talked about displacement and training programs, but I think what we really need to talk about are training programs going forward, making sure that there are opportunities for people to be qualified on advanced technologies.

I held a commercial driver's license. There are endorsements for those licenses, whether it's air brakes, school bus, passenger endorsements. I think it's important for us to think through technology as we advance. How do we train and qualify people for advanced technology? Because these systems are going to be complex and it's going to require a different set of skills.

Senator PETERS. Well, that's actually related to I think my next question, so I think you're ahead of it, because the Advocates raise concerns about driver training, as you just expressed, and they believe that drivers operating a highly automated truck must have

additional endorsement on their CDL to ensure that they have been properly trained to monitor and understand the operating design domain of the vehicle, and if need be, take over the control of that highly automated truck. They believe this training should include a minimum number of hours behind the wheel, and it sounds as if that's the direction that you're going to. That's something we need to think through.

Ms. HERSMAN. I absolutely think as long as human beings are engaged, we have to make sure that we do it safely. I know everyone is talking about Levels 2, 3, 4, 5, but I would posit that one of the most dangerous environments are when a human being and the vehicle are sharing control. And how we handle those handoffs and how we structure the notifications, the warnings, and the training are very important. This is where we've seen in the aviation industry mode confusion, overreliance on automation. These are really important conversations for us to have, even about Levels 2 and 3, before we get to 4 and 5. It's going to be a very messy environment, and we need to talk about those things.

Senator PETERS. Yes, absolutely. I agree.

And just one final point, Mr. Chairman.

They are also suggesting that motor carriers using highly automated trucks should be required to apply for additional operating authority. Has the National Safety Council—have you considered that issue?

Ms. HERSMAN. I think it's important that they apply for operating authority as they're required to do so today. I think it's really important for the Federal Motor Carrier Safety Administration to identify what that means. And they need to be part of the conversation with respect to vehicle standards that NHTSA is responsible for, but operations are completely within their purview. And I think, as we're saying, it's a new world out there. Everybody has got to come along and identify what that means.

Senator PETERS. Right. Well, I appreciate those answers. And it's clear we need to do a whole lot more thinking about this. And I appreciate your response. Thank you.

The CHAIRMAN. Thank you, Senator Peters.

And again thanks to our panel today. It has been great conversation and discussion, and I think it has shed a lot of light on important issues as we try and shape our bill, and we've been working, as I said, Senator Peters and I, and Senator Nelson and others on this Committee, for some time and trying to craft a bill that really does enable the technology to move forward and with maximum emphasis on safety. And so we're trying to figure out how to thread that needle.

I would argue that it makes sense not to have two safety standards out there, one for trucks and one for automobiles, and that as we think about these things, we want to make sure that we're providing the safest environment for all motorists on the highways, but that's a point that we continue to talk about in terms of the final bill that we end up filing. So we've got a draft out there. I know many of you have looked at it, and we welcome your thoughts and your input and certainly the testimony this morning and the responses to the questions have been very, very helpful in that regard.

And I would simply say for members of the Committee who have questions for the record, to submit those. And if we could have all of you respond within a two-week time period, it would be very appreciated. And we'll make all that part of the hearing record. So thank you again for being here.

With that, this hearing is adjourned.

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

A P P E N D I X

SELF-DRIVING TRUCK TECHNOLOGY IS THE ANSWER TO SAFER ROADS

Gary Shapiro

Over a century ago, trains moved freight across our Nation. When technology changed and cabooses no longer played a role in train safety, railmen fought for laws to require cabooses to be manned with unnecessary workers. This blip in our history of fully embracing innovation is instructive for our current debates over the shift to self-driving vehicles—technology that will save millions of lives and empower the elderly and people with disabilities.

Today, trains and trucks compete to move freight. But trucking is one of the most dangerous jobs in America. In 2015, 745 drivers died on the road. This is roughly one-quarter of all workplace fatalities—more than any other industry. It comes as no surprise, then, that the trucking industry has struggled to hire drivers in recent years. The American Trucking Association says there were 48,000 fewer drivers than available jobs in 2015. And for qualified, active drivers, this means longer and more frequent trips to fill the gaps.

Self-driving trucks will transform American commerce while dramatically improving road safety, They will revolutionize transportation—and also make it less expensive—letting companies send goods over long distances without worrying about whether a driver has the stamina for yet another marathon drive.

This week, the Senate Commerce Committee is hearing arguments on including self-driving trucks in self-driving legislation. It's a tough question: There's no denying that in the long term, self-driving trucks will change the role and responsibilities of truck drivers. However, this will be a generational shift, not an abrupt displacement of drivers, and in fact, will likely improve conditions for them.

Simply resisting self-driving trucks to protect existing jobs overlooks big problems the trucking industry now faces. And self-driving trucks will reduce human error, increasing safety both for drivers and for the millions of Americans with whom they share the Nation's highways.

Safety issues aside, keeping self-driving trucks off the road in an effort to keep drivers employed obscures the deeper problem. Innovation will always disrupt the job market. Trying to stop the tide of technology never works, and the time and energy spent resisting it is a Sisyphean challenge. A wiser effort is to adapt. In nature and in business, the winners are not the strongest or fastest, but the quickest to adapt to change. Self-driving vehicles will create new industries and new kinds of jobs. We'll need auto workers who know how to repair these new vehicles. We'll need tech workers to develop and update the software that powers these cars. We'll need construction workers to help prepare our infrastructure for the changes that self-driving technology will bring.

The good news is that we're already ahead of the curve. It will be several years—maybe decades—before we have the right legal and physical framework for total adoption to occur. We can—and must—use this time to prepare.

This means staying technology-neutral—allowing all forms and models of a technology to emerge unhindered. Effective implementation, however, will require candid policy discussions. Government needs to act to ensure that legacy interests, including the different regulatory schemes for commercial and personal vehicles, do not wind up creating a patchwork of rules that delay the benefits of self-driving vehicles—benefits that include a potential

30,000 American lives saved each year.

It also means that the public and private sectors must work together to create the necessary physical framework—and that means helping workers get the right skills to get the job done. We must focus on technical skills and develop apprentice programs. We must invest in STEM education from an early age to prepare the next generation to take the jobs of the future. We must also help those who are already

in the workforce transition smoothly, teaching them how to navigate new technologies as older ones begin to retire.

Self-driving vehicles are an exciting inevitability. Education—not protection—is the most effective way to deal with disruption. And in many industries, we should embrace technology to improve working conditions and make jobs easier.

Let's get to work laying down the necessary systems and structures so that this technology can emerge without delay. With the right laws and the right strategies, our roads will be safer, our transportation less expensive and our workforce stronger because of it.

Gary Shapiro is President and CEO of the Consumer Technology Association. the U.S. trade association representing more than 2,200 consumer technology companies, and author of the New York Times best-selling books, "Ninja Innovation: The Ten Killer Strategies of the World's Most Successful Businesses" and "The Comeback' How Innovation Will Restore the American Dream."

ADVOCATES FOR HIGHWAY AND AUTO SAFETY
September 12, 2017

Hon. JOHN THUNE, Chairman,
Hon. BILL NELSON, Ranking Member,
Senate Committee on Commerce, Science, and Transportation,
Washington, DC.

Dear Chairman Thune and Ranking Member Nelson:

Thank you for convening tomorrow's important hearing, "Transportation Innovation: Automated Trucks and our Nation's Highways." We are pleased that the Committee is considering the role of autonomous commercial motor vehicles (ACMVs) and urge you to adopt a strong regulatory framework for their development and deployment. We respectfully request that this letter be included in the hearing record.

Advocates for Highway and Auto Safety (Advocates) supports the development of automated vehicle technology because it has the potential to significantly reduce crashes, including those involving large trucks and buses. Advancing proven technological solutions is especially critical given that truck crashes have skyrocketed in recent years. In 2015, 4,067 people were killed in crashes involving large trucks. This is an increase of more than 4 percent from the previous year and a 20 percent increase from 2009. Additionally, in 2015, 116,000 people were injured in crashes involving large trucks. This is the highest number of injuries since 2004. Since 2009 there has been a 57 percent increase in the number of people injured in large truck crashes. Moreover, in fatal two-vehicle crashes between a large truck and a passenger motor vehicle, 97 percent of the fatalities were occupants of the passenger vehicle. It is clear that this is a serious and growing public health problem that merits urgent attention.

While Advocates sees great potential for fully autonomous vehicles, including CMVs, to be the catalyst for meaningful and lasting reductions in deaths and injuries, in the interim there are many effective technologies that could be implemented immediately. In 2015, Advocates filed a petition with the National Highway Traffic Safety Administration (NHTSA) seeking the issuance of a rule to require forward collision avoidance and mitigation braking systems (F–CAM), also known as automatic emergency braking (AEB), on trucks and buses with a gross vehicle weight rating (GVWR) of 10,000 pounds or more. The agency granted the petition in October of that year but, nearly two years later, no further regulatory action has been taken despite studies showing the potential to significantly reduce crashes, deaths and injuries. The agency should be required to expeditiously issue this rule.

Additionally, Advocates has consistently supported the use of speed limiting devices for CMVs because high speed crashes involving CMVs are far more deadly than those that occur at lower speeds. As such, Advocates filed comments with the Federal Motor Carrier Safety Administration (FMCSA) and NHTSA urging that the devices, already installed on most CMVs, be turned on and set at a safe speed. These technologies are readily available and could be saving lives now if they were standard on every truck. Again, this is another truck safety rule that is needlessly languishing at the DOT. Both AEB and speed limiter technologies are already required as mandatory equipment on commercial vehicles in Europe. In fact, speed limiting technology has been required in the European Union for over two decades and AEB since 2012. The European Union is far ahead in providing a safer operating environment for CMVs, while the U.S. lags behind as deaths in truck-involved crashes skyrocket.

The emergence of experimental ACMVs and their interactions for the foreseeable future with conventional motor vehicles demand an enhanced level of Federal and state oversight to ensure public safety. It is imperative that CMVs be regulated. If not, the development and deployment of ACMVs will be subject to the ineffective and unenforceable voluntary guidelines developed by NHTSA for new vehicles. Moreover, the FMCSA has not even issued voluntary guidelines for the operating rules to govern the safety of ACMVs once on the road. The lack of proper oversight clearly will have a negative impact on public safety. Some experts predict that automated technology will be placed in commercial vehicles before light passenger vehicles. The potential for an 80,000 pound truck using unregulated and inadequately tested technology on public roads is a very real and dangerous scenario if these vehicles are only subject to voluntary guidelines. In addition, automated passenger carrying commercial motor vehicles that have the potential to carry as many as 53 passengers will need additional comprehensive safeguards that will be unique to this mode of travel.

In order to minimize major threats to the public and ensure that ACMVs are developed and deployed safely, they must be subject to the following essential provisions:

- Each manufacturer of an ACMV must be required to submit a detailed safety assessment report that details the safety performance of automated driving systems and automated vehicles. Manufacturers should be required to promptly report to NHTSA all fatal, injury and property damage only crashes involving ACMVs.

- ACMVs that do not comply with Federal Motor Vehicle Safety Standards (FMVSS) should *not* be sold and they should not be subject to exemptions. Sales of CMVs in the United States do not nearly equal passenger vehicle sales and therefore exempting large numbers of CMVs from FMVSS is unnecessary for the development of ACMVs and will result in a potentially significant and unnecessary threat to public safety.

- NHTSA must require that manufacturers of ACMVs meet a "functional safety standard" to guarantee the safety of ACMVs. This is a well-known process by which a product is tested to ensure that, as a whole, it will function safely and will prevent or mitigate defects or misuse which could lead to unsafe conditions.

- Any safety defect involving the ACMV must be remedied before the ACMV is permitted to return to operation. The potential for defects to infect an entire fleet is heightened with AV technology. Therefore, manufacturers should be required to promptly determine if a defect affects an entire fleet. Those defects that are fleet-wide should result in an immediate suspension of operation of the entire fleet until the defect is remedied.

- ACMVs must be required to meet a minimum cybersecurity standard that should be issued by the Secretary within 3 years of enactment of the legislation.

- The Secretary should be required to establish a database for ACMVs that includes such information as the vehicle's identification number; manufacturer, make, model and trim information; the level of automation of each automated driving system with which the vehicle is equipped; the operational design domain of each automated driving system with which the vehicle is equipped; and the Federal motor vehicle safety standard or standards, if any, from which the vehicle has been exempted.

- In the near term, rulemakings should be considered for elements of ACMVs that may require performance standards including human machine interface, sensors and actuators and the need for software and cybersecurity standards. Standards for ACMVs should be required to be issued by specific deadlines set by Congress and before there is large scale deployment.

- Manufacturers of ACMVs should be required to have in place a privacy plan before an ACMV is sold.

- For the foreseeable future, regardless of their level of automation, ACMVs must have an operator with a valid commercial driver's license in the vehicle at all times. Drivers will need to be alert to monitor not only the standard operations of the truck but also the automated system. Therefore, the Secretary must issue a standard for driver engagement. In addition, critical safety regulations administered by FMCSA such as those that apply to driver hours-of-service, licensing requirements, entry level training and medical qualifications must not be weakened.

- Motor carriers using ACMVs should be required to apply for additional operating authority.

- Drivers operating an ACMV must have an additional endorsement on their CDL to ensure they have been properly trained to monitor and understand the operating design domain of the vehicle and, if need be, to operate an ACMV. This training should include a minimum number of hours of the behind-the-wheel training.
- FMCSA must consider the additional measures that will be needed to ensure that ACMVs respond to state and local law enforcement authorities and requirements, and what measures must be taken to properly evaluate an ACMV during roadside inspections. In particular, the safety impacts on passenger vehicle traffic of several large ACMVs platooning on roads and highways should be assessed.
- NHTSA should be given imminent hazard authority to protect against potentially widespread catastrophic defects with ACMVs, and criminal penalties to ensure manufacturers do not willfully and knowingly put defective ACMVs into the marketplace.
- NHTSA and FMCSA must be given additional resources, funding and personnel, in order to meet demands being placed on the agency due to the advent of AV technology.

Without these necessary safety protections, truck drivers and those with whom they share the road are at risk. Advocates has always been a champion for technology and the advent of AV technology is no different. However, allowing technology to be deployed without adequate testing, oversight, and safety standards is a direct threat to the motoring public which is exacerbated by the sheer size and weights of large commercial motor vehicles. We look forward to working with the Committee to address these important issues and advance legislation that provides for the safe development and deployment of lifesaving technologies.

Sincerely,

JACQUELINE GILLAN,
President Affairs.
CATHERINE CHASE,
Vice President of Governmental.

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TRANSPORTATION FOR AMERICA
September 12, 2017

Hon. JOHN THUNE,
Chairman,
Senate Committee on Commerce,
 Science, and Transportation,
Washington, DC.

Hon. BILL NELSON,
Ranking Member,
Senate Committee on Commerce,
 Science, and Transportation,
Washington, DC.

Dear Chairman Thune and Ranking Member Nelson:

Thank you for holding this important hearing on Transportation Innovation: Automated Trucks and our Nation's Highways. As Congress and the administration develop Federal automated vehicle (AV) policy, it is critically important for this Committee to thoroughly understand how to balance the long-term safety benefits with the short-term challenges of testing and deployment. Today's hearing focuses particularly on safety in the trucking industry, but this issue does not exist in a vacuum and it is important to include all commercial and non-commercial automated vehicles in any conversation about Federal AV policy.

Transportation for America (T4A) is an alliance of elected, business and civic leaders seeking smart, homegrown and locally driven transportation solutions. One of our initiatives, the Smart Cities Collaborative, is a learning and support network providing direct technical assistance to 16 leading edge cities advancing smart urban mobility strategies. We are working with cities as they develop model policies and launch pilot projects to test and learn about automated vehicles, shared mobility and data analytics.

We are writing today to express our concerns with the Senate discussion draft of the American Vision for Safer Transportation Through Advancement of Revolutionary Technologies (AV START) Act.

Along with the 16 cities of our Smart Cities Collaborative, T4A supports the deployment of automated vehicles and is pleased to see Congress supporting the effort of automakers to test and improve this technology. The best way to do this is to ensure that the testing is done with full transparency and in cooperation with the cities and states that own and manage the roads on which AVs are operating. Un-

fortunately, the staff discussion draft circulated last Friday fails to do that. It leaves cities and states out of the conversation and jeopardizes the safety of millions of Americans by allowing the vehicles to operate with little accountability or oversight.

Currently, state and local governments have the authority to manage the operation of vehicles on their streets. This allows them to address concerns such as noise, congestion or safety. When it comes to automated vehicles, cities and states want to be able to manage their presence on their roads in the same way they manage all other vehicles, commercial and non-commercial, in order to ensure the safety of everyone using their system.

The Senate discussion draft requires a Safety Evaluation Report (SER) from manufacturers that have introduced a highly automated vehicle into interstate commerce. They are required to submit information on vehicle safety, compliance with applicable laws, cybersecurity and crashworthiness.

The SER serves as the framework for pre-empting local and state authorities. All states and local governments are prohibited from enacting or enforcing any laws related to any of the SER subject areas.

None of us want to see a patchwork of regulations that stifle innovation, but the unified Federal framework in this case is a poisoned chalice: it provides almost zero mechanism for state or local governments to collaborate with those companies or hold them accountable for the safety of their vehicles or technology. The discussion draft strips these governments of the authority to manage the vehicles on their roadways and leaves them without the tools to deal with the problems that will surely arise during the testing and deployment of automated vehicles.

We are also interested in seeing a Federal framework that allows the National Highway Traffic Safety Administration (NHTSA) and the Federal Government to ensure the vehicles are safe for deployment. On its face, the safety report is a step in the right direction for managing these vehicles on our roads, but in reality it's just an exercise: it prevents the Secretary of Transportation from taking any action based on a review of that SER data. If the safety report showed that a particular fleet of AVs was frequently blowing through red lights, even the Secretary of Transportation would have no recourse to require changes or to pull the cars from the road.

The result of this framework is that no one—federal agents, state or local governments—has authority over these vehicles on the road other than the manufacturers.

We have already seen automated vehicles struggle in cities like San Francisco, CA and Pittsburgh, PA with serious safety issues. This new technology is exciting and poised to have dramatic impacts on the safety of our streets in the long-term, but in the short-term, we need to give our cities and states—where these vehicles are operating—the authority to ensure that they're operating safely and following all local traffic laws, and we need to give the Secretary of Transportation the authority to determine when a vehicle poses a threat to the American public and respond.

Automated vehicle technology has the potential to provide aggregated information about how people and goods move through our streets, but without access to these data, city and state governments will be blind to the impacts of emerging transportation technologies.

The SER provides additional data for local governments to view but with a few restrictions. The report allows for the redaction of trade secrets or confidential business information but the imprecise definition makes it unclear how much information will be hidden from public view. This provides only an impression of transparency while giving manufacturers a free pass to keep their operations a secret. The limited information provided to local governments is not adequate to inform them fully of what's happening on their roads and make the appropriate changes to guarantee the safety and smooth introduction of this technology. For example, if a certain type of LIDAR system is incapable of reading a stop sign if vandalized with graffiti or confused by bike lanes if painted a certain shade of green, there is nothing that encourages or requires those testing AVs to share that information with those most able to address the problem.

Understanding vehicle movement at the corridor level provides immense value for governments and citizens, and automated vehicles provide a new for communities to know what's happening on their roads. Data on vehicle collisions and near misses allows cities to proactively redesign dangerous intersections and corridors to ensure safety for all street users. Real-time data on vehicle speeds, travel times and volumes has the potential to inform speed limits, manage congestion, uncover patterns of excessive speeds, evaluate the success of street redesign projects and ultimately improve productivity and quality of life. We need to ensure cities get the data they need to safety bring these vehicles onto their streets and eliminate any restrictions on what manufacturers can hide from them and the public.

Cities have long been the source of innovation in transportation policy and practice. With active deployments in cities such as Pittsburgh, PA, Tempe, AZ, and Boston, MA, cities continue to drive automated vehicle innovation and testing. These deployments are conducted in close partnership with automakers and private mobility providers allowing them leverage their respective knowledge and experience to understand the impacts of these technologies. Further, state departments of transportation manage the bulk of our transportation program. But in spite of the wealth of information cities and states have to share in order to assist with deployment, the discussion draft fails to require any inclusion of state or local representatives on a new Federal Highly Automated Vehicles Technical Safety Committee.

All of these issues are exacerbated by the discussion draft's provision to allow up to 50,000 vehicles per manufacturer to be deployed overnight, with up to 100,000 over three years. We have already heard from Colonel Scott G. Hernandez, Chief of the Colorado State Patrol, on the time, expense and labor required to test just one truck in Colorado—even with the assets of robust data sharing, and communication and collaboration between the public and private sectors. We're concerned about the ability to run even a second test of these vehicles, let alone hundreds and thousands of them at once.

Protecting public safety is the fundamental role of government, but this discussion draft would set up a system that prevents federal, state and local authorities from supporting safe conditions for the testing and deployment of automated vehicles. It does not encourage the needed cooperation and transparency between the public and private sectors. It is hard to imagine how the deployment of AVs could be promoted effectively by hiding AV safety performance from the public and preventing the managers of our roadways and public safety officers from having a role in managing them.

We encourage the Committee to make changes to address the concerns and to hold a hearing with city and state partners to receive their input.

If you have any questions or need more information, you can contact our Director of Smart Cities, Russ Brooks at russ.brooks@t4america.org or (612) 460–8181.

Sincerely,

BETH OSBORNE,
Interim Director,
Transportation for America.

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TRUCK & ENGINE MANUFACTURERS ASSOCIATION
Chicago, IL, September 12, 2017

VIA EMAIL AND HAND DELIVERY

Chairman JOHN THUNE,
Committee on Commerce, Science, and
  Transportation,
U.S. Senate,
Washington, DC.

Ranking Member BILL NELSON,
Committee on Commerce, Science, and
  Transportation,
U.S. Senate,
Washington, DC.

Re: AV START Act—Staff Discussion Draft

Dear Chairman Thune and Ranking Member Nelson,

The Truck and Engine Manufacturers Association (EMA) applauds the hard work of the Senate Committee on Commerce, Science, and Transportation in developing the *American Vision for Safer Transportation through Advancement of Revolutionary Technologies Act* (AV START Act). *We support the creation of a Federal regulatory structure to ensure that the* inevitable deployment of highly automated vehicles is implemented safely and reliably, and we appreciate your willingness to consider the input of the heavy-duty truck and engine manufacturers that is reflected in the staff discussion draft of the bill. The AV START Act addresses critical aspects of the automated vehicle technologies that are emerging in passenger cars and heavy-duty commercial vehicles—technologies that show great promise in our common goal of improving motor vehicle safety.

EMA represents the world's leading manufacturers of commercial motor vehicles (greater than 10,000 pounds gross vehicle weight rating, or GVWR). EMA member companies design and produce medium- and heavy-duty vehicles that are highly customized to perform a wide variety of commercial functions, including line-haul trucking, regional trucking, package delivery, refuse hauling, and construction.

EMA members have a long history of being at the forefront of developing and deploying advanced driver assistance systems (ADAS) that utilize automation technologies to assist the driver in maintaining control of the vehicle and avoiding a

crash. The automation technologies utilized in ADAS, such as anti-lock braking, electronic stability control, automatic emergency braking, and adaptive cruise control, serve as the building blocks for the highly automated driving systems that are addressed in the AV START Act. Existing and future automated *vehicle technologies show great promise in minimizing the human error that leads to a vast majority of motor vehicle crashes, including those involving heavy-duty trucks.* Reducing the potential error of the driver of an 80,000 pound over-the-road tractor-semitrailer combination vehicle is why EMA members are developing and deploying automated vehicle technologies.

It is very important to note that the role of the commercial vehicle operator is much more expansive than that of a passenger car driver. A commercial vehicle operator is the face of their trucking business employer; conducts critical pre-trip vehicle inspections; ensures that the correct cargo is loaded and secured; manages and reports on the logistics of delivering the freight; and guards the vehicle and freight against theft. Accordingly, *we anticipate that heavy duty commercial vehicles will always require an operator, albeit one assisted by* automation.

The AV START Act would establish a sound regulatory structure for the design and manufacture of highly automated vehicles under the purview of the National Highway Traffic Safety Administration (NHTSA). Like passenger car manufacturers, EMA members have been certifying vehicles to comply with NHTSA's Federal Motor Vehicle Safety Standards (FMVSSs) since soon after the National Traffic and Motor Vehicle Safety Act was enacted in 1966. That longstanding nationwide framework provides heavy-duty manufacturers the regulatory certainty needed to efficiently supply compliant vehicles to their interstate fleet customers. Accordingly, we urge the Committee to maintain the Federal regulatory framework in the AV START *Act for the design, construction and performance of highly automated vehicles, as exists with NHTSA's current FMVSSs.* To maintain NHTSA's broad regulatory authority over the automation technologies in heavy-duty vehicles, *the AV START Act also should keep commercial vehicles (over 10,000 pounds GVWR) in the definition of **Highly Automated Vehicle.***

As proposed, the AV START Act would limit pre-production testing of highly automated vehicles to only manufacturers. However, each heavy-duty truck is highly customized by the manufacturer to meet the needs of the commercial customer's particular trucking operation, and the process of developing and deploying new technologies in that business-to-business relationship requires that the manufacturer provide prototype vehicles for fleet customers to assess in real-world operation. In other words, a commercial fleet customer will not invest in a new technology before a thorough evaluation of a prototype vehicle to ensure the technology will function as expected—and return a profit. Such real-world prototype evaluation is performed by the fleet customer in close coordination with the truck manufacturer. Accordingly, *the AV START Act should allow commercial vehicle fleets to test and evaluate highly automated* heavy-duty vehicles along with the manufacturer.

Since heavy-duty vehicles are developed, sold and operated in a commercial environment, we hope to be able to constructively engage with the NHTSA working group envisioned in the AV START Act to be responsible for automated driving education efforts. However, we believe that education efforts for the commercial vehicle sector are best addressed by the Federal Motor Carrier Safety Administration, under its existing authority *to regulate commercial driver licensing and training.*

We look forward to continuing to work with the Commerce Committee on the AV START Act—legislation that is crucial to the safe and efficient deployment of automated vehicle technologies in commercial motor vehicles. If you have any questions, or if there is any additional information we could provide, please do not hesitate to contact me at (312) 929–1972, or tblubaugh@emamail.org.

Very truly yours,

TIMOTHY BLUBAUGH,
Executive Vice President.

cc: Cherilyn Pascoe (Cherilyn Pascoe@commerce.senate.gov)

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STATEMENT OF PROPERTY CASUALTY INSURERS ASSOCIATION OF AMERICA

The promise of "self-driving" vehicles to improve road safety and mobility continues to generate debate about what the appropriate regulatory frame work for the testing and deployment of such vehicles. As automation of driving functions increases, some motor vehicle laws and regulations will need to be changed to accommodate the testing and deployment of self-driving vehicles. The Property Casualty Insurers Association (PCI) is pleased that the Committee continues to work dili-

gently to address policy issues related to the testing and deployment of automated vehicles.

PCI is composed of nearly 1,000 member companies, representing the broadest cross section of insurers of any national trade association. PCI members write $202 billion in annual premium, 35 percent of the Nation's property casualty insurance. That figure includes more than 46 percent of the commercial auto insurance premium written in the United States.

The increasing automation of the driving function is likely to bring significant change to the auto insurance industry. To adapt to these changes and support innovation in transportation, insurers will need to have access to data and information regarding vehicles with automated driving systems whether they are used for commercial or personal purposes. It is critical for insurers developing historical loss data and pricing for new insurance products in an evolving marketplace to have the ability to identify not only which vehicles have automated driving technology but also the type of technology used by each vehicle.

Additionally, insurers need to have reasonable access to data for claims handling purposes. In many auto accidents, apportionment of liability is likely to hinge upon whether a human driver or the vehicle itself was in control and what actions either the driver or the vehicle did or did not take immediately prior to the loss event.

Neither HR 3388, the SELF DRIVE Act that recently passed the House, nor draft legislation currently under development in the Senate address these data access issues directly. PCI strongly urges policymakers to ensure access to data for insurers in Federal law. Doing so is essential for prompt claims handling and could potentially avoid many liability disputes that could delay compensation to accident victims. While cybersecurity is a critical concern for automated vehicles, it is important that cybersecurity requirements do not block access to vehicle data by third parties, such as insurers.

Testing requirements, guidelines and standards for use on public roads should set clear expectations for the public and provide clear compliance direction for technology developers and manufacturers. Modifications to existing auto safety laws and motor vehicle safety standards must be rare, and limited to only the highest levels (*i.e.,* fully autonomous) of automated driving, and should clearly define the levels of automation to which the modification applies. Vehicles with automated driving systems will share the road and occasionally collide with human driven vehicles for many years to come. As such, PCI believes that exemptions to the Federal Motor Vehicle Safety Standards (FMVSS) should not be permitted for crash protection standards. Clear and effectively enforced auto safety laws and vehicle standards can save lives on our roads today and, when applied to automated driving systems, foster public confidence that will ultimately determine if the technology realizes its potential.

Insurers have valuable contributions to make to any advisory council that will make recommendations on automated vehicle policy, when the committees charge will involve cybersecurity, data sharing and safety. We recommend that insurer representation be specifically provided for in any such advisory committee being created. PCI is eager to participate on these advisory groups and work with all stake holders to establish a framework for sharing information that protects vehicle user privacy and the intellectual property rights of the manufacturers.

Automated driving technology holds great promise for the future, and implementing clear policies that ensure that insurers have access to vehicle data on reasonable terms to efficiently handle claims, develop products and underwriting methods to support these innovations are an essential first step toward that future. PCI and its members look forward to working with legislators and regulators at the Federal and state level to establish a sound regulatory framework for automated driving.

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PREPARED STATEMENT OF HON. DAVID L. STRICKLAND, ESQ., COUNSEL, SELF-DRIVING COALITION FOR SAFER STREETS; AND PARTNER, VENABLE LLP

Chairman Thune, Ranking Member Nelson, on behalf of the Self-Driving Coalition for Safer Streets, I am honored to submit this written statement discussing the future of transportation innovation, including fully self-driving commercial vehicles.

The Coalition, which was founded in April of last year by Ford Motor Company, Lyft, Uber, the Volvo Car Group, and Waymo (formerly Google's self-driving car project), is focused on enabling the development and deployment of Level 4 and Level 5 fully self-driving vehicles, including light passenger vehicles and heavy duty trucks.

This cross-section of companies demonstrates the widespread interest in developing self-driving technology across different industry sectors—including technology, automotive, ridesharing, and commercial trucking. Despite their different backgrounds, the companies came together to form the Coalition because of their commitment to bring the tremendous potential safety benefits of self-driving vehicles to consumers in the safest and swiftest manner possible. As examples of their efforts, Waymo completed the world's first fully driverless ride on public roads in Austin in October 2015 and has now driven more than 3 million miles on public roads, mostly on city streets; Lyft has set itself a public goal that half the rides on its platform will be in a self-driving vehicles by 2021; Ford intends to have a fully self-driving vehicle "for commercial application in mobility services in 2021; and Uber already is providing rides using its self-driving vehicles (with an operator behind the wheel) in Tempe, Arizona and Pittsburgh, Pennsylvania.

The Senate Committee on Commerce, Science, and Transportation stands at the intersection of the digital economy, the Internet of things, and, most importantly, consumer safety. This is a critical moment for the Committee as it wrestles with questions that will impact the future of transportation safety, mobility, and innovation for decades to come. On behalf of the Coalition, I thank the Committee Members and their staff for working with a wide array of automated vehicle technology stakeholders over the past several months to try to develop self-driving vehicle legislation. Over the course of this period, you have engaged in a thoughtful discussion over how to safely deploy self-driving technology, and we are grateful for the opportunity to provide input.

The Coalition believes fully self-driving vehicles, whether light duty passenger or medium-to-heavy duty commercial vehicles, will play a key role in making our roads safer,improving mobility and maintaining U.S. leadership on innovation. Self-driving vehicles offer an opportunity to significantly increase safety, reduce congestion, and transform how people, goods, and services get from point A to B. Self-driving vehicles also hold the promise to enhance mobility for the disabled and elderly and improve transportation access and access to goods and services for underserved communities.

Ultimately, safety is the driving force behind deploying self-driving technology. Although it has been often cited, it still bears repeating that 35,092 Americans died in motor vehicle crashes and 2.44 million were injured in 2015, and tragically, these numbers are growing. The National Highway Traffic Safety Administration ("NHTSA") estimates a 10.4 percent increase in roadway fatalities in the first half of 2016. Since 94 percent of all crashes are the result of a human decision, fully self-driving vehicles are very likely to significantly reduce fatal traffic crashes because they remove human error from the driving process entirely.

The same holds true in the trucking space. A staggering 87 percent of truck-related crashes are caused by human errors.[1] Trucks are involved in a disproportionate share of crash fatalities, where trucks represent only 1 percent of registered vehicles and less than 6 percent of all miles traveled but are involved in almost 9 percent of all crash fatalities.[2] This translates to somebody dying in a crash involving a freight truck every three hours. Unfortunately, the trend is worsening. 4,311 large trucks and buses were involved in fatal crashes in 2015, an 8-percent increase from 2014.[3] In fact, the number of large trucks and buses in fatal crashes has increased by 26 percent from its low in 2009. 87,000 large trucks were involved in injury crashes in 2015, a number similar to 2014, and the number of buses involved in fatal crashes increased by 11 percent. According to the Federal Motor Carrier Safety Administration ("FMCSA"), in 2015, 33 percent of the fatal crashes involving large trucks involved at least one driver-related factor for the truck driver—including speeding, distraction/inattention, and impairment (fatigue, alcohol, illness, etc.), and 57 percent of fatal crashes involving trucks had at least one driver-related factor for the passenger vehicle driver.[4]

It is important that we not simply cite these statistics as mere talking points. The context of the Committee's inquiry into trucking at this hearing goes beyond exploring the landscape of self-driving technology at an introductory level. The Committee

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[1] See https://www.fmcsa.dot.gov/safety/research-and-analysis/large-truck-crash-causation-study-analysis-brief (Table 1).

[2] For statistics on the number of vehicles and vehicle registrations, see https://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_01_11.html; https://www.fhwa.dot.gov/policyinformation/statistics/2014/mv9.cfm. For information on the breakdown of trucking-related injuries and fatalities, see https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812246.

[3] See https://www.fmcsa.dot.gov/safety/data-and-statistics/large-truck-and-bus-crash-facts-2015.

[4] Id.

is delving deeper into specific issues related to the longer-term application of self-driving technology and automation to trucks and heavy duty vehicles. We encourage the Committee to consider the grave toll that these thousands of fatalities and millions of injuries are having on American society, and how that trend will worsen if higher levels of automated driving technology are prohibited from being responsibly deployed across the transportation landscape in a timely manner. As NHTSA stated in its Federal Automated Vehicle Policy ("FAVP") last year, "whether through technology that corrects for human mistakes, or through technology that takes over the full driving responsibility, automated driving innovations could dramatically decrease the number of crashes tied to human choices and behavior."[5] In its new policy document, NHTSA reiterates this finding, noting that "NHTSA believes that Automated Driving Systems (ADSs), including those contemplating no driver at all, have the potential to significantly improve roadway safety in the United States."[6] This point is just as true for trucks as it is with passenger vehicles.

Moreover, we urge the Committee to consider the productivity and efficiency improvements that will result from the deployment of self-driving technology. Approximately 25 percent of today's nonrecurring congestion is attributable to incidents ranging from a flat tire to an overturned hazardous material truck.[7] Our already overburdened highway infrastructure will be even further strained by freight shipments that will grow another 24 percent by 2025 and 45 percent by 2040.[8] Yet 15–25 percent of truck miles driven are empty and more than a third of the non-empty miles are underutilized.[9] Automated trucks can break the "vicious cycle" of worsening congestion, restrained productivity, and lives lost in congestion-related crashes by driving in off-peak times and increasing the utilization rates.

NHTSA's oversight and jurisdiction covers all motor vehicles, whether light vehicles or heavier vehicles, including those weighing over 10,000 pounds.[10] As such, the Department of Transportation's policy statement and framework for automated vehicles, both the in original version released in September 2016 and the recently revised document released just yesterday, explicitly make clear that the guidance covers all motor vehicles.[11] We do not feel that the Senate or Congress should deviate from that approach and establish a distinction. Congress should continue to encourage NHTSA to leverage its resources, expertise and learnings across all vehicle and equipment types in order to fulfill the Agency's safety mission. Placing medium and heavy duty vehicles, such as trucks, on a separate track would establish a dangerous precedent that would only create confusion, uncertainty, and potentially jeopardize the full safety benefits that self-driving vehicles can potentially provide.

Finally, in light of this Committee's consideration of a new discussion draft of legislation that would address automated vehicle issues, I would like to take this opportunity to provide feedback on some of the key elements that the Coalition believes are necessary to construct a robust, fair, and efficacious legislative framework for automated vehicles.

1. *Clarifying the appropriate Federal and state roles and responsibilities when it comes to fully self-driving vehicles.* The Federal Government should retain the authority to promulgate and enforce nationally uniform motor vehicle safety standards applicable to all vehicle types, regardless of the weight or type of motor vehicle. We do not believe self-driving vehicles present a reason to deviate from that well established precedent. States should be discouraged from creating a patchwork of inconsistent laws and regulations relating to such standards that have the potential to stifle this emerging industry. Any bill should clearly delineate that the states should continue to retain their traditional role in establishing and maintaining the rules of the road, vehicle registration, traffic enforcement, and with respect to insurance, while making clear that it is the Federal Government's exclusive authority to set standards related to the safety, performance, and design of fully self-driving vehicles.

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[5] U.S. Dep't of Transportation, Federal Automated Vehicles Policy (2016), at 5.
[6] U.S. Dep't of Transportation, Automated Driving Systems 2.0: A Vision for Safety (2017), at 1.
[7] *See https://ops.fhwa.dot.gov/aboutus/opstory.htm.*
[8] *See https://www.epa.gov/smartway/why-freight-matters-supply-chain-sustainability.*
[9] *See http://business.edf.org/projects/green-freight-facts-figures/.*
[10] NHTSA's regulatory authority over motor vehicles makes no exception for commercial vehicles. 49 U.S.C. § 30111. NHTSA has issued standards on such subjects as heavy vehicle brakes and tires, bus emergency exits, and motorcoach seat belts. FMCSA's authority over commercial vehicle safety does not conflict with, but instead complements, NHTSA's authority. 49 U.S.C. §§ 30103(a) and 31136(a).
[11] U.S. Dep't of Transportation, Automated Driving Systems 2.0: A Vision for Safety (2017), at 2.

2. *Expanding NHTSA's current exemption authority to permit new safety features unique to fully self-driving vehicles.* Today, Level 4 and Level 5 fully self-driving vehicles are subject to all of the criteria in the Federal safety standards, even though certain decades-old provisions were clearly designed with a human driver in mind. Under today's rules, NHTSA can exempt a maximum of 2,500 vehicles from a manufacturer's fleet for up to 2 years so long as an applicant demonstrates that its vehicles provide a level of safety at least equal to current motor vehicle safety standards. We do not propose any change to the standard of equivalent safety. However, the numerical and temporal limitations on exemptions under current law present a concrete obstacle to achievement of the goal of rapid, safe and robust deployment necessary to attain the safety and mobility benefits we believe fully self-driving vehicles promise. Congress should increase the exempted fleet size and extend the exemption period to advance consumer acceptance and to promote self-driving technology's safety, accessibility, and mobility benefits. Congress also should be mindful to extend such additional flexibility to both traditional OEMs and other developers of self-driving technology. The Coalition sees expanded exemption authority not as a replacement for industry-wide standards, but rather as as a necessary short-term measure to deploy safety innovations pending the completion of extended rulemakings.

3. Encourage USDOT modes, including NHTSA and FMCSA, to appropriately review and address existing Federal regulations, as needed, to ensure that vehicles without human drivers or human driver controls continue to be permissible, to ensure the safety and mobility benefits described.

4. Ensure Consistency Between the Proposed Draft and USDOT's *Automated Driving Systems 2.0: A Vision for Safety,* particularly on categories of safety processes to be considered by AV companies.

I want to thank the Committee for its leadership on these important issues. The Coalition looks forward to serving as a resource concerning both technical and policy questions and working with you to make fully self-driving vehicles a reality.

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PREPARED STATEMENT OF ERIC MEYHOFER, HEAD OF ADVANCED TECHNOLOGIES GROUP (ATG), UBER TECHNOLOGIES, INC.

Hon. JOHN THUNE, Chairman,
Committee on Commerce, Science, and
  Transportation,
United States Senate,
Washington, DC.

Hon. BILL NELSON, Ranking Member,
Committee on Commerce, Science, and
  Transportation,
United States Senate,
Washington, DC.

Dear Chairman Thune, Ranking Member Nelson, and Members of the Committee:

We appreciate the opportunity to provide written testimony on self-driving vehicles and, more specifically, the significant safety advantages regarding self-driving commercial motor vehicles on our highways.

Self-driving trucks can lead to significant and outsized safety gains for all road users. Therefore, the Committee should not delay in establishing a safety-oriented regulatory environment for all vehicles that will encourage ongoing investments in the research and development of these technologies.

In 2015, Uber launched our Advanced Technologies Group (ATG) which focuses on developing both self-driving cars and Class 8 freight trucks. In our trucking efforts, we are driven by the vision of self-driving trucks becoming the safest and most efficient way to move freight. We are also motivated by the knowledge that technology has long been the driver of transportation safety gains. Forward collision warning and crash imminent braking systems in heavy trucks are already estimated to reduce fatalities by 24 percent and decrease injuries by 25 percent.[1] New technologies such as lane keeping assistance and adaptive cruise control features have begun to have significant impacts as well. Put simply, full self-driving systems are the logical next step in the decades-long evolution of technology driven safety improvements in trucking.

Self-driving trucks will lead to many benefits not just for the trucking industry but also for the public at large. First and most critically, these trucks will be involved in fewer crashes, especially tragic fatal ones. That is good news for everyone because approximately 3 in 4 fatal truck crashes involve a collision with another ve-

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[1] *NHTSA, UMTRI*

hicle,[2] and over 80 percent of deaths are those of people that were outside the truck.[3] Truck drivers will also benefit enormously, as theirs is the single deadliest profession in absolute numbers.[4]

Additionally, self-driving trucks will reduce gridlock due to fewer crashes and from the increased ability to use off-peak times, such as driving safely in the middle of the night. In turn, this will improve the utilization rates of trucks, cut overall shipping times and make the national freight network more efficient. As a result, there will also be less fuel waste and fewer harmful pollutant emissions. Taken together, and in light of the central role that trucking plays in the national economy,[5] self-driving trucks could one day help support broader economic growth.

These ultimate benefits are well-known and understood by experts, but before they are realized, we must first build and iterate on the technology. The Uber ATG team is hard at work doing just that. Although we have engaged in limited trucking pilots, we have not yet developed self-driving trucks that are capable of sustained operation without a driver behind traditional driving controls. However, we believe that achieving such capabilities for ramp-to-ramp driving on interstate highways is one of the best near-term opportunities for any self-driving vehicle, not just trucks.

The autonomous vehicle industry is still in the early stages, but Uber believes this is the right time for Congress to act. We look forward to continuing to work with the Committee to shape legislation that will establish a smart, safe, and responsible regulatory framework. Your work on these issues today will help encourage strategic, long-term innovation in this space.

Self-driving trucks on interstates offer outsized safety gains for all of us who share the road and significantly advance the development of the entire autonomous vehicle ecosystem because:

1. Automated high-speed highway driving offers great potential safety benefits (especially since trucks are disproportionately represented in fatal crashes) yet presents a more straightforward engineering challenge.

2. Trucks on interstates offer unique opportunities for rapid learning and safety gains for all self-driving vehicles. The technical learning from self-driving trucks helps accelerate the development of all vehicles with self-driving technologies because trucks more frequently face the challenging highway scenarios that any self-driving vehicle needs to overcome.

3. The trucking industry long ago established best practices in fleet management and complex transportation networks that are crucial for the development of many self-driving efforts.

Automating trucks on interstates provides an excellent near-term safety opportunity.

Freight trucks are disproportionately involved in serious crashes: combination trucks are only 1 percent of registered vehicles and drive less than 6 percent of all miles traveled, but are involved in almost 10 percent of all crash fatalities.[6] This translates to someone dying in a crash involving a freight truck every three hours. And while 87 percent of truck-related crashes are caused by human errors,[7] it also bears noting that many of these errors are those of other motorists engaging in risky behavior around large trucks.

Self-driving trucks will mitigate and prevent crashes caused not only by truck drivers, but also by drivers in other vehicles. That is because self-driving technologies do more than just avoid the unsafe behaviors, distractions and fatigue of a truck driver. They also enable a self-driving truck to "see" in all directions at once, react faster, and even predict cut-offs and other movements of neighboring vehicles. In other words, the same factors that result in trucks being disproportionately represented in serious crashes could also result in disproportionate safety gains in the automation of trucks relative to other vehicles.

This places trucks on freeways at the forefront of our ability to begin realizing the safety potential of all self-driving vehicles. Because of the high-speed environment and the difference in the mass of trucks versus cars, crashes with heavy trucks tend to be much more serious than those involving just cars. Yet the interstate highway environment also offers a somewhat easier engineering challenge for our team to solve in the near term. On the highway, the flow of traffic is predict-

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[2] *FMCSA*
[3] *NHTSA*
[4] *BLS*
[5] Over 70 percent of the goods all Americans use every day are moved by truck. (*ATA*)
[6] *US DOT, FHWA, FMCSA, NHTSA*
[7] *FMCSA*

able, the lanes are wide and there are few or no cross streets. Pedestrians, bicycles and other vulnerable road users are a rare occurrence, and there are no traffic lights and sharp turns to navigate. Moreover, it is relatively straightforward and cost-effective to create and maintain maps of the few hundred miles of interstate lanes on which the first self-driving trucks will drive.

Because self-driving trucks can lead to such significant and outsized safety gains for all road users sooner rather than later, we should not delay in establishing a safety-oriented regulatory environment that will encourage ongoing investments in the research and development of these technologies.

Research and development of self-driving trucks enables rapid improvement in the safety of all self-driving vehicles, not just trucks.

At Uber ATG, our self-driving trucks and cars will be different products with different customers and business opportunities. However, the engineering team developing the core technology is the same. Furthermore, the majority of the hardware and software powering our self-driving efforts is also used across both vehicle platforms. This is no accident—last year, we expanded our self-driving efforts to include trucks precisely because we saw a great opportunity for cars and trucks to learn from one another and improve in tandem, thereby accelerating our ability to capture the safety potential of self-driving vehicles.

During these early days of the self-driving industry, vehicles with the new technologies will be deployed in an overwhelmingly human-centric driving environment. The challenging high-speed scenarios encountered more frequently by self-driving trucks on interstate highways will also need to be mastered by all autonomous vehicles. Our engineers will efficiently and quickly leverage the highway safety learning of self-driving trucks to realize even greater safety gains with our self-driving cars, benefitting all road users.

Self-driving trucks and self-driving cars are part of the same transportation ecosystem, as are all traditional vehicles of all sizes. A decision to pass legislation that only provides regulatory certainty for some motor vehicles while leaving others in an uncertain status would have the practical consequence of delaying the development of the technology for the vehicles not covered by the legislation. Businesses, especially in the trucking industry, operate on long lead-times and require clarity with respect to regulatory matters. In addition, because the roads and basic technologies are shared, such a delay in establishing basic safety and vehicle design standards for self-driving trucks would directly delay and impede the development of all autonomous vehicles for highway driving and, ultimately, slow progress on road safety for all Americans.

Professional fleet operations and maintenance are the norm in the trucking industry.

As has been widely noted, including in Uber's June 13, 2017 written testimony for this Committee, most technology companies and OEMs are investing in a fleet model when it comes to their self-driving efforts. That approach holds the key to faster and safer development of these technologies. The fleet model makes self-driving technology more cost effective, provides for shared learning and improvement of all vehicles in the fleet, greatly improves overall efficiencies in the deployment and routing of automated vehicles and—most importantly—ensures that the vehicles are deployed in the safest manner possible and only in the conditions that they are able to safely operate in.

We are excited that Uber will be at the forefront of this transition in passenger vehicle use from the traditional manufacturer-sold, owner-operated model to the shared fleets that self-driving cars will need. But while ride-sharing services like ours are a relatively new option for the mass mobility of people in cities, the trucking industry has depended on fleets and advanced network management to get goods across great distances for many decades. As such, the large cadre of professional truck drivers, safety-oriented fleet maintenance and management, and advanced supply chain operations mean that long-haul trucking is an ideal setting for self-driving technologies.[8] Given that the vast majority of research and development work in all self-driving vehicles for the foreseeable future will be based on the fleet model, we should not delay in implementing a regulatory safety framework that

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[8] We note, also, that the business-to-business nature in the development of self-driving trucks will further promote safety-first efforts. Large shippers that need to move valuable goods across the country and the motor carriers they rely upon for freight transport will demand tangible and measurable safety improvements over traditional driving. They will not adopt self-driving technology simply because they are "gadget enthusiasts" nor will they be subject to the same temptations as individual consumers to push the technology to its limits and potentially misuse it.

would foster great innovation in the one industry with the longest-established best practices in fleet based transportation.

Recommendations

We are encouraged by congressional interest in establishing a clear role for the Federal Government in the regulation of self-driving vehicles, starting with a framework for vehicle design standards that would ensure safety while encouraging further investment in research and development. We believe it is critical that all vehicles benefit from the regulatory certainty that comes with Federal legislation. It is especially important that the trucking industry, which has high capital expenditures, long lead times, and is dependent upon the smooth flow of interstate commerce, not be left in limbo while legislation covering different classes of vehicles moves forward. Such an outcome would not only be contrary to current Federal Motor Vehicle Safety Standards but also hinder the development of the entire autonomous vehicle ecosystem.

We therefore recommend that any legislation encompass all self-driving vehicles, so that they can be subject to the same basic vehicle design and safety standards. That is the best way for Congress to encourage today's ongoing safety-first R&D efforts in the self-driving space. Although this is just the first step, we are very bullish about the future of trucking, both self-driving and traditional. Earlier this year Uber announced the launch of Uber Freight, a significant long-term investment in improving traditional freight efficiency through a more effective freight brokering approach, with a focus on addressing many of the pain points for truck drivers today and well into the future.

As Uber continues to expand our self-driving ventures in trucking and passenger vehicles, we are eager to continue working with Congress and all other stakeholders in the drive to deploy self-driving vehicles safely and rapidly. We are committed to building and rolling out the technology in the safest way, as demonstrated in our close cooperation with the State of Colorado, including the Colorado State Patrol, before successfully delivering the world's first shipment by a self-driving truck in October 2016.

Uber thanks Chairman Thune, Ranking Member Nelson, Senator Peters and all members of the Committee for their continued leadership and foresight on these issues. We greatly appreciate the opportunity to share our vision for the future of the entire self-driving ecosystem, and look forward to working with you all to ensure that we are maximizing the benefits of this technology for all road users.

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EMBARK

September 21, 2017

Chairman Thune, Ranking Member Nelson, and distinguished members of the Committee, thank you for opportunity to submit written testimony for the hearing "Transportation Innovation: Automated Trucks and our Nation's Highways." Embark Trucks, Inc. (Embark) is a San Francisco-based developer of software that powers automated driving systems for trucks. Embark's aim is to develop a self-driving system that can pilot a truck, *without a human occupant,* from exit to exit on long haul highway routes.

We appreciate the opportunity to provide the perspective of our company from the front lines of the nascent automated vehicle industry given the vast amount of speculation, hype, and misconception that has permeated this topic in recent years, especially with respect to commercial vehicles. From concerns at the dawn of the industrial revolution to President Johnson's National Commission on Technology, Automation, and Economic Progress in the 1960s, the debate on automation and fears of the disruption it may cause is not a new topic.

This is not to minimize such concerns, rather to point out that innovation, progress, and growth often come at the cost of disrupting business as usual. How we as a country support and empower the individuals and businesses affected by such disruption is a worthy topic of discussion, but we sincerely hope that the path of simple obstruction is not an option.

This testimony will cover these four topics for the Committee:

(1) Why trucking is now seen as a leading application for automation, attracting interest from major companies, startups, and foreign governments.

(2) How self-driving technology will be introduced to the trucking industry

(3) What the impacts of truck automation will be for the industry and American economy

(4) Why automated vehicle legislation should include all vehicles

Why Trucks

Within the automated vehicle industry, heavy duty commercial vehicles have recently emerged as a likely early use case for high automation. Sessions on automated trucks at annual conferences have grown from nearly empty to standing room only. Startups have been joined by large companies like Waymo and Tesla in exploring how automated driving technology can be applied to commercial vehicles. Governments from the United Kingdom and Netherlands to China are investing in automated truck research. While self-driving passenger vehicles might best capture our imagination given America's love affair with the car, the potential benefits to commercial trucking actually create a clearer case for on-highway truck automation.

On a technical level, the many hours a long-haul truck spends on multi-lane, limited access highways and interstates is an ideal first environment for automation. A driverless truck restricted to highway environments would not have to contend with pedestrians, cyclists, intersections, or traffic lights. For automated systems that require detailed 3D maps, maintaining maps of 48,000 miles of interstate is more attainable and lower cost than mapping all 2.6 million miles of paved roads in the U.S.[1] From the business case perspective, the trucking industry has a clear financial incentive to adopt new methods of improving productivity and safety while reducing costs. While passenger vehicle decisions can be made for a variety of reasons—convenience, comfort, brand loyalty—the pragmatism of the trucking industry means if something new can be proven to improve efficiency or reduce crashes, fleets will pay attention.

How Automation Will Be Deployed

As many stated during the Commerce Committee's September 13th hearing on the topic, truck automation will not happen overnight. Today we are seeing the maturing of commercially available level 1 automation technology in trucking with adaptive cruise control systems. Capabilities of these types of driver-assistive systems will continue to increase in the future. At Embark, our goal lies beyond driver assistive, to design a system that is capable of operating from exit to exit without a human in the cab. However, this does not mean "professional driver" will cease to be a viable profession in a matter of years, despite much of the sensationalism around this issue.

Early driverless systems will aim to tackle the "low hanging fruit" of freight trucking: long, simple stretches of interstate outside of dangerous weather conditions and with non-hazardous cargo. Even on relatively simple routes, there are many complex logistical and operational issues that will need to be overcome in cooperation with regulators, law enforcement, and other stakeholders. Each fleet or shipper will have to evaluate the technology and decide if it is the right fit for their needs, and if so, what portion. It is likely that some portions of long, predictable truck runs become automated while other portions are kept manual to deal with last minute changes in dispatching, capacity, or complex weather. Experienced drivers may prefer local or regional routes that use their technical driving skills in urban environments and allow them to sleep in their own bed every night. The bottom line is that automation will not be everywhere, all at once. But automated trucks are coming, and over time will significantly improve the freight trucking landscape.

Impacts of Freight Trucking Automation

So what will the impacts be, and what's at stake? Freight trucking is a $726 billion industry that moves over 70 percent of the Nation's freight.[2] The industry is the circulatory system of the American economy, and its health and efficiency touch virtually every other industry and consumer. Every product we buy or export includes some cost of moving it. Thousands of fleets and owner-operators operate under tight timelines and tighter margins, bringing us the things we need each day to run our businesses, care for the sick, and live our lives.

First and foremost, automation holds the key for turning the tide in the struggle for safer roads. Embark is a proud member of the Road to Zero Coalition, and we firmly believe that deploying highly automated driving systems for both cars and trucks is the only way to truly get to a future of zero road fatalities when 87 percent

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[1] While there are over 2.6 million miles of paved roads in the United States, only about 228,000 miles are part of the National Highway System, and less than 48,000 miles—or about 1.8 percent—are interstate per Federal Highway Administration—Highway Statistics 2013 *Table HM–12* and *Table HM–15*

[2] American Trucking Associations (*http://www.trucking.org/News_and_Information_Reports _Industry_Data.aspx)*

of large truck crashes[3] and 94 percent of all vehicle crashes[4] are due to human error. NHTSA has estimated the total value of societal harm from motor vehicle crashes in 2010 was $836 billion, including $242 billion in pure economic costs—$784 for every person living in the United States and 1.6 percent of GDP.[5] Highly automated trucks can eliminate the dangers of driver distraction and fatigue that are the constant subject of an ever-evolving regulatory regime. There are certainly many miles to travel, both literally and figuratively, to bring self-driving trucks to market. However, simply put, when 11 people per day die in truck related accidents in the United States, the safety potential from truck automation is too dramatic and important to delay.

The economic impacts of truck automation are significant and positive. Much attention has been focused on the first order benefit of reducing operating costs to move freight. However, while this effect will alone have the broad impact on the cost of both raw and finished goods, automation can dramatically reshape what is possible for the freight trucking industry to accomplish in service of a multitude of other industries. Imagine the benefits of reducing by several days the time it takes to move goods across the country because a self-driving truck can run the majority of a long-haul route free from hours of service regulations meant to manage human fatigue. Wastage of perishable goods would be reduced, medical equipment would be delivered to hospitals faster and cheaper, and business inventory decisions could be made later with better information. American manufacturing would have an advantage of a freight system that is safer, cheaper, and more efficient than other parts of the world.

Furthermore, it is estimated that the relative skill of a driver can account for a 35 percent difference in fuel efficiency.[6] Self-driving trucks can learn to drive a route in a maximally efficient manner, and do so reliably every time, contributing significantly to freight trucking efficiency.

On a broad economic level, the U.S. is facing slowing growth in both labor force productivity and size, which will create headwinds for GDP growth. The McKinsey Global Institute estimated that automation technologies, including heavy truck automation, could improve global productivity growth by as much as 1.4 percent annually.[7]

Labor interests have voiced understandable concern regarding how automation may affect current and future drivers. The industry is currently facing a driver shortage as well as a demographic cliff of older drivers retiring—all at a time when freight tonnage is forecasted to increase by over 36 percent in the next decade driven by online retailing and other trends.[8] Automation can help fill this gap. In the medium term, as automated long-haul routes are established, some drivers will be attracted to an expected increased volume of local and regional routes that include moving freight to staging areas for automated routes. Such routes would rely more heavily on the skillsets of experienced drivers to navigate complicated non-highway roads while providing a higher quality of life by allowing them to stay close to home. It is important to note that automation will not be everywhere, all at once. Development of self—driving systems will take years, while deployment will occur in specific use cases, on specific routes. A deliberate pace of deployment will allow working collaboratively with the driver community to address any job displacement from long-haul routes and augment training to allow drivers to take advantage of new types of jobs created by truck automation—while still ensuring the broad economic benefits of truck automation. We firmly believe, based on our in-depth understanding of self-driving truck technology, that everyone employed in the trucking industry today will be able to retire in the trucking industry.

Why Include Commercial Vehicles in Legislation

At this early but critical stage in the development of a regulatory regime, we believe it is in the best interest of the Federal Government, technology developers, and the road-faring public that Congress includes heavy vehicles in any national frame-

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[3] Large Truck Crash Causation Study, Federal Highway Administration, July 2007

[4] Singh, S. Traffic Safety Facts Crash Stats. Report No. DOT HS 812 115. Washington, D.C.: National Highway Traffic Safety Administration

[5] NHTSA "The Economic and Societal Impact of Motor Vehicle Crashes 2010 (revised 2015)" available at *https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812013*

[6] American Trucking Associations Technology and Maintenance Council Recommended Practice 1114A: Driver's Effect on Fuel Economy

[7] McKinsey Global Institute, "A Future That Works: Automation, Employment, and Productivity," Jan. 2017. Available at *http://www.mckinsey.com/global-themes/digital-disruption/harnessing-automation-for-a-future-that-works*

[8] ATA Freight Transportation Forecast 2017 (*http://www.trucking.org/article/ATA-Forecasts-Continued-Growth-for-Trucking-and-Freight-Economy*)

work. From our perspective, it is important that Congress's work builds on NHTSA's *inclusive* approach and avoids creating a bifurcated regulatory environment for automated vehicle equipment that excludes heavy vehicles.

We are not alone in believing the first applications of vehicle automation are best suited for long haul freight trucking, from both a technical and economic perspective. By excluding heavy vehicles, Congress risks ignoring the growing industry consensus that early applications of vehicle automation, including self-driving systems, will likely include long-haul trucking.

Excluding heavy vehicles from the Senate bill will not prevent the development of this technology, which will continue under various state-level regulatory regimes. However, the practical effect will be to leave the development of this important technology outside of the emerging Federal regulatory regime intended to promote certain safety, transparency, and cybersecurity practices while increasing uncertainty and complexity for technology developers. Meanwhile, international efforts to develop similar technology w ill continue with full-throated support from foreign governments. China has recently announced that it intends to become the world leader in artificial intelligence—the key to unlocking level 4 and 5 automation—by 2025. This is no idle threat. Chinese automated truck companies are testing on road today, and the Chinese government roadmap foresees their core AI industry being worth $59 billion by 2025, with associated industries including self-driving being worth a combined $740 billion.[9] Legislation that only supports lower levels of automation or certain vehicle types will not allow America to maintain its current but threatened position as leader on technologies that will power the global economy in the coming decades.

There are certainly additional regulatory and operational issues specific to commercial vehicles that FMCSA and other relevant agencies will need to address in consultation with industry as highly automated trucks are developed. Nothing in the current draft as contemplated by the Committee would circumvent this important work from proceeding thoughtfully and with deliberate speed if trucks are included. But from an equipment perspective, the sensors,processors, and software that will power automated trucks are not dissimilar from those that will power automated passenger vehicles. The testing, validation, and cybersecurity requirements to prove the safety and reliability of automated driving systems will still need to be of the highest rigor regardless of vehicle type. Fundamentally, we believe the most sensible way forward for this and future bills is to continue to build framework for establishing if an automated vehicle is safe for public roads, regardless of the size of the vehicle.

Conclusion

Embark thanks Chairman Thune, Ranking Member Nelson, and the rest of the Committee on their thoughtful leadership on this issue, and the opportunity to share our perspective as a leader in commercial vehicle automation. We are eager to continue to contribute to a clear-eyed conversation on how best to deploy this technology safely and efficiently for the benefit of the American public and American economy.

Respectfully,

ALEX RODRIGUES,
CEO and Co-founder,
Embark.

JONATHAN MORRIS,
Head of Public Policy,
Embark.

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PREPARED STATEMENT OF TRUCK SAFETY COALITION

The Truck Safety Coalition (TSC) thanks Members of the U.S. Senate Committee on Commerce, Science, and Transportation for holding this important hearing, "Transportation Innovation: Automated Trucks and our Nation's Highways." We look forward to working with members of the Committee as well as safety advocates, technology companies, and leaders in the trucking industry to continue discussing the role of autonomous technologies in commercial motor vehicles and to develop an oversight framework that prioritizes safety first.

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[9] Kania, Elsa. "China's Artificial Intelligence Revolution." The Diplomat. July 27, 2017. Available at *http://thediplomat.com/2017/07/chinas-artificial-intelligence-revolution/*

TSC recognizes the potential safety benefits of autonomous technologies in trucking, especially at a time when truck crashes continue to climb. Since 2009, truck crashes have gone up by 45 percent, resulting in a 20 percent increase in truck crash fatalities and a 57 percent increase in truck crash injuries. To make matters worse, truck vehicle miles decreased by three percent in that same time, meaning that the truck crash involvement, truck crash injury, and truck crash fatality rates have all increased over the past six years.

Current technology

While TSC is excited that autonomous technologies have the potential to prevent and mitigate thousands of crashes resulting from human error, we also want to ensure that the process for testing and developing AV technology in trucks does not jeopardize public safety. As we continue to figure out the details of the regulatory framework associated with AV technology, we urge lawmakers to work towards mandating automatic emergency braking (AEB) and heavy vehicle speed limiters on all trucks.

Mandating speed limiters be set on all trucks is a commonsense step to improving truck safety that will produce more net benefits than costs. Since the 1990s, speed limiter technology has been built into all truck engine control modules, which eliminates the cost of installing this life saving technology. Additionally, motor carriers will see a return on investment by reducing their speed-related, at-fault crashes—some of the deadliest and costliest types of truck crashes. In fact, the Ontario Ministry of Transportation found that speed-related, at-fault truck crashes dropped by 73 percent after Ontario's truck speed limiter mandate took effect.

Automatic emergency braking is not a new technology either. The European Union mandated AEB on large trucks back in 2012, requiring all new trucks to be equipped with it by 2015. Here in the U.S., motor carriers have been using AEB long enough to establish its effectiveness and reliability. In fact, one trucking company saw their number of rear-end collisions decrease by nearly 80 percent from 2003 to 2015 after equipping their fleet with an active system of collision avoidance and mitigation.

Another large trucking company, performed an internal study over a 30-month period on approximately 12,600 of its trucks to determine the extent to which a suite of safety technologies (AEB, electronic stability control (ESC), and lane departure warning) installed on the trucks in its fleet reduced the frequency of various types of collisions. The results were clear and compelling: trucks equipped with the suite of safety systems had a lower crash rate and frequency of engagement in risky driving behavior compared to vehicles without such systems; these trucks exhibited a 71 percent reduction in rear-end collisions and a 63 percent decrease in unsafe following behaviors.

We urge members of the Committee to look at the drastic reductions in truck crash fatalities in the European Union, which requires both speed limiters and automatic emergency braking. Listen to the CEOs of successful companies who will attest to the safety and cost benefits of equipping their trucks with these technologies. Meet with the survivors and families of victims of truck crashes that could have been prevented had these technologies been mandated.

Speed limiters and automatic emergency braking serve as building blocks to achieving a fully autonomous truck, and, more importantly, can improve safety today, rather than several years from now.

AV Technology

The deployment of autonomous technology in trucking is both inevitable and fast approaching. Yet, the rapidity of the technological advancements in trucking does not absolve the Department of Transportation of its responsibility to promote safety across an industry that engages in Interstate commerce on publicly funded roads. The DOT must go beyond a weak voluntary agreement and develop a regulatory framework that protects public safety without stymying innovation.

As we approach a future where driver-assisted and autonomous commercial motor vehicles will be operating alongside driver-operated vehicles, it will become increasingly important for the Federal Government to ensure that the test to determine the efficacy of AV technology as well as the technology itself are standardized. Failure to create agreed upon methods and metrics to determine success could result in trucks operating with unreliable and unsafe technologies and testing that does not accurately assess whether a technology will perform as it is intended. This creates two potential problems: (1) a technology intended to make our roads safer will instead diminish road safety, and (2) the public's confidence in this technology will erode, making it more difficult to roll out on a large scale.

No exemptions for trucks

The Truck Safety Coalition supports several recommendations that we believe will make sure that the rollout of AV technology in trucks is both safe and smooth:

There should be no exemption for commercial motor vehicles from Federal legislation regarding the development and deployment of autonomous vehicle technology. Although trucks and cars should face different performance and testing standards, Federal oversight for trucks is critical.

Manufacturers of AV Technology Requirements

- AV systems must comply with Federal Motor Vehicle Safety Standards without any exemptions
- AV systems must meet or exceed a "functional safety standard" as to be determined by the National Highway Traffic Safety Administration (NHSTA)
- AV systems must meet or exceed a minimum cybersecurity standard as to be issued by the Secretary within 3 years of enactment of this legislation
- Submit a detailed report that analyzes the safety performance of automated driving systems and automated vehicles
- Remove from operation any autonomous commercial motor vehicle with a defect
- Determine whether a defect affects one vehicle or if the defect is fleet-wide
- Report all fatal, injury and property damage only crashes involving driver-assisted and autonomous trucks to NHTSA
- Establish a privacy plan

Motor Carrier Requirements

- Apply for additional operation authority
- An operator with a valid commercial driver's license must be in the autonomous commercial motor vehicle at all times
  - The operator shall have an additional endorsement on his CDL denoting that he has been adequately trained to manage the AV technologies in the truck

Secretary of Transportation Requirements

- Establish a database for autonomous commercial vehicles. Information should include:
  - Vehicle's identification number
  - Manufacturer, make, model and trim information
  - Level of automation and operational design domain of each of the vehicle's automated driving systems
  - Any exemptions from Federal motor vehicle safety standards granted to the vehicle
- Promulgate a regulation on driver engagement
- Determine any additional enforcement measures pertaining to AV technology that state and local law enforcement should consider during road side inspections
- Request and direct additional resources to NHTSA and the Federal Motor Carrier Safety Administration (FMCSA) to develop regulations and execute enforcement efforts relating to AV technology.

We strongly believe that AV technology has the potential to eliminate many preventable injuries and needless deaths, but policy-makers must proceed prudently. Policy-makers should look to ensure that we are proceeding safely in our pursuit of achieving safe and reliable AV technology in trucks. We hope to work with members of the Committee as well as other interests to determine the benchmarks of adequate testing, the extent of Federal oversight, and the details of safety standards as we work towards realizing driver assisted and autonomous trucks that reduce crashes, prevent injuries, and save lives.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. MAGGIE HASSAN TO
COLONEL SCOTT G. HERNANDEZ

Question. Mr. Clarke noted in his testimony, that he sees drivers becoming "more like airline pilots", and keeping an eye on the fleet and managing various aspects of the trucking experience. While I'm pleased to see that he and other truck manufacturing companies see truck drivers staying in their jobs in a slightly different role, I do want to address the larger issue of employment in this workforce. New Hampshire is home to over 27,000 people who work in the trucking industry. What kinds of job training and re-training should be available to these workers? What is the role of industry in helping us alleviate these challenges?

Answer. While I appreciate the question, the issue is outside my area of expertise and I would defer to the other expert witnesses on the panel.

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RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. MAGGIE HASSAN TO
TROY CLARKE

Question. Mr. Clarke, thank you for your testimony. You note in your testimony, that you see drivers becoming "more like airline pilots", and keeping an eye on the fleet and managing various aspects of the trucking experience. While I'm pleased to see that you and other truck manufacturing companies see truck drivers staying in their jobs in a slightly different role, I do want to address the larger issue of employment in this workforce. New Hampshire is home to over 27,000 people who work in the trucking industry. What kinds of job training and re-training should be available to these workers? What is the role of industry in helping us alleviate these challenges?

Answer. The industry is already experiencing a driver shortage and as the American Trucking Association pointed out in their testimony, we are expecting that shortage to grow to 1 million drivers over the next decade. Our industry is focused on driver assisted technology that will help attract new, younger drivers to this noble profession. My customers continue to express their views that they still see a driver in the seat of a truck, not the elimination. Regarding training programs, manufacturers are focused on how do we train drivers to use this technology and receive the benefits. I believe that we need training classes, whether through the established CDL process or other formal training, that ensures that drivers are well equipped to handle this technology in the safest way possible.

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RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. AMY KLOBUCHAR TO
DEBORAH A.P. HERSMAN

Distracted Driving. While I was at the hearing there was significant discussion about the ongoing need to reduce crashes caused by distracted drivers. National Highway Traffic Safety Administration data show that almost 3,500 people were killed in distraction-related crashes in 2015—an increase of almost 300 from 2014. I included a provision in the FAST Act to help more states qualify for Federal grants to fight distracted driving, but there is still more to be done. Technology like emergency braking and lane departure warnings can help reduce distraction-related crashes, but the technology is only deployed in about ten percent of trucks.

Question. Ms. Hersman, what can be done to increase the deployment of these technologies in large trucks?

Answer. If we want to see greater penetration of life-saving technology, we can pursue regulations to require a standard for new manufacture and/or retrofit, we can encourage or incentivize all commercial motor vehicle manufacturers to offer AEB as a voluntary standard, and we can educate operators on the benefits and the return on investment for the technology so they will elect to purchase only vehicles with this technology.

NSC recognizes that mandating or regulating safety standards in the U.S. has not been as prevalent as it once was due to industry opposition and the lengthy process for finalizing rules, but we are falling behind the rest of the world when it comes to embracing technology and adopting standards. The European Union required all new trucks and buses sold after November 1, 2015 to be equipped with advanced emergency braking systems and lane departure warning systems. While these technologies are often available as options—safety should not be dependent on the operator upgrading their option package—these lifesaving technologies protect not just the commercial driver, but the travelling public since 90 percent of fatalities involving large commercial vehicles are the occupants of passenger cars.

We applaud the voluntary commitment made in March of 2016 by 20 automakers to include automatic emergency braking (AEB) on all personal vehicles sold in the U.S. by 2022. Toyota has already committed to beat this date and install the technology by 2018. This model can be replicated in the commercial motor vehicle industry. As we learned at the hearing, my fellow witness from Navistar stated that they already offer AEB as standard on their truck tractors, but not everyone keeps it as an option. This model can be replicated for other technologies as well, like lane departure warning and blind spot monitoring.

We appreciate your leadership on distracted driving and your efforts to engage your colleagues on this important issue—the public looks to legislators and policy-makers to set the standards for acceptable behavior and passing strong laws sends a message that distracted driving is not acceptable. The National Safety Council supports your efforts. Additionally, NSC works with businesses to eliminate the use of mobile devices behind the wheel. Some of our member companies have instituted complete cell phone bans—hand-held AND hands-free—and we encourage all businesses to evaluate such an option.

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RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. MAGGIE HASSAN TO DEBORAH A.P. HERSMAN

Question. Mr. Clarke noted in his testimony, that he sees drivers becoming "more like airline pilots", and keeping an eye on the fleet and managing various aspects of the trucking experience. While I'm pleased to see that he and other truck manufacturing companies see truck drivers staying in their jobs in a slightly different role, I do want to address the larger issue of employment in this workforce. New Hampshire is home to over 27,000 people who work in the trucking industry. What kinds of job training and re-training should be available to these workers? What is the role of industry in helping us alleviate these challenges?

Answer. The National Safety Council is committed to eliminating preventable deaths at work, in homes and communities and on the road. Unfortunately, the transportation sector is one of the deadliest occupations. Motor vehicle crashes are also the leading cause of ALL workplace deaths. It is important to recognize that moving these jobs from the cab of a truck to a control room could would result in greater safety on-the-job for these professionals.

Thinking about the driving task, I do not believe that truck drivers will be forced out of their jobs for the foreseeable future. Commercial interstate driving along long stretches of controlled-access highways may be the first sector to see level 4 or 5 trucks, but we must recognize that some real-time monitoring will be required—whether in cab or from a remote location. The monitoring, much like controlling air traffic or operating a drone, will require qualified and trained professionals. Additionally, when an automated vehicle exits highly controlled environments to navigate city streets and make deliveries, it is likely that drivers will be necessary even on basic routes for the near term. Additionally, the driver plays other important roles, like verifying the safety of the vehicle before a trip, monitoring changing conditions and safely securing a load—these functions cannot be done by a machine today.

As the trucking industry evolves, some new jobs will be created to help monitor fleet operations and ensure proper vehicle maintenance. These jobs and perhaps others that we cannot conceive of today, will likely require a higher level of technical skills. In order to ensure a smooth transition for these workers, Congress, states and industry should ensure technical training is widely available, with a special emphasis on reaching existing truck drivers. State and local programs already exist that may be good models to consider. Finally, our junior colleges and technical schools could play an important role in providing STEM education and targeted training needed to fill these new roles. Creating high-paying, rewarding and safe jobs is something everyone can get behind.

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RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. BILL NELSON TO CHRIS SPEAR

Question. Workforce issues are important to the truck drivers, who keep our economy moving, and to the companies that rely on their skilled labor to deliver goods. What steps should Congress take to address the impacts that automated technologies will have on the trucking industry?

Answer. Thank you for your question, Senator Nelson. It is important to remember that one of the main impacts automated technology will have on the trucking industry and its drivers is the reduction of crashes. These technologies are also ex-

pected to bring benefits to the trucking industry in productivity, efficiency, and driver health and wellness. Congress should encourage the development of this technology and establish a clear leadership role for the Federal Government in automated truck policy which, where necessary, exercises Federal preemption to ensure that there is no conflict between Federal and state regulations. It is critically important to provide certainty to the developers of automated truck technology that there will not be a disparate set of state laws, now or in the future, that unnecessarily impedes the ability of a company to test and operate vehicles with their technology across state lines and in interstate commerce. This will allow more on-road data to be collected more quickly, which will lead to improved system design and better information for making both regulatory and business decisions, including gaining a better understanding of how automated technologies will affect the role of the driver in real-world applications. Expanding the number and duration of exemptions that NHTSA is authorized to allow from current standards that prevent new safety technology from being put on the road will also help in this regard. Congress could also direct FMCSA to review Federal Motor Carrier Safety Regulations and see what might be changed to account for the new driving environment with automated technology where the driver may be in the seat but not operating the controls. A better understanding of how these technologies may benefit the public along with consideration of how regulations can be changed to take advantage of the capabilities that this new technology provides will lead to better policy decisions and the development of a regulatory framework that help to realize these benefits. Perhaps there can be changes made in hours of service that would improve productivity without reducing safety? How should speeds be managed with connected and automated technology? These are questions that could be answered as we gather data from real-world testing and operation of vehicles with automated technology.

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RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. AMY KLOBUCHAR TO CHRIS SPEAR

Human Trafficking. I introduced the Combatting Human Trafficking in Commercial Vehicles Act with Chairman Thune to give truckers more tools to recognize and report human trafficking which passed the Senate on September 14. This bill increases coordination of human trafficking prevention efforts within the Department of Transportation, gives the Federal Motor Carrier Safety Administration new authority to work with drivers on education and outreach efforts, and promotes commercial driver's license training. Truckers are on the front lines in the battle against human trafficking and we must support them.

Question. Mr. Spear, what steps has the American Trucking Associations and its members taken to help drivers combat human trafficking?

Answer. Thank you for the question Senator Klobuchar, and for your efforts to bring greater attention to the horrific crime of human trafficking. Let me begin by acknowledging your legislative initiative, the Combatting Human Trafficking in Vehicles Act. I believe that your bill, once enacted, will take an important step forward in improving the Federal coordination of anti-human trafficking efforts, as well as amplifying the outreach, education and reporting efforts against human trafficking. It will be a vital tool in efforts to combat this horrendous crime, a fight that we are all in together. The trucking industry, legislators, law enforcement and the general public, must work hand in glove to bring an end to human trafficking.

ATA and its members have long worked with the industry and our drivers to combat human trafficking. Our drivers are the eyes and ears of the Nation's highways, and are on the front lines of this fight, identifying, reporting and prevent human trafficking. ATA serves on the board of Truckers Against Trafficking, supporting their efforts on education, information sharing, and amplifying resources to fight human trafficking. Additionally, ATA's America's Road Team Captains, made up of a small group of professional truck drivers who share superior driving skills, remarkable safety records and a strong desire to spread the word about safety on the highway, travel the country educating the general public on important trucking safety issues, and also the realities of human trafficking and how to report it effectively.

Many of ATA's members are also actively involved in the Department of Homeland Security's Blue Campaign. Furthermore, numerous ATA members, as well as our federation of 50 state trucking associations, have made tremendous efforts to increase driver education and training on how to identify and prevent human trafficking. And finally, in recognizing the need for greater collaboration between the trucking industry and law enforcement, ATA intends to convene a summit of interested parties on November 30th to discuss issues including human trafficking, and

how we can work more closely together to prevent this terrible crime. These are just some of the efforts ATA and the trucking industry are taking to combat human trafficking, and we look forward to continuing to work closely with you and your colleagues, law enforcement and the good people of our Nation to bring an end to human trafficking.

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RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. MAGGIE HASSAN TO CHRIS SPEAR

Question. Mr. Clarke noted in his testimony, that he sees drivers becoming "more like airline pilots", and keeping an eye on the fleet and managing various aspects of the trucking experience. While I'm pleased to see that he and other truck manufacturing companies see truck drivers staying in their jobs in a slightly different role, I do want to address the larger issue of employment in this workforce. New Hampshire is home to over 27,000 people who work in the trucking industry. What kinds of job training and re-training should be available to these workers? What is the role of industry in helping us alleviate these challenges?

Answer. Thank you for your question, Senator Hassan. Because of the complexity and diversity of the trucking industry, we expect the driver will retain an important role in trucking for a long time to come, with automated truck technology applied to improve safety and productivity. In fact, the trucking industry is currently facing a shortage of drivers, particularly for long-distance drivers, around 50,000. If these trends continue, the shortage could hit over 150,000 in a decade, with projections are that we'll need to hire about 890,000 truck drivers over the next 10 years. As an industry, we are working hard to recruit new drivers and retain the excellent drivers we have now. However, we do not dismiss the importance of considering the potential impact on the workforce and the need to develop programs that will help prepare workers with the skills needed for the jobs of the future. We believe that the application of automated technology in trucking will center on solutions in which there remains a role for drivers, rather than a driverless approach. In addition to monitoring the automated driving systems and manually driving in the cityscape and at loading docks, drivers will retain their current responsibilities for securing the cargo, particularly hazardous cargo, as well as for customer interaction with the shipper and receiver. Trucking companies will train their employees to operate equipment with the new technology and likely promote the availability of the advanced technology on their trucks to attract new and younger workers to the industry. The American Transportation Research Institute, the not-for-profit research arm of the trucking industry, recently released a report on how autonomous technologies will impact the trucking industry. That assessment found that highly automated trucks will likely draw new, younger drivers into the trucking industry by better meeting the job expectations of millennial workers. Additionally, these new technologies are expected to make drivers safer and more productive, making truck driving a more attractive career choice, and attracting new people to our industry. Affected stakeholders from industry, labor and government should embrace this coming innovation and work together to prepare the workforce to operate with the new technology. This issue is not unique to the trucking industry, but applies to drivers of other commercial and non-commercial vehicles as well as other industries where new technologies are being introduced that will change the roles and duties of the workforce. By giving the trucking industry access to the same preemptions that the autos receive in the Senate Commerce AV START Act we can address these concerns now and develop the kind of training and retraining programs that insure that safe vehicle operators remain behind the steering wheel of all commercial vehicles.

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RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. BILL NELSON TO KEN HALL

Question. Workforce issues are important to the truck drivers, who keep our economy moving, and to the companies that rely on their skilled labor to deliver goods. What steps should Congress take to address the impacts that automated technologies will have on the trucking industry?

Answer. Senator Nelson, the first step Congress should take is to study this technology in greater detail. No two pieces of automation technology are exactly the same, so we should not assume that their impacts on workers will be the same either. Congress should explore in depth what type of technology will be deployed first, and then create policies to address the threats each one poses.

In our estimation, downward pressure on wages and the erosion of basic working conditions and safety may be the most significant impact drivers feel from this technology. Anything that undercuts the quality of a truck driver's profession should be a core component of what Congress Studies. Any policy prescriptions stemming from that examination must ensure this profession remains a good, middle-class Sustaining job.

Throughout this process, Congress must also keep in mind that the biggest threat to workers from Self-driving vehicles may not be job losses. Drivers who are never in danger of being laid off may have as much to fear from this technology as anyone. They could face lower wages, a reduction in benefits, fundamental changes to their work Schedules, or a longer work day, If a driver is only performing half of the driving duties he or she once was, or those duties have changed companies may try to change the Current wage rates. Companies may also immediately decide to reclassify drivers as "operators' or "monitors' to avoid paying them on a driver's pay-scale.

When examining all the impacts this technology will have on workers, we should also look past traditional paycheck issues and examine the other ways it will impact a driver's workday. The health and Safety of Workers is a key component of this technology that has largely been ignored. A driver in the cab of an automated truck will have LiDAR, Sonar, and radar sent through their bodies in massive quantities. That exposure could last for days on end, and from far more heavy duty sensors than what will be found in automated passenger cars. What steps is industry taking to examine the physical effects the technology may have on the human body? Being able to get through the workday safely is a core issue facing the driving workforce, so these types of issues should be treated as "workforce issues".

We will work actively with the Committee to identify other issues that will impact workers. From worker privacy concerns, to the need for expanded driver training on new vehicles, to worker liability in the case of a crash, there is a long list of topics that must be examined. Each one poses its own challenge to the driving workforce, and each must be scrutinized in detail so that we can create policies to address them before, not after, this technology is rolled out.

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RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. MAGGIE HASSAN TO KEN HALL

Question. Mr. Clarke noted in his testimony, that he sees drivers becoming "more like airline pilots", and keeping an eye on the fleet and managing various aspects of the trucking experience. While I'm pleased to see that he and other truck manufacturing companies see truck drivers staying in their jobs in a slightly different role, I do want to address the larger issue of employment in this workforce. New Hampshire is home to over 27,000 people who work in the trucking industry. What kinds of job training and re-training should be available to these workers? What is the role of industry in helping us alleviate these challenges?

Answer. Senator Hassan, while I'm also pleased to hear manufactures say there will be a continued role for a driver, they can be of immediate help by explaining what exactly that new role will be. They allude to these other responsibilities a driver will have when in the truck, without ever going into any detail.

The examples they give, like fleet management or dispatching, are not particularly realistic. Drivers in big fleets don't tend to have much familiarity with that side of the business, and assigning these jobs to a driver wouldn't fit into the structure of most large companies. If those are indeed the new job functions that a driver will be performing, industry must make crystal clear what the new expectations of their employees are and provide in depth training. They must also convey to Congress and Safety regulators how a driver would be able to actively monitor the truck's self-driving technology while also performing those new job tasks. Airline pilots are constantly monitoring autopilot technology even when a plane is "flying itself". We need to make sure that a driver is able to do the same. They can't be overloaded with these new responsibilities in a way that could compromise the safety of the vehicle's operation.

What's more, if those manufactures are wrong, and drivers are not needed in the future, there are massive hurdles that you should be conscious of when it comes to retraining people in this profession. The nature of a truck driver's job usually has them out on the road all day, or for multiple days on end. That makes retraining difficult. There aren't usually a significant number of drivers in one centralized location throughout the day who can be pulled into a classroom or other workshop setting for instruction.

To address this, employees must be given days or weeks off, with pay, to complete any comprehensive retraining. As I'm sure you would agree, we cannot accept a sit-

uation where millions of drivers are expected to be retrained on their own dime, or after they've already been kicked to the curb. It will likely be incumbent on Congress to compel companies to share in this sacrifice and look out for your constituents. Our experience shows that companies are unlikely to do this voluntarily without being compelled to do so.

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