Remarks Prepared for

David Strickland, Administrator

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Thank you, Mark [Mark Scheinberg, President, GNYADA] And good morning, everyone. I'm so honored to speak to all of you today.

We're gathered at an exciting moment in the evolution of our transportation systems. There are some tremendous innovations and developments underway that I believe will reshape the context of driving in the future.

Today I want to speak about the amazing prospect of automated vehicles within the larger context of new crash avoidance technologies and our goals for highway safety. As you know, safety is our overarching objective at the National Highway Traffic Safety Administration, and the purpose of our programs is to reduce crashes and resulting deaths, injuries and property damage. For me, crash avoidance is truly the North Star of highway safety in the years to come. And as such, I am encouraged by the new technologies being developed and implemented by automakers and others that have the potential to reduce significantly the many thousands of fatalities and injuries that occur each year due to crashes.

Recently, research activities by several vehicle manufacturers and suppliers to develop "autonomous" or self-driving vehicles that can perform some driving functions automatically in certain circumstances have captured the nation's attention. At the same time, NHTSA and other Department of Transportation agencies, in conjunction with the auto industry, have been conducting in-depth research and demonstration of vehicle-to-vehicle or V2V communications technology.

These activities reflect three distinct but related streams of technological change are occurring simultaneously: (1) in-vehicle crash avoidance systems that provide warnings and sometimes active control of safety functions; (2) V2V communications that support crash avoidance applications; and (3) self-driving vehicles. While all three of these technologies are beginning to converge, today I will focus on V2V communications and self-driving vehicles.

V2V COMMUNICATIONS

V2V communications technologies enable vehicles to automatically send messages and receive warnings about impending crashes so that drivers can take action to avoid a collision. We believe that V2V offers substantial crash avoidance possibilities, particularly when linked to active in-vehicle crash avoidance technologies. In fact, this technology would provide vital information that could enable drivers to avoid or mitigate crashes in 80 percent of the vehicle crash scenarios involving unimpaired drivers.

In 2011 and 2012, NHTSA and our research partners conducted Safety Pilot driver acceptance clinics that assessed drivers' attitudes regarding in-vehicle collision warnings such as "do not pass" alerts. We are encouraged to report that 9 of 10 drivers who experienced these technologies said they believed that they would improve driving safety.

And last August, Secretary LaHood launched the second phase of our vehicle to vehicle research—a real-world field test based in Ann Arbor, Michigan, that includes nearly 3,000 cars, trucks, and buses equipped with V2V communications technology. Conducted by the University of Michigan's Transportation Research Institute (UMTRI), the road test, or model deployment, is a first-of-its-kind test of V2V technology in the real world. The test vehicles, most of which have been supplied by volunteer participants, are equipped with communication devices that will gather extensive data about the operation of the system and its effectiveness at reducing crashes.

To accomplish this, the test vehicles send electronic data messages, receive messages from other equipped vehicles, and translate the data into a warning to the driver during specific hazardous traffic scenarios. Such hazards include an impending collision at a blind intersection, a driver changing lanes into the path of another vehicle hidden in the driver's blind spot, or an impending collision with the rear end of a vehicle stopped ahead, among others.

Vehicle-to-vehicle communication has the potential to be the ultimate game-changer in roadway safety – but we need to understand how to apply the technology in an effective way in the real world. NHTSA will use the valuable data from the 'model deployment' as it decides if and when these connected vehicle safety technologies should be incorporated into the fleet.

NHTSA has announced that we plan to make a decision about the Agency's next steps for V2V technology for light duty vehicles in 2013—and a decision for heavy duty vehicles in 2014.

VEHICLE AUTOMATION

The second emerging technology that I want to address is self-driving vehicles. Among the reasons that so many people are focused on self-driving vehicles are the potential safety benefits for all drivers, including seniors, and for another group that is not currently able to drive, the visually impaired. Our reality on the road today is that the overwhelming majority of vehicle crashes can be attributed to driver error. The great promise of vehicle automation is that these technologies may address the one component for which NHTSA cannot mandate a recall: the human factor.

As in the case of V2V, in order for vehicle automation to be successful, we must have reliable technology and fulfill requirements for safety, privacy, cyber security, and consumer acceptance. Especially in the case of high levels of automation, there is also a real need to develop performance specifications and non-traditional methods to validate the performance of automated driving where the vehicle is making decisions for the driver in complex driving situations. It's clearly a challenge.

We must understand and develop standards and methods of operation that accommodate distinct levels of automated control. To help us do this, we think about the progressively higher levels of automation. As you move up that continuum, the balance between the roles of the driver and the machine steadily shifts more and more toward the machine. The continuum runs from vehicles with no automatic control systems all the way to vehicles with full automation that are capable of self-driving in all traffic and environmental conditions.

We are already familiar with function specific automation, where the driver has complete authority, but cedes limited fundamental control to the vehicle in certain normal driving or crash-imminent situations (such as enhanced steering control, automatic braking, adaptive cruise control, or lane keeping).

Combined function automation involves shared authority: The driver cedes primary control, but is still responsible for monitoring and safe operation. The driver is expected to be available at all times. An example would be a system that combined lane centering with adaptive cruise control for "hands-off" and "feet-off" driving. But it is still "eyes-on" driving; the driver must continually monitor the road and traffic.

In limited self-driving automation driving, the driver can cede full control authority to the vehicle under certain traffic and environmental conditions, but is expected to be ready and able to assume control occasionally. We consider the current Google concept vehicles to be in this category. At this level of automation, it would be possible for the driver to ride "hands-off," "feet-off," and "eyes-off" until the driver (or the vehicle) decides that it's time for the driver to resume control.

In the full self-driving automation mode, the driver provides destination or navigation input, but is not expected to be available for control. Full control authority rests solely on the automated systems. However, the driver can still decide to assume control whenever the driver thinks it is desirable or appropriate to do so. We know of no such vehicle being designed for civilian highway use now, but at some time in the future this may be the logical outcome of the many efforts at automation currently underway.

Automation offers an important and challenging new method for reducing crash risk that we believe holds great promise. The question is what we should be doing in terms of research and demonstrations to ensure that this new technology is responsibly entering the market and is ready for the unexpected. We must anticipate, for example, how vehicles with different levels of automation will respond to each other. As with any new and complicated technology, we must take care to guard against the creation of unintended negative consequences that could affect the public's confidence.

NHTSA has been having extensive discussions with Google and numerous car makers and suppliers about their plans to develop and deploy vehicles with higher levels of automation and the issues that we believe are going to be important to its safe introduction.

The development of increasingly self-driving vehicles is a worthy goal, with great potential for improving vehicle safety. Our challenges include:

- Understanding and evaluating driver behavior in these vehicles

- Developing performance requirements and test procedures for the highly complex potential crash environments that they will encounter, and
- Ensuring that the systems (including sensors, maps, and software) are effective and reliable.

The agency has been conducting research on vehicle automation for many years. For example, our work on electronic stability control (ESC) led us to develop standards that make this function-specific automation technology mandatory on all new light vehicles since MY 2011. As we continue our work on function- specific automation and the safety benefits those single-function systems may offer in the near term, we have begun research on higher levels of automation as well. We have developed a Motor Vehicle Automation Roadmap to examine the performance of automated technology as a vehicle safety system. As part of this work, we plan to conduct research on a variety of topics, including the reliability and cyber security of software systems that support automated vehicle control and on the performance of drivers interacting with these vehicles.

While the agency is conducting research along the entire automation continuum, it is currently placing greatest emphasis on determining whether those crash reduction technologies that are currently available or very soon may be available are not only safe, but effective. However, because these same technologies are the building blocks for what may one day lead to a self-driving vehicle, we have also begun research currently focused on driver behavior in the context of highly automated vehicle safety systems.

The introduction of self-driving vehicles has the potential to change not only the way that vehicles operate, but also the way we at NHTSA regulate them. Most of NHTSA's safety standards assume the need for a human driver to operate the vehicle controls and required safety equipment. A vehicle that drives itself challenges this basic assumption.

This is also true of state efforts to govern motor vehicle safety. State highway safety programs overwhelmingly focus on preventing driver behaviors that are deemed unsafe, such as speeding or impaired driving. When a crash occurs today, we can usually determine, largely through physical examination, what factors contributed to it. This determination may be much more difficult when control of the vehicle seamlessly transitions from the driver to the vehicle and its increasingly interconnected and intelligent electronic vehicle crash avoidance and mitigation systems. It is likely that NHTSA's standards may need to evolve to address these aspects.

NHTSA may also have to consider new methods of testing vehicles in order to specify minimum performance standards for automated vehicles. The agency's regulations currently focus on the performance of safety systems in discrete operating scenarios or test conditions. They require a certain minimum safety performance of a system and specify a test procedure to evaluate this aspect of performance.

On a fully self-driving vehicle, all of the vehicle's safety systems are connected and controlled through a computer which must function in every driving scenario. Thus, testing that vehicle on a test track in one scenario, or even in multiple scenarios, may not sufficiently assess the full range of performance capabilities of the vehicle. We must consider the cumulative cost of test track testing and the supplementary role that might be played by other methods such as simulation.

Automated vehicles will use some combination of sensors, GPS, and telecommunications to obtain information in order to make their own judgments regarding safety-critical situations and act appropriately by asserting control at some level. Accordingly, vehicles equipped with V2V technology that provides safety warnings are not automated vehicles, even though such warnings by themselves can have significant safety benefits and can provide very valuable information to the driver. However, the development, reliability, and broad-scale implementation of the highest level of automation may conceivably rely on V2V technology as an important input to ensure that the vehicle has full awareness of its surroundings.

In addition to the potential safety impact of V2V and automation, the agency is also aware that these technologies have significant added potential to contribute to intelligent management of roadway traffic and reduce the burden of highway traffic on the environment. These potential benefits are additional reasons why the continued exploration of these technologies is an extremely worthwhile endeavor. NHTSA's decisions on these technologies will inevitably influence the manner and pace with which they are adopted.

NHTSA is seeking to be an active partner in the development and implementation of V2V communications and automated driving technologies—an undertaking that requires collaboration with product developers, insurers, academia, and state and federal governments. We eagerly embrace this challenge and look forward to working with you all to realize the full potential of emerging technologies to reduce crashes and their resulting burden.

Thank you.