Statement before the Senate Committee on Commerce, Science, and Transportation

Hearing on Fighting Drunk Driving: Lessons Learned in New Mexico

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Thank you, Senator Udall, for the opportunity to speak at this hearing and thank you for your continued leadership on drunk driving prevention, particularly on the advanced alcohol detection research program, known as DADSS, which I am here to describe.

In 2009, close to 11,000 people died on the nation's highways and hundreds of thousands more were injured because of alcohol-impaired drivers. Although these numbers have been gradually coming down, the loss of so many lives every year is unacceptable. Strong DUI laws and enforcement of those laws can help to deter people from driving while over the legal limit, but we know that in spite of the best efforts of law enforcement and the judicial system, many millions of drivers will continue to drive when impaired by alcohol, and thousands of deaths and injuries will continue to occur every year. The solution to this problem is to develop vehicles that will prevent alcohol-impaired drivers from operating their vehicle.

In 2008 the National Highway Traffic Safety Administration (NHTSA) and the Automotive Coalition for Traffic Safety (ACTS) began a five-year, $10 million initiative, known as the Driver Alcohol Detection System for Safety (DADSS) Program, to explore the feasibility, the potential benefits of, and the public policy challenges associated with a more widespread use of non-invasive technology to prevent alcohol-impaired driving. This research and development effort is funded jointly by NHTSA and most of the world's leading automakers (BMW, Chrysler, Ford, General Motors, Honda, Hyundai/Kia, Jaguar Land Rover, Mazda, Mercedes Benz, Mitsubishi, Nissan, Porsche, Toyota, Volkswagen, and Volvo). The DADSS program is developing technologies that would prevent the vehicle from being driven when the device registers that the driver's blood alcohol concentration (BAC) is at 0.08 percent or above (the legal limit throughout the United States). This is a data-driven, scientific research program, with the technologies to be demonstrated in one or more research vehicles by the second half of 2013. As we move forward with this technology and demonstrate its effectiveness, the research has suggested the American public will want to voluntarily adopt the technology in their vehicles.

The starting point for DADSS is a strong conviction that for in-vehicle alcohol detection technologies to be acceptable for widespread use among drivers, many of whom do not drink and drive, it must be seamless with the driving task; it must be non-intrusive, that is, accurate, fast, reliable, durable, and require little or no maintenance. Sober drivers who are under the legal limit of 0.08 percent should not be inconvenienced with such systems. This requires that the performance requirements be extremely stringent.

The DADSS program

In 2007, ACTS formed a Blue Ribbon Panel of experts including representatives from automotive manufacturers and suppliers, public interest organizations, government representatives both domestic and international, and experts in the science of alcohol toxicology, behavioral impairment, human factors, and research, to advise the DADSS program on technical and policy issues. The DADSS program then undertook a comprehensive review of emerging and existing state-of-the-art technologies for alcohol detection, and the development of performance specifications. A Request For Information (RFI) was published as a means by which the DADSS program was first communicated to potential vendors. The goal of the RFI was to establish the level of interest among technology developers in taking part in the research, the kinds of technologies available, and their states of development relevant to in-vehicle application. Based on an evaluation of the 17 responses received, a Request for Proposals (RFP) was sent to eight organizations with prior experience in alcohol detection or related technologies. Subsequent to a detailed and rigorous evaluation process, three contracts were awarded for the development of Phase I proof-of-principle prototypes.

Two approaches were identified for Phase I development as having considerable promise in measuring driver BAC non-invasively: 1) Tissue Spectrometry, a touch-based approach allowing assessment of alcohol in human tissue, and 2) Distant Spectrometry, a breath-based approach allowing assessment of alcohol concentration in the driver's exhaled breath. In the touch-based approach, measurement begins by shining an infrared light on the user's skin (similar to a low-power flashlight). A portion of the light scatters several millimeters through the user's skin before returning back to the skin's surface where it is collected by an optical touch pad. This light contains information on the tissue's unique chemical properties which can be analyzed to determine the tissue alcohol concentration. The breath-based approach makes it possible to perform a contact-free, quick, unobtrusive measurement of the driver's breath alcohol by using the concentration of carbon dioxide as a measure of dilution of the driver's exhaled breath. Multiple sensors placed in the vehicle cabin will allow the system to ensure that the breath sample is from the driver and not other passengers.

Demanding performance standards

Performance standards for in-vehicle alcohol detection devices must be much more rigorous than current alcohol-testing technologies if they are not to inconvenience drivers. To that end, ACTS has developed extremely stringent performance specifications[1]. Requirements for very high levels of accuracy and precision and very fast measurement times (less than half a second) will ensure that drivers who are under the legal limit will not be inconvenienced. We continue to address long-term reliability and system maintenance requirements, the influences of vehicle environment, and issues related to user acceptance, and the technologies must meet the exacting standards for in-vehicle use adopted by automakers.

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[1] The performance specifications with definitions, measurement requirements, and acceptable performance levels are provided in the DADSS Subsystem Performance Specification Document (http://dev.dadss.org/performance-specification/download).

To validate the performance of the Phase I prototypes, unique standard calibration devices (SCDs) were developed by ACTS for both the breath- and touch-based systems. These SCDs go well beyond current alcohol-testing specifications. Two different SCDs were developed for prototype testing; one breath-based and one touch-based. There are two aspects that were addressed. First, samples of simulated "breath" and "tissue" were developed to provide a calibrated alcohol concentration in vapor and/or liquid to the prototype. These samples provide close facsimiles of human breath and tissue and must exceed the DADSS specifications by an order of magnitude. Next, hardware was developed to deliver the breath-based and touch-based samples to the prototypes for blood alcohol measurement. The SCDs that were developed met the needs for Phase I testing, but additional work is required in order to undertake Phase II testing. Specifically, advances need to be made both in the accuracy and precision of the breath-based and touch-based samples, and refinements are needed for the delivery systems.

Phase I effort completed

The Phase I effort, now complete, focused on the development of working proof-of-principle prototypes capable of rapidly and accurately measuring the driver's BAC non-intrusively. The prototypes, which were required to address just the accuracy, precision, and speed of measurement specifications, did not attempt to simulate the visual appearance, choice of materials or intended manufacturing process. The overall aim was to validate the potential design approach, as well as point to areas where further development and testing may be necessary. Three Phase I proof-of-principle prototype devices were delivered in mid 2010 and were tested at the laboratories of QinetiQ North America. The testing program was designed to determine whether the devices demonstrate the potential to meet the stringent performance specifications established for non-invasive alcohol testing. Bench testing was undertaken to determine the prototypes' accuracy, precision, and speed of measurement, and to identify what additional development might be needed. Limited human subject testing, conducted with the Harvard Medical School, permitted an understanding of the relationship among the various measures of blood alcohol provided through blood and breath samples, and those provided by the breath-based and touch-based prototype devices.

Based on the results of prototype testing, sensors demonstrating both the touch-based approach and breath-based approach are judged to have the potential in Phase II development to measure BAC quickly, and with high levels of accuracy and precision. Currently one of each of the breath-based and touch-based devices have come close to meeting accuracy requirements, but have fallen short on precision measurements. Significant additional development is needed, but the developers have identified potential modifications to the devices that will enable them to meet the DADSS specifications at the end of the Phase II development.

Phase II program

Phase II is the major development effort that will lead to one or more research vehicles to demonstrate the technologies. The Phase II program is envisaged to span approximately two years and will include only those technologies that have successfully completed Phase I. It is anticipated that Phase II development will begin in the fourth quarter of 2011.

Although impressive progress has been made to date, as technology development continues into Phase II there are many different facets of performance that need to be addressed to prepare the technology for in-vehicle use. Accuracy and precision have to improve, and measurement time has to decrease to meet or exceed performance specifications. With respect to touch-based technology, a sensor redesign using solid state components is planned to meet the rigors of the in-vehicle environment. This requires a new approach both for the sensor architecture and for the algorithms used to estimate tissue alcohol concentration. For the breath-based technology, sensor development needs to be accelerated to improve accuracy and precision, and optimal vehicle sensor locations need to be identified based on in-vehicle human breath aerodynamics, across a wide variety of environmental conditions. Revised prototype designs have been proposed to address vehicle integration and consumer affordability. Both breath-based and touch-based sensors will need to meet the exacting standards automakers require for all new vehicle safety equipment. The development of standard calibration devices required to test the Phase II sensors is ongoing and significant improvements will need to be made to ensure sensors meet the exacting DADSS requirements.

These technical challenges can be met with the additional development planned in Phase II.

Consumer feedback to the design process

As technology development progresses and decisions are being made about best practices for integrating such technology into vehicles, researchers are soliciting public opinions about the proposed in-vehicle alcohol detection devices. Consumer willingness to deploy the technology in their vehicles will depend on how public attitudes are taken into account during the development process. The failed adoption of seat belt ignition interlocks in the 1970s taught us the need to understand in advance the issues and concerns of the driving public. DADSS has been conducting focus group testing around the United States to gauge public perceptions and concerns about the different technology approaches, and these opinions will influence development of the technology. In the coming years a broader understanding of consumer sentiment will be sought through a national survey of drivers.

DADSS will make a difference

The technical and public policy challenges are substantial, but the potential benefits to society of in-vehicle alcohol detection systems are compelling. DADSS has the potential to save up to 8,000 lives per year (Insurance Institute for Highway Safety, 2010)[2], and there is evidence that the public is ready for in-vehicle devices to combat alcohol-impaired driving. Two-thirds of drivers say they consider the use of advanced technology to keep alcohol-impaired drivers off the roads to be a “good” or “very good” idea[3].

While impressive progress has already been made, there is much more to be done before this research is ready for consumer application. S. 510 (ROADS SAFE Act of 2011) will help accelerate this effort and open the door to a future where alcohol-impaired driving fatalities are a rarity versus the chronic traffic safety problem it remains today.

The benefits of a successful DADSS Program should not be underestimated. We are on the cusp of being able to eliminate the deaths and injuries caused by alcohol-impaired driving for generations to come.

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[2] Insurance Institute for Highway Safety. 2011 http://www.iihs.org/research/fatality_facts_2009/alcohol.html. Accessed August 1, 2011

[3] McCartt, A. T., Wells, J.K., Teoh, E.R. 2010. Attitudes toward in-vehicle advanced alcohol detection technology. Traffic Injury Prevention, 11, 158-164