

DRIVER ALCOHOL DETECTION SYSTEM FOR SAFETY (DADSS) – A NON-REGULATORY APPROACH IN THE DEVELOPMENT AND DEPLOYMENT OF VEHICLE SAFETY TECHNOLOGY TO REDUCE ALCOHOL-IMPAIRED DRIVING

Susan A. Ferguson

Ferguson International LLC

Eric Traube

National Highway Traffic Safety Administration

Abdullatif Zaouk

Qinetiq/Foster Miller

Robert Strassburger

Alliance of Automobile Manufacturers

U.S.A.

Paper Number 09-0464

ABSTRACT

While government regulations play an important role in ensuring vehicle safety, voluntary approaches to the design and implementation of vehicle safety systems are increasing in importance as vehicle manufacturers deploy safety systems well in advance of, and even in the absence of, government regulations requiring them. This paper provides an overview of regulatory and non-regulatory approaches to vehicle technology development and deployment, and will describe a new, innovative public\private partnership underway to develop an in-vehicle alcohol detection system. In response to concerns about limited progress in reducing alcohol-impaired driving in the United States during the last decade, attention is focusing on technological approaches to the problem. One strategy includes efforts to increase the application of current breath alcohol ignition interlocks on the vehicles of Driving While Intoxicated (DWI) offenders. However, in recognition that many alcohol-impaired drivers have not been convicted of DWI, an effort is underway to develop advanced in-vehicle technologies that could be fitted in vehicles of all drivers to measure driver blood alcohol concentration non-invasively. The Automotive Coalition for Traffic Safety (ACTS, a group funded by vehicle manufacturers) and the National Highway Traffic Safety Administration (NHTSA) have commenced a 5-year cooperative agreement entitled Driver Alcohol Detection System for Safety (DADSS) to explore the feasibility of, and the public policy challenges associated with, widespread use of in-vehicle alcohol detection technology to prevent alcohol-impaired driving. This paper will outline the approach being taken, and the significant challenges to overcome.

INTRODUCTION

Prior to the mid-1960s, the role of vehicle design in preventing crashes and mitigating crash injuries was not generally considered. The focus at that time was on trying to prevent crashes by changing driver behavior (O'Neill, 2003). However, in 1966, in the aftermath of U.S. Senate hearings on vehicle safety, legislation was enacted that authorized the U.S. Federal Government to set safety standards for new vehicles. The result, in 1967, was the first U.S. Federal Motor Vehicle Safety Standard specifying requirements for seat belt assemblies. A host of other regulations quickly ensued to address vehicle performance in several categories: pre-crash (e.g., tires, brakes, transmissions), crash-phase (e.g., head restraints, front and side impact protection, roof crush, windshields), and post-crash (e.g., fuel system integrity, flammability of interior materials). Shortly thereafter other governments followed suit in implementing similar regulations, for example, in Europe, Australia, and Canada. Most U.S. motor vehicle regulations have been evaluated by the National Highway Traffic Safety Administration (NHTSA) at least once since 1975 (Kahane, 2008). Based on these evaluations, NHTSA estimates that Federal Motor Vehicle Safety Standards have saved 284,069 lives between the time of their inception and 2002 (Kahane, 2004).

Government regulations are important in ensuring that vehicles meet a minimum standard of safety. However, there are many other ways in which vehicle safety can be advanced outside of the regulatory framework.

It was once believed that “safety does not sell”. However, that perception has changed as more

and more consumer-oriented vehicle assessment crash test programs have proliferated around the world. The aim of consumer crash test programs is to encourage manufacturers to go beyond these minimum requirements incorporated in the regulations.

NHTSA was the first to launch a consumer-oriented crash-test program. Starting in 1978, under the authority of Title II of the Motor Vehicle Information and Cost Savings Act of 1973, NHTSA began assessing the frontal crash protection capabilities of new cars by measuring injury potential in crash tests at speeds higher than those required by law. This program, known as the New Car Assessment Program (NCAP) was expanded in 1983 to include frontal crash protection for light trucks, and again in 1997 with the launch of NCAP tests assessing side impact protection (www.safercar.gov). More recently, in 2001, NHTSA also began adding information about rollover resistance to their NCAP program, and information about the availability of advanced technology is being added with the 2011 model year.

In the last 15 years, consumer crash test programs have been launched in many other countries. In the United States, the Insurance Institute for Highway Safety (IIHS) began providing passenger vehicle crash test ratings in 1995, and now offers information on frontal offset, side, and rear impact protection (<http://www.iihs.org/ratings/>). European NCAP was launched in 1997, and includes vehicle crash test ratings for frontal, and side impacts, including a pole test to measure head protection, and tests to assess pedestrian protection (<http://www.euroncap.com/>). The Australian NCAP, in place in Australia and New Zealand, began testing similar to EuroNCAP in 1999 and uses the same rating system (<http://www.ancap.com.au/testing/>). Japan began its NCAP in 1995, (<http://www.nasva.go.jp>), Korea initiated crash testing in 1999 (<http://www.kotsa.or.kr/main.jsp>) and China also now has begun its own NCAP program (<http://www.fia.com/oldautomotive/issue4/mobility/article2.html>).

The desire to earn good ratings in such programs has driven major improvements in vehicle safety, and they have become de facto standards for much of the automobile industry. NCAP-type programs have resulted in clear improvements in

vehicle designs to withstand crash forces, and in significant reductions in dummy injury measures. For example, in 1979, when U.S. NCAP was just beginning, the Head Injury Criterion (HIC), a measure to indicate the likelihood of a serious head injury, was exceeded in 22 of 30 vehicles tested. In contrast, only one of 29 vehicles tested in 1995 exceeded the HIC (Ferguson, 1999).

Comparing the performance of 1995-98 model vehicles with 1999-2001 vehicles, IIHS reported large improvements in vehicle ratings on their frontal-offset crash-test program largely as the result of improvements in vehicle structures (Lund, et al., 2003, see also O'Neill, 2005). Furthermore, these improvements have come about at a faster pace than would have been possible through regulation. There have been a few evaluations that indicate such programs are effective in improving occupant protection in real world crashes. These studies indicate that vehicles that perform better in frontal crash tests result in lower injury risks for their occupants (Farmer, 2005; Kahane, 1994; Newstead et al., 2003). Lie and Tingvall (2002) evaluated European crash test ratings, which are derived from a combination of frontal offset and side impact tests, and demonstrated a correlation with real-world crash injury risk.

In recent years, there have been some clear examples of the automobile industry and government working together to expedite the safety process. The safety marketplace has proven to be a catalyst for innovative technologies and vehicle manufacturers increasingly are deploying safety systems well in advance of, or even in the absence of, government mandates.

Since 1999 frontal airbags have been required in all new passenger vehicles, however, side airbags were introduced without government regulations requiring them. Because early experience indicated that frontal airbags could result in injury or death to occupants who were close to them when they deployed, there were some concerns about the potential of side airbags to injure out-of-position occupants. In May, 1999 the NHTSA Administrator requested that the automobile industry work together to quickly develop test procedures for assessing side airbag safety. The Side Airbag Technical Working Group, sponsored by IIHS, the Alliance of Automobile Manufacturers (the Alliance), the Association of International Automobile

Manufacturers, and the Automotive Occupants Restraints Council, was formed and within 15 months voluntary standards had been developed (<http://www.iihs.org/ratings/protocols/default.html>). All vehicle manufacturers committed to follow this protocol when designing new side airbag systems and 90 percent of vehicles with side airbags conform to these voluntary guidelines (www.safercar.gov).

Another example of cooperative research to improve vehicle safety is provided by the Blue Ribbon Panel for the Evaluation of Advanced Airbags. The Panel was formed in 2001, amid concerns about possible negative effects of changes in frontal crash-test regulations to reduce the aggressivity of deploying airbags (<http://www.brpadvancedairbags.org/>). The Panel's independent group of experts oversaw the collection of Alliance-funded frontal crash data, the purpose of which was to hasten and facilitate the understanding of redesigned frontal airbag performance. It was agreed that data collection should utilize the existing National Automotive Sampling System/Crashworthiness Data System program and NHTSA observers took part in all the meetings and provided guidance to the Panel on data collection issues.

In addition, the Panel conducted timely research and sponsored research by others. A 2008 research review undertaken by the Panel concluded that redesigned frontal airbags resulted in far fewer airbag-induced injuries to vulnerable occupants, while at the same time maintaining their overall effectiveness in frontal crashes (Ferguson et al., 2008).

Programs such as these illustrate the benefits of government and industry working together to address important safety concerns. Progress can be accelerated and the end result is better working relationships and programs that are more likely to have widespread acceptance. The latest example of an innovative public/private partnership is the Driver Alcohol Detection System for Safety (DADSS) program which seeks to find a solution to the problem of alcohol-impaired driving.

DADSS - A NEW DEVELOPMENT AND DEMONSTRATION PROGRAM



Background

Alcohol-impaired driving is a major factor in the tens of thousands of deaths that occur every year on U.S. roads. In 2007, there were almost 13,000 fatalities in crashes involving drivers with blood alcohol concentrations (BACs) of 0.08 g/dL or higher – the legal limit in all 50 U.S. States (NHTSA, 2008). This number represented 32 percent of total traffic fatalities for the year. Although significant progress was made during the 1980s and the first half of the 1990s in reducing this problem, since then progress has been limited. Strong laws and enforcement have been effective in reducing deaths and injuries from drinking and driving (Elder et al., 2002; Shults et al., 2001). Such efforts will need to continue; however more must be done if substantial progress is to be made in the long term.

The potential for in-vehicle technology that could prevent alcohol-impaired driving has been recognized. Current aftermarket breath testing devices, in use for several decades, can be installed in vehicles and measure a driver's BAC. These devices predominantly are used by drivers convicted of DWI, and require drivers to provide breath samples before starting their vehicles. If a positive Breath Alcohol Concentration (BrAC) is registered, the vehicle cannot be started. Studies indicate that while these devices are on the vehicles of convicted DWI offenders, they can reduce recidivism by about two-thirds (Willis et al., 2004).

A total of 47 States permit or mandate alcohol ignition interlocks for certain offenders, however, they are generally underutilized. Many lives could be saved if they were more widely applied among the population of DWI offenders. It has been estimated that, if all drivers with at least one alcohol-impaired driving conviction within 3

years prior to the crash were restricted to zero BACs, about 1,100 deaths could have been prevented in 2005 (Lund et al., 2007).

Efforts are underway in the United States to increase the use of breath-alcohol ignition interlocks among convicted DWI offenders, both through passage of stronger state laws that will require them for first-time offenders, and through efforts to work within the criminal justice system to maximize their adoption (<http://www.madd.org/Drunk-Driving/Drunk-Driving/Campaign-to-Eliminate-Drunk-Driving.aspx>).

Even if such efforts are successful, they would only partially solve the problem of alcohol-impaired drivers. That is because a large proportion of the alcohol-impaired fatal crashes that occur every year involve drivers with no prior DWI convictions. In 2006 only 7 percent of drivers in fatal crashes with BACs 0.08 g/dL or higher had previous alcohol-impaired driving convictions on their records for the prior 3 years (IIHS, 2008).

Wider deployment of current alcohol ignition interlock technology as a preventative measure among the general public is not advisable because of the obtrusive nature of the technology – requiring the driver to provide a breath sample each and every time before starting the vehicle. In the United States about 40 percent of the population indicate they do not drink and only about 3 percent of the population say they have driven after drinking during the last 12 months (Chou et al., 2006; Williams et al., 2000). Therefore, to be acceptable for use among all drivers, many of whom do not drink and drive, in-vehicle alcohol detection technologies must be seamless with the driving task; they must be non-intrusive, reliable, durable, and require little or no maintenance.

The technical challenges are substantial, however the possible benefits to society are compelling, with the potential to prevent almost 9,000 motor vehicle deaths every year if all drivers with BACs at or above the legal limit (0.08 g/dL) were unable to drive (Lund et al., 2007).

There has been growing interest among legislators to broaden the scope of in-vehicle technology to prevent alcohol-impaired driving, and several state governments in the United

States have considered legislation to require it. In the 2004 legislative session three U.S. States (New Mexico, New York, and Oklahoma) considered legislation to mandate breath alcohol ignition interlocks on all new vehicles. In New Mexico a Governor's Task Force was established to study alcohol ignition interlock devices and provide recommendations concerning their broader use.

There also has been considerable international interest. In 2005, the provincial government of Ontario, Canada also explored a requirement to mandate alcohol ignition interlocks on all vehicles. In 2006, the Swedish government announced its intention to equip all commercial vehicles with alcohol ignition interlocks by 2010 and all passenger vehicles by 2012.

Since then, the focus in Sweden has shifted to the voluntary application of breath alcohol ignition interlocks as a primary prevention measure (i.e. in vehicles of drivers who have not been convicted of a DWI) among fleet vehicles, including local government vehicles. It has been decided that they will await the development of non-invasive technologies before pursuing universal deployment. The governments of Norway and Finland also have expressed support for this strategy. Because of concern about a number of deaths of innocent victims of alcohol-impaired drivers, the Japanese government also has expressed interest in developing a comprehensive technological solution to the alcohol-impaired driving problem.

A number of automobile manufacturers have indicated that they are developing driver alcohol detection systems for vehicles. Beginning in 2008, Volvo now offers the AlcoGuard™ as optional equipment on their vehicles sold in Sweden. This device is integrated into the vehicle's man/machine interface but still requires drivers to provide a breath sample each time before starting the vehicle. In August 2007, Nissan announced a concept car with multiple potential systems to measure drivers' BAC, including alcohol in drivers' breath and sweat. Saab also has indicated it is developing a breath-alcohol device for use in its vehicles.

As interest was growing in the United States and internationally for technological solutions to the alcohol-impaired driving problem, an International Technology Symposium was sponsored by MADD in June 2006. The

potential of advanced technologies for preventing alcohol-impaired driving was considered and a timeline was developed for their development and deployment. Also discussed was the suitability of extant technologies that could be completely transparent to the driver, such as tissue spectroscopy and transdermal or ocular detection. Representatives of NHTSA, automobile manufacturers, researchers, and safety experts agreed that with collaborative research and development, in-vehicle devices meeting these needs might be developed and deployed within a 10-15 year time frame. There also was broad agreement that the time had come to pursue a technological approach to alcohol-impaired driving.

Cooperative Agreement

In February 2008, the Automotive Coalition for Traffic Safety (ACTS) and NHTSA entered into a Cooperative Agreement to explore the feasibility, potential benefits of, and the public policy challenges associated with a more widespread use of in-vehicle technology to prevent alcohol-impaired driving – known as the Driver Alcohol Detection System for Safety (DADSS) program. Funding for ACTS currently is provided by motor vehicle manufacturers (BMW, Chrysler, Ford, General Motors, Jaguar Land Rover, Mazda, Mercedes Benz, Mitsubishi, Nissan, Porsche, Toyota, Volkswagen).

The approach being taken is a non-regulatory approach that will encourage voluntary adoption. This 5-year, cost-sharing agreement requires that ACTS and NHTSA work together to engage in cooperative research that advances the state of

alcohol detection technology. This effort seeks to develop technologies that are less-intrusive than the current in-vehicle breath alcohol measurement devices and that will quickly and accurately measure a driver's BAC in a non-invasive manner. These technologies will be a component of a system that can prevent the vehicle from being driven when the device registers that the driver's BAC exceeds the legal limit (0.08 g/dL in all U.S. states). Such devices ultimately must be compatible for mass-production at a moderate price, meet acceptable reliability levels, and be unobtrusive to the sober driver.

The agreement seeks to assess the current state of impairment detection devices, and to support the development and testing of prototypes and subsequent hardware that may be installed in vehicles. The goal, at the end of the 5-year program, is the practical demonstration of an alcohol detection subsystem, suitable for subsequent installation in a vehicle.

DADSS Project Team Organization

The overall DADSS Program Management is being carried out by ACTS with oversight by NHTSA. Technical research and development oversight is being undertaken under contract with QinetiQ NA/Foster-Miller, Inc.

Figure 1 shows the program team organization.

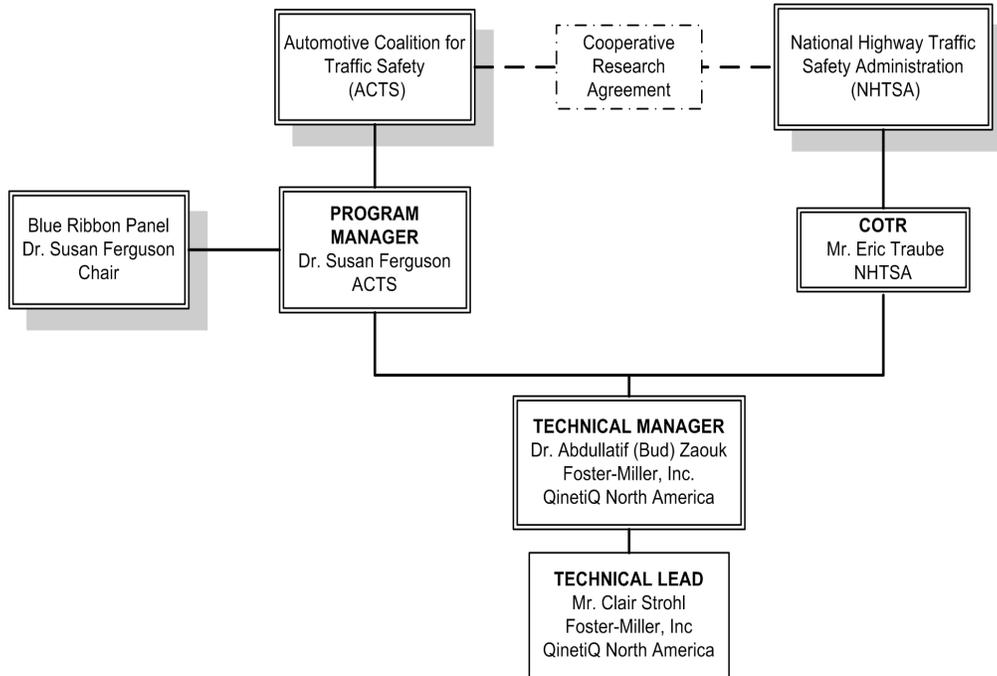


Figure 1. DADSS program team organization

ACTS has formed a Blue Ribbon Panel (BRP) of experts in order to consider the views of industry and other stakeholders. The BRP includes 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.

The BRP has assigned three working groups to assist in this effort. They are:

- The Research Plan Working Group, who have assisted in the development of the Program Management Plan and advised on the overall direction of the project.
- The Performance Specifications Working Group, who have assisted in the development of the Performance Specifications document. This document is the primary tool to direct the development of in-vehicle advanced alcohol detection technologies.

- The Public Policy Working Group, who will address the issues of public perceptions and attitudes towards in-vehicle alcohol detection systems for all drivers, to examine acceptability of alternative solutions and specifications, and to address relevant policy issues.

DADSS Program Details

The DADSS Program Management Plan, approved by NHTSA in May, 2008, laid out a timetable for development of the DADSS system, detailing the program’s tasks, milestones and deliverables.

The current DADSS development and demonstration timeline is shown in Figure 2.

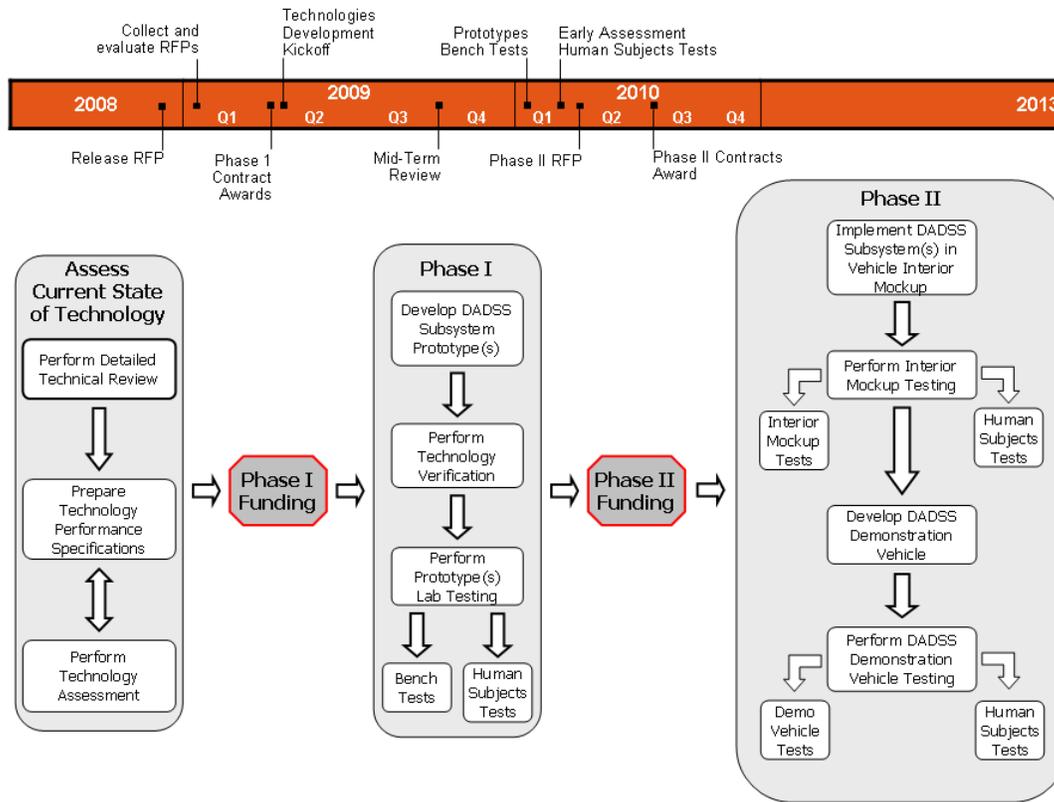


Figure 2. DADSS program development process

Detailed Technical Review

Once a Program Management Plan had been established, one of the first tasks of the project team was to perform a comprehensive review of emerging and existing state-of-the-art technologies for alcohol detection and to develop performance specifications. Prior to the commencement of the Cooperative Agreement, the Volpe National Transportation Systems Center of the U.S. Department of Transportation’s Research and Innovative Technology Administration (Pollard et al., 2007) was tasked by NHTSA to identify current and emerging vehicle-based technologies and systems that can detect driver BAC and monitor driver impairment due to alcohol. The first undertaking of the literature review was to review the Volpe paper. The study included an assessment of the practicability and effectiveness of such systems and the capability of existing and anticipated technologies to detect and prevent alcohol-impaired driving. Additional technology scans were undertaken through patent and literature reviews, and these scans will be

repeated periodically throughout the life of the program.

Technology Performance Specifications

Based on input from the BRP, ACTS developed performance specifications to assess the in-vehicle advanced alcohol detection technologies. The specifications are designed to address the current and future state of relevant emerging and existing advanced alcohol detection technologies. The influence of environment, issues related to user acceptance, long-term reliability and system maintenance are assessed, and the resulting list of specifications with definitions, measurement requirements, and acceptable performance levels are documented in the DADSS Subsystem Performance Criteria Document (<http://dev.dadss.org/performance-specification/download>). In the future, Vehicle Integration Specifications also will be developed.

Request For Information

A Request For Information (RFI) was published as a means by which the DADSS program was first communicated to potential vendors. The RFI was posted on the Federal Business Opportunities (FBO) web site, www.fedbizopps.gov on April 5, 2008. FBO is the single point-of-entry for Federal Government procurement opportunities with over 550,000 vendors and buyers registered. Additionally, direct notice went out to a list of vendors including all major alcohol detection technology developers, various medical technology associations, international contacts, and the BRP members.

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 applications. The many responses received from industry provided a degree of confidence that there were numerous potential bidders. A 'first-order' assessment of what potential bidders were developing was completed by making visits to those companies that exhibited a strong grasp of the technologies necessary. A standardized visit report format allowed an initial cross-comparison of the companies visited.

Request For Proposals

Subsequent to the RFI process described above, a Request For Proposals (RFP) was issued by ACTS in November, 2008. Receipt of the RFP was restricted to a selected number of respondents to the RFI. The RFP solicited proposals from businesses with prior experience in alcohol detection or related technologies, for the development of in-vehicle devices meeting the ACTS requirements.

A two-phased R&D program

As shown in Figure 2 above, the DADSS R&D effort is following a two-stage process. Phase I will focus on developing a working prototype, and Phase II is the major R&D effort that will lead to a demonstration vehicle.

Phase I The specific objective for Phase I of this effort is to develop a Proof-of-Principle (POP) Prototype intended to represent a device capable of rapidly and accurately measuring the driver's

BAC non-intrusively. The POP Prototype will be used to test several aspects of the intended in-vehicle alcohol detection technology design without attempting to simulate the visual appearance, choice of materials or intended manufacturing process. Its aim is to validate the potential design approach, as well as point to areas where further development and testing is necessary. The basis for awards will be the scientific and technical merit of the proposal and its relevance to ACTS requirements and priorities. Eligible institutions include for-profit, nonprofit, public, and private organizations, such as universities, colleges, hospitals, laboratories, and companies. Phase I is proceeding to plan, and awards are to be made to successful bidders before mid-2009, and will involve a 12-month period of performance.

Phase II is the principal R&D effort that will result in the practical demonstration of an alcohol detection subsystem, suitable for subsequent installation in a vehicle. The program is envisaged to span approximately two years. Phase II awards will be made only to those bidders that have achieved successful Phase I progress, with regard to the merits of their technological approach adopted, ACTS priorities, and the availability of appropriated funds to support the Phase II effort.

Potential technologies

Under the Phase I program, the successful contractors will commence the development of prototype devices based on various promising technological approaches. Such approaches may include, but not be limited to:

1. Tissue Spectrometry Systems that can measure alcohol concentration in tissue. A beam of light, at a wavelength that is sensitive to the presence and amount of alcohol in the tissue (within the near-infrared spectrum) is shone through the skin. The amount of light that is reflected and captured can be used to measure alcohol concentration.
2. Electrochemical Systems include transdermal systems that measure alcohol concentration present in a person's sweat, and advanced breath-based systems able to measure BAC through passive sampling of a driver's breath.

3. Distant Spectrometry Systems use an approach that is similar to tissue spectrometry, except that no skin contact is required. Infrared light is transmitted toward the subject from a source that receives and analyses the reflected and absorbed spectrum, to assess alcohol concentration in the subject's tissue or exhaled breath.

PUBLIC ACCEPTABILITY CHALLENGES

Although the current program is specifically focused on technology development it is recognized that there is a need to address public perceptions and attitudes towards such systems during the course of the program. Many of these issues are being addressed through the Blue Ribbon Panel and its subcommittees as these issues are intertwined with successful technology deployment. A non-regulatory, voluntary approach to in-vehicle driver alcohol detection systems will depend on public acceptance for its full implementation, and likely will be affected by a number of factors. It will depend on whether the public believes that alcohol-impaired driving is an important public health and safety issue that should be addressed by society collectively, or whether they think only those who drive impaired should shoulder the burden. It will likely depend on their own personal habits; whether they are teetotalers, social or heavy drinkers, and whether they drink and drive, how often, and how much. Public acceptance also may be influenced by personal experiences regarding alcohol-impaired drivers and whether they know anyone whose life has been impacted or cut short by an impaired driver. But most importantly, it will depend on how the technology is designed and introduced by vehicle manufacturers. It is paramount that it not impede the normal activities performed by the driver.

During the next few years research is planned to gauge drivers' perceptions of the alcohol-impaired driving problem, and their attitudes toward potential solutions. Research also will address what technology options will be publicly acceptable and how they might successfully be implemented. For example, how the general public views different measurement systems, the adoption of different operating thresholds, running retests, the need for an emergency override function and so on.

Communicating with the public

As the DADSS program develops there will be a need to educate the public about the DADSS program, the potential technologies that are being developed, and the way in which these might be implemented. A website, www.DADSS.org, has been launched to provide public access to the progress of the DADSS program. The web site provides key details of the DADSS development program progress, discusses issues associated with drinking and driving, and lists relevant research.

CONCLUSIONS

Government regulations are important in ensuring that vehicles meet a minimum standard of safety, but the process involved in producing new regulations necessarily takes time. There are many other ways in which vehicle safety can be advanced outside of the regulatory framework. Consumer crash-test assessment programs, now in place around the world, have been instrumental in advancing vehicle safety on a faster schedule than would have been possible through regulation. Increasingly, voluntary approaches to the design and implementation of vehicle safety systems play an important role as vehicle manufacturers deploy safety systems well in advance of, and even in the absence of, government regulations requiring them.

Public/private partnerships also have a crucial role to play. They can accelerate efforts to implement new safety technologies and they can provide an important mechanism for developing workable approaches that are acceptable both to government and industry. For example, the Side Airbag Technical Working Group developed voluntary test procedures to assess the potential of side airbags to injure out-of-position occupants within 15 months of being asked to do so by the government. Side airbags, though not required by regulation, now are in more than two-thirds of 2008 model vehicles http://www.iihs.org/ratings/side_airbags/side_airbags.aspx .

The DADSS program represents the latest and most innovative public/private partnership that aims to develop and demonstrate a critically important advance in highway safety – that of keeping alcohol-impaired drivers from driving. Starting with a requirement to develop a non-invasive technology that will quickly and

accurately measure a driver's BAC, the project team has established a Program Plan, developed Performance Specifications, solicited industry interest, and begun the process of identifying technological approaches that show promise. The goal at the end of the 5-year program is the practical demonstration of an alcohol detection subsystem which is suitable for subsequent installation in a vehicle.

The adoption of non-regulatory, voluntary approaches to the implementation of advanced vehicle technology makes it critical that policy and public acceptance issues be addressed concurrent with the technology development. This is particularly important when it comes to the widespread implementation of technologies to prevent alcohol-impaired drivers from getting behind the wheel. The majority of the driving public in the United States either does not drink, or does not drink and drive. It is therefore necessary that advanced technologies to assess BACs must be seamless with the operation of the vehicle and not impede the sober driver.

The general public fully understands the dangers of drinking and driving. In a survey on drinking and driving attitudes and behavior (NHTSA, 2003), ninety-seven percent of respondents indicated that drinking and driving is a threat to their personal safety. With the growing public perception that vehicle safety is an important factor in the vehicle purchase decision, advances in safety technology are gaining public acceptance more readily than in the past. Communicating with the public regarding the DADSS program, the potential technologies that are being developed, and the way in which these might be implemented will be an important component of this effort.

REFERENCES

- Chou, S.P., Grant, B.F., Dawson, D.A., Stinson, F.S., Saha, T., Pickering, R.P. 2006. Twelve-month prevalence and changes in driving after drinking. United States, 1991-1992 and 2001-2002. *Alcohol Research and Health*, 29, 143-151.
- Elder, R.W., Shults, R.A., Sleet, D.A., Nichols, J.L., Zaza, S., Thompson, R.S. 2002. Effectiveness of sobriety checkpoints for reducing alcohol-involved crashes. *Traffic Injury Prevention*, 3, 266-74.
- Farmer C. M. 2005. Relationships of Frontal Offset Crash Test Results to Real-World Driver Fatality Rates. *Traffic Injury Prevention*, 6, 31-37.
- Ferguson, S.A. 1999. Consumer demand. North Vancouver, British Columbia, Canada: Insurance Corporation of British Columbia (ICBC). Recovery 10:11-13.
- Ferguson, S.A., Schneider, L.W. 2008. History and performance of frontal airbags with changes in frontal crash test requirements in the United States. *Traffic Injury Prevention*, 9, 421-31.
- Insurance Institute for Highway Safety. 2008. Q&As. Alcohol:General. Arlington, VA. http://www.iihs.org/research/qanda/alcohol_general.html
- Kahane, C. 1994. Correlation of NCAP Performance with Fatality Risk in Actual Head-On Collisions. DOT HS 808 061. Washington DC: National Highway Traffic Safety Administration, U.S. Department of Transportation.
- Kahane, C. 2004. Lives Saved by the Federal Motor Vehicle Safety Standards and Other Vehicle Safety Technologies, 1960-2002. DOT HS 809 833. Washington DC: National Highway Traffic Safety Administration, U.S. Department of Transportation.
- Kahane, C. 2008. Evaluation Program Plan, 2008-2012, DOT HS 810 983. Washington DC: National Highway Traffic Safety Administration, U.S. Department of Transportation.
- Lie A., Tingvall C. 2002 How do Euro NCAP results correlate with real-life injury risks? A paired comparison study of car-to-car crashes, *Traffic Injury Prevention*, 3, 288-293.
- Lund, A.K. and Nolan, J.M. 2003. Changes in vehicle designs from frontal offset and side impact crash testing. SAE Technical Paper Series 2003-01-0902. Warrendale, PA: Society of Automotive Engineers.
- Lund, A.K., McCartt, A.T., Farmer, C.M. 2007. Contribution of Alcohol-Impaired Driving to Motor Vehicle Crash Deaths in 2005. Proceedings of the T-2007 Meeting of the International Council on Alcohol, Drugs, and Traffic Safety. Seattle, Washington.

National Highway Traffic Safety Administration. 2003. National survey of drinking and driving attitudes and behaviors, 2001. Traffic Tech, Number 280. Washington DC: National Highway Traffic Safety Administration, U.S. Department of Transportation.

Willis C, Lybrand S, Bellamy N. Alcohol ignition interlock programmes for reducing drink driving recidivism. Cochrane Database of Systematic Reviews 2004;18(4):CD004168.

National Highway Traffic Safety Administration. 2008. Alcohol-Impaired Driving, 2007 data. Traffic Safety Facts. DOT HS 810 985. Washington DC: National Highway Traffic Safety Administration, U.S. Department of Transportation.

Newstead S.V., Narayan S., Cameron M.H., Farmer C.M. 2003. U.S. consumer crash test results and injury risk in police-reported crashes, Traffic Injury Prevention, 4, 113–127.

O'Neill, B. 2003. Improving vehicle safety: The role of regulation and Consumer Information. Proceedings of the Safety Transport Solutions: Regulations and Practices International Conference and Exposition. New Delhi, India.

O'Neill, B. 2005. Strategies for encouraging vehicle safety improvements. Presentation at the 19th ESV Conference, Washington D.C. Accessed at http://www-nrd.nhtsa.dot.gov/departments/nrd-01/esv/19th/Discussions/O_Neill_19thESV2005.pdf, January 1, 09

Pollard, J. K., Nadler, E. D., Stearns, M. D. 2007. Review of Technology to Prevent Alcohol-Impaired Crashes (TOPIC). DOT HS 810 833, Washington, DC: National Highway Traffic Safety Administration, U.S. Department of Transportation.

Shults, R.A.; Elder, R.W.; Sleet, D.A.; Nichols, J.L.; and Alao, M.O. 2001. Reviews of evidence regarding interventions to reduce alcohol-impaired driving. American Journal of Preventive Medicine 21:66-88.

Williams, A. F.; Ferguson, S. A.; and Cammisa, M. X. 2000. Self-reported drinking and driving practices and attitudes in four countries and perceptions of enforcement. Proceedings of the 15th International Conference on Alcohol, Drugs, and Traffic Safety (CD ROM). Borlänge, Sweden: Swedish National Road Administration.