



Driver Alcohol Detection System for Safety

ACTS/NHTSA Cooperative Research Program

Briefing and Status Report

for

Obama – Biden Transition Project Transportation Team

December 15, 2008





Outline

- ◆ Cooperative Research Agreement
- ◆ Alcohol Absorption & Elimination
- ◆ Potential DADSS Technology Types
- ◆ Request for Information (RFI)
- ◆ Potential Safety Benefits
- ◆ Request for Proposals (RFP) – Phase I
- ◆ Public Acceptance Research Agenda
- ◆ View of Congress





Cooperative Research Agreement

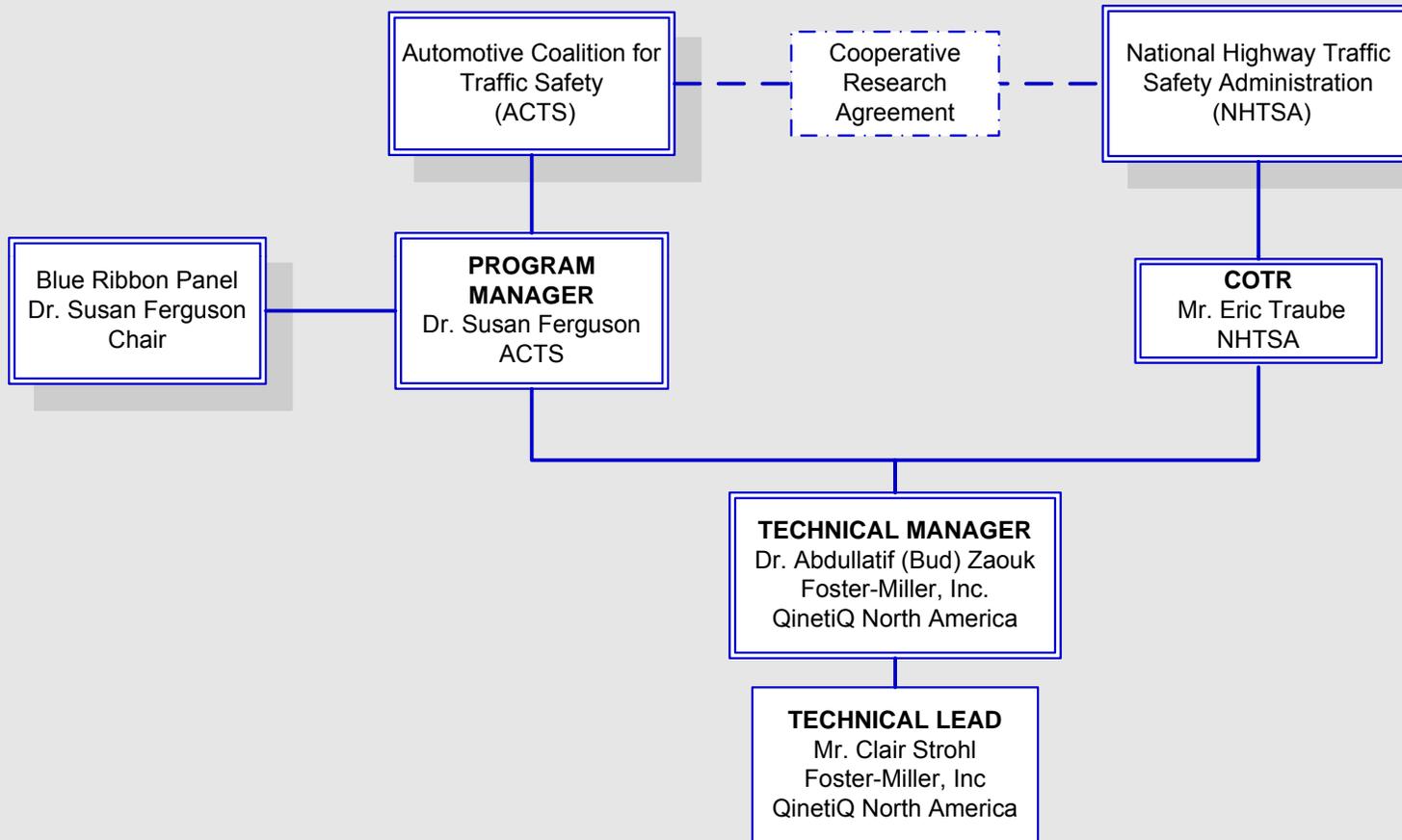
February 2008 – February 2013

- ◆ Automotive Coalition for Traffic Safety (ACTS) and the National Highway Traffic Safety Administration (NHTSA) have entered into a cooperative research agreement to *“explore the feasibility, the potential benefits of, and the public policy challenges associated with the more widespread use of unobtrusive technology to prevent drunk driving”*
- ◆ Five-year program to develop and test prototype devices that may be considered for vehicle integration thereafter
- ◆ Devices intended to prevent drunk drivers (BAC \geq 0.08) from driving their vehicles
- ◆ Blue Ribbon Panel (BRP) providing expert advice





DADSS Organizational Structure





DADSS Blue Ribbon Panel

- ◆ BRP appointed by ACTS in an advisory capacity
- ◆ Comprised of experts from various disciplines, including:
 - Automobile manufacturers and suppliers, alcohol toxicology, alcohol impairment, ignition interlocks, human factors, research scientists, MADD, IIHS, NHTSA and other government representatives
- ◆ Three meetings conducted to date: July 2007 and January and September 2008
- ◆ Working groups in place to address various topics:
 - DADSS Program Management Plan
 - DADSS Technology Specifications
 - DADSS Public Acceptance and Policy Issues





Communicating with the Public



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Communicating with the Public

A website resource

- ◆ Website established – provides both public and private access:
 - Public content
 - A “go to” site to provide project details, and answer key questions about technology development and drinking and driving
 - A way to communicate with technology developers interested in responding to Request for Information (RFI) and Request for Proposal (RFP)
 - Private content
 - For sharing documents among project leaders and BRP members





Communicating with the Public

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WHY UNDERTAKE THIS RESEARCH?
EMERGING TECHNOLOGIES
ABOUT THE PROCESS
FIND OUT MORE

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Why are we here?

The Automotive Coalition for Traffic Safety and the National Highway Traffic Safety Administration have entered into a cooperative research agreement to explore the feasibility, the potential benefits of, and the public policy challenges associated with a more widespread use of in-vehicle technology to prevent alcohol-impaired driving.

Aftermarket ignition interlocks have been used successfully among convicted drunk drivers to significantly reduce the incidence of impaired driving. However, deployment of the current technology on a more widespread basis as a preventative measure is not likely to occur because drivers are required to provide a breath sample each and every time before starting the vehicle. To be acceptable for use among the general public, including those who do not drink and drive, alcohol detection technologies must be far less intrusive – they must not impede sober drivers from starting their vehicles. They would need to be capable of rapidly and accurately determining and measuring alcohol in the blood. They would also need to be small, reliable, durable, repeatable, maintenance free, and relatively inexpensive.

The technical challenges in meeting these goals are substantial, however, the potential benefits to society are compelling. It has been estimated that almost 9,000 road traffic deaths could be prevented every year if alcohol detection devices were used in all vehicles to prevent alcohol-impaired drivers from driving their vehicles. To achieve these goals, a step-by-step, data-driven process will be followed to ensure that effective technologies are developed. Technological solutions can be effective only if the driving public who use the technologies understand and accept them. Only when technology meets the exacting standards described above and is coupled with public acceptance, will consideration be given to applying it more widely.



Interested in developing a new alcohol detection technology?

The Automotive Coalition for Traffic Safety has issued a Request for Information (RFI) to solicit interest from companies with the expertise and capabilities to develop and demonstrate in-vehicle alcohol detection technologies that are less intrusive than present breath-based ignition interlocks. The technologies are envisioned as a key component of a system that can prevent vehicles from being driven when the driver's blood alcohol concentration (BAC) exceeds a preset threshold.

For further instructions on submitting your documents, download the full RFI below.

 [DOWNLOAD THE RFI](#)



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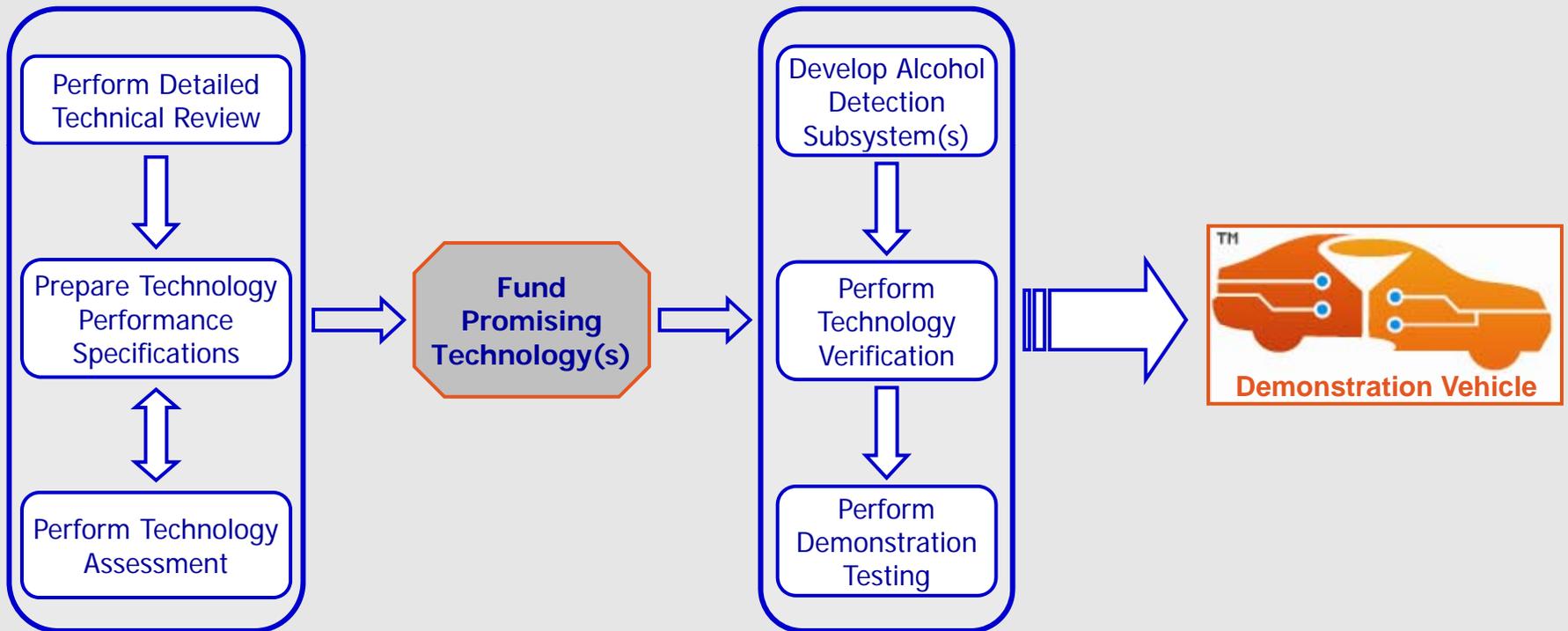
Tasks under the Cooperative Agreement

- ◆ Task 1 - Kick off meeting (Completed)
- ◆ Task 2 - Program Management Plan (Completed)
- ◆ Task 3 - Technology review and criteria development (Completed – Technology Review on-going continuously)
- ◆ Task 4 - Technology assessment (Under way)
- ◆ Task 5 – Technology verification
- ◆ Task 6 - Demonstration testing
- ◆ Task 7 - Final project report





DADSS Program Process





Current Status

- ◆ **Task 2: Program Management Plan**
 - Program Management Plan completed and posted on the DADSS website

- ◆ **Task 3: Technology Review and Performance Requirements**
 - The latest version of the DADSS Performance Specifications document posted on the DADSS website
 - RFI responses each scored, and ranked based on specified evaluation criteria.
 - Follow-up meetings completed with top scoring RFI respondents to further evaluate proposed technologies
 - Task 3 Report submitted to NHTSA and accepted October 31, 2008; undergoing legal review prior to posting to DADSS website





Current Status

- ◆ **Task 4: Determine Priority Candidates for DADSS**
 - Request For Proposals distributed November 24, 2008
 - Collect, review and evaluate RFP responses (target completion: March 2009)

- ◆ **Miscellaneous**
 - Public acceptance research agenda developed in concert with Working Group
 - Most recent BRP meeting held in Washington DC, September 3, 2008



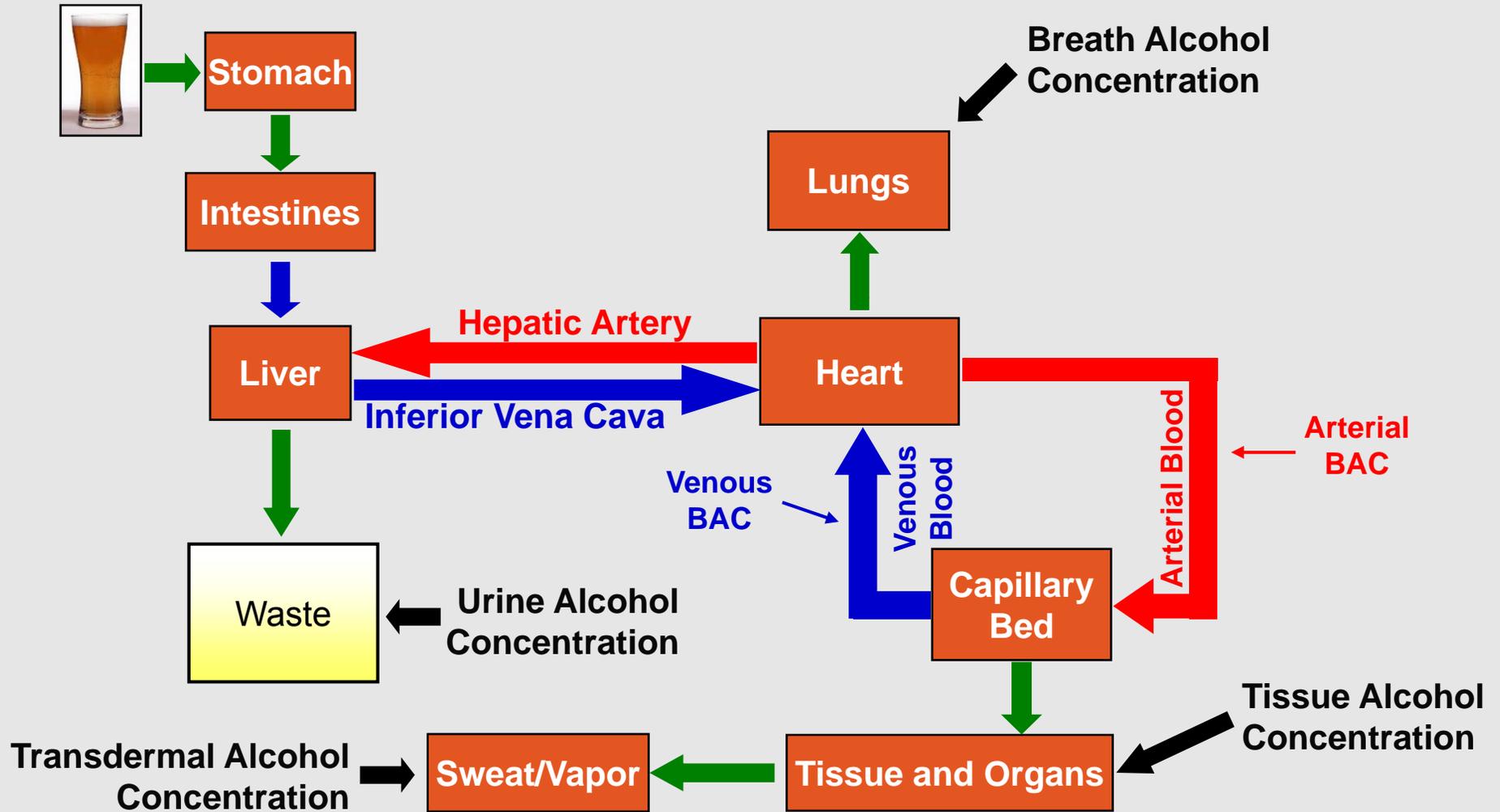


Alcohol Absorption and Elimination



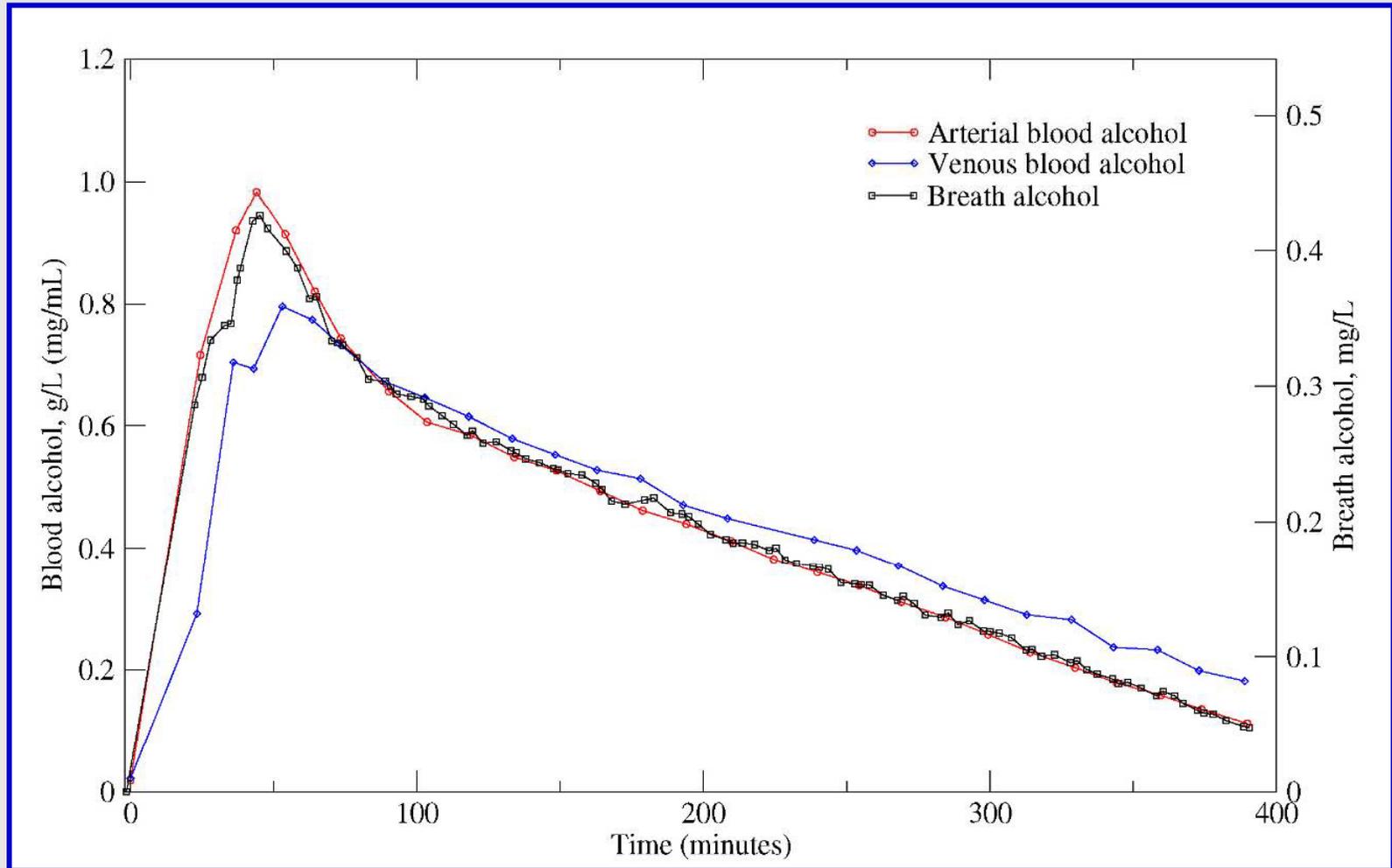


Alcohol Absorption and Elimination





Breath Alcohol (BrAC) vs. Venous & Arterial BAC



BrAC correlates well to Arterial BAC which is the measurement that correlates best to impairment (Lindberg et. al.)





Potential DADSS Technology Types





Potential DADSS Technology Types

- ◆ Based on Patent Search, Literature Review and RFI Responses, potential DADSS technologies were grouped into one of four technology types:
 1. **Tissue Spectrometry (TS)**
 - TS subsystems allow estimation of BAC by measuring how much light has been absorbed at particular wavelength from a beam of Near-Infrared (NIR) reflected from the subject skin
 - Touch-based systems that require skin contact
 - BAC value correlation utilizes a proprietary system algorithm
 2. **Distant/Offset Spectrometry (DOS)**
 - IR or laser light is transmitted to the subject from a source that receives and analyses the reflected and absorbed spectrum, to assess chemical content of tissue or liquid in vapor
 - No skin contact required
 - BAC value correlated to expired reference gas concentration and proprietary algorithm





Potential DADSS Technology Types

3. Electrochemical (ECHEM)

- Chemical-reaction-based devices such as transdermal and breathalyzer systems
- Alcohol in the presence of reactant chemical will produce changes measured by spectral analysis or semi-conductor sensor
- BAC value correlation calculation includes use of partition coefficient

4. Behavioral

- Detects impaired driving through objective behavioral measures
- Includes ocular, gaze, eye movement, and driving performance measures





Request For Information (RFI)





Request For Information RFI

- ◆ Purpose of RFI
 - Part of a technology scan
 - Identification of potential technologies and technology providers
 - Provide an initial understanding of the level of interest among technology developers
- ◆ RFI was posted on **April 3, 2008** on the following websites:
 - Federal Business Opportunities (www.FedBizOpps.com)
 - Posted on various medical technology associations
 - E-mailed to identified vendors, international contacts and BRP
 - Posted on DADSS website (www.dadss.org)
- ◆ RFI response due date was **May 5, 2008** but additional responses accepted after due date
- ◆ 17 RFI responses received to date





Volvo Alcotest - Electrochemical

- ◆ **Volvo has developed a more convenient breath alcohol detection system that is being offered in Sweden as optional equipment**
 - The Volvo Car alcohol interlock (Alcotest) is based on an active breath alcohol measurement, with an Electrochemical sensor
 - Integrated into the vehicle and has a wireless communication to the vehicle's Central Electronics Module (CEM)





Distant Spectrometry - KAIA

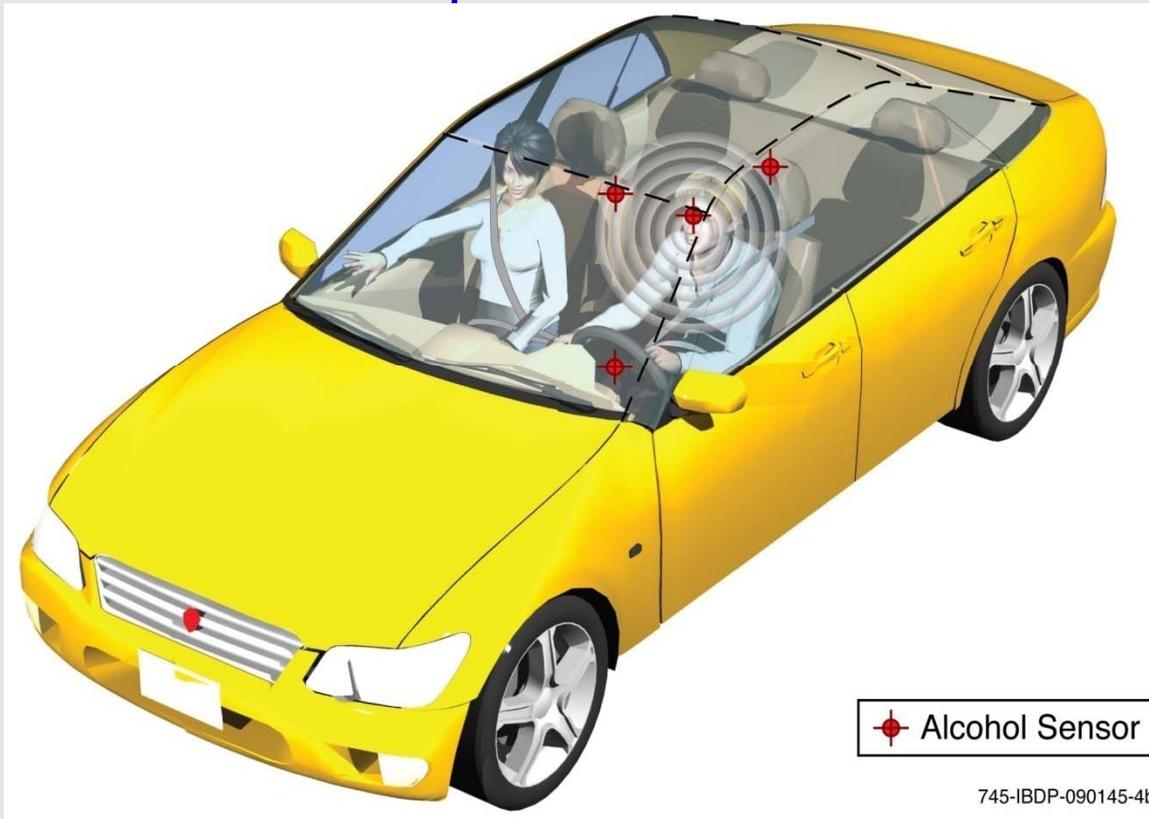
- ◆ The current KAIA approach is being developed in Sweden and features:
 - Ease of operation, with no mouthpiece, fast response, minimization of effect of interfering substances
 - Contactless expiration – air mixing ratio determined by measurement of carbon dioxide
 - Alcohol and carbon dioxide measured by infrared (IR) sensor system – no sensor degradation through product life cycle





Distant Spectrometry – Future Approaches

- ◆ The next step in measuring breath alcohol non-invasively is to mount sensors around the driver to detect ethanol in expired breath





Tissue Spectrometry

- ◆ Theory of operation
 - Currently user's forearm is illuminated with NIR light, but future approaches may utilize the hand
 - NIR light propagates into tissue
 - Portion of the NIR light is diffusely reflected back to the skin's surface and collected by measurement system
 - Light contains information on the unique chemical information and tissue structure of the subject
 - Light is analyzed to determine the alcohol concentration
 - Development testing with human subjects has verified the viability of this approach to measure BAC





Possible Vehicle Application of Tissue Spectrometry

- ◆ Future versions of the technology for vehicle application will scan tissue in the hand



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Transdermal Alcohol Sensors - Electrochemical

- ◆ Transdermal alcohol systems measure alcohol in perspiration through contact with the skin
- ◆ Transdermal alcohol levels do not rise as quickly as BrAC & BAC
- ◆ Transdermal sensing has a lag time due to the pharmacokinetics of alcohol in the tissue and skin compartment
- ◆ Intrinsic pharmacokinetics lag time:
 - Sweat has a time delay on the order of 60 minutes
 - Alcohol begins to arrive at the skin surface in quantities the sensor can detect in approximately 30-45 minutes



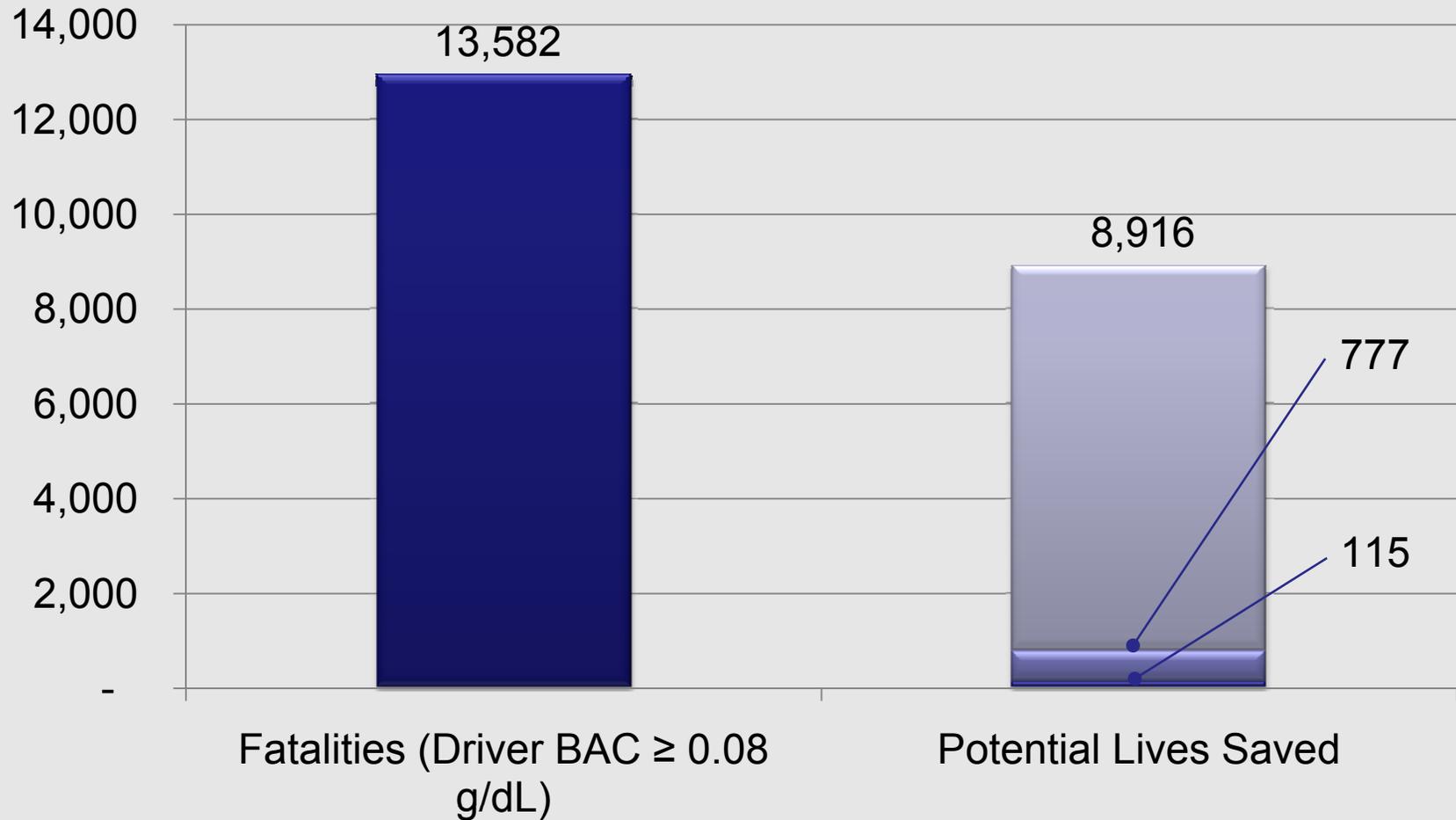


Potential Safety Benefits





Potential lives saved in the U.S. in 2005 if vehicle technologies limited driver BAC to specified levels – IIHS, 2007





Request for Proposal – Phase I





Request for Proposal

- ◆ Purpose of RFP
 - Elicit bids for the development of DADSS Subsystem from top scoring technology providers from RFI process
- ◆ RFP:
 - Outlines the program deliverables and establish a framework for program execution
 - Stipulates the requirements and the conditions required of applicants to minimize the possibility of misunderstandings and errors
- ◆ DADSS RFP developed so that it is similar to a Small Business Innovative Research (SBIR) RFP
 - Phased approach





DADSS Research Phases

Phase I

- ◆ Provides support for the conduct of feasibility-related experimental or theoretical research or R&D efforts
- ◆ Period of performance of approximately 12 months
- ◆ The basis for award will be the scientific and technical merit of the proposal and its relevance to DADSS requirements and priorities
- ◆ Potential for multiple awards (up to 4)
 - 2 High Risk Approaches
 - 1 Medium Risk Approach
 - 1 Low Risk Approach





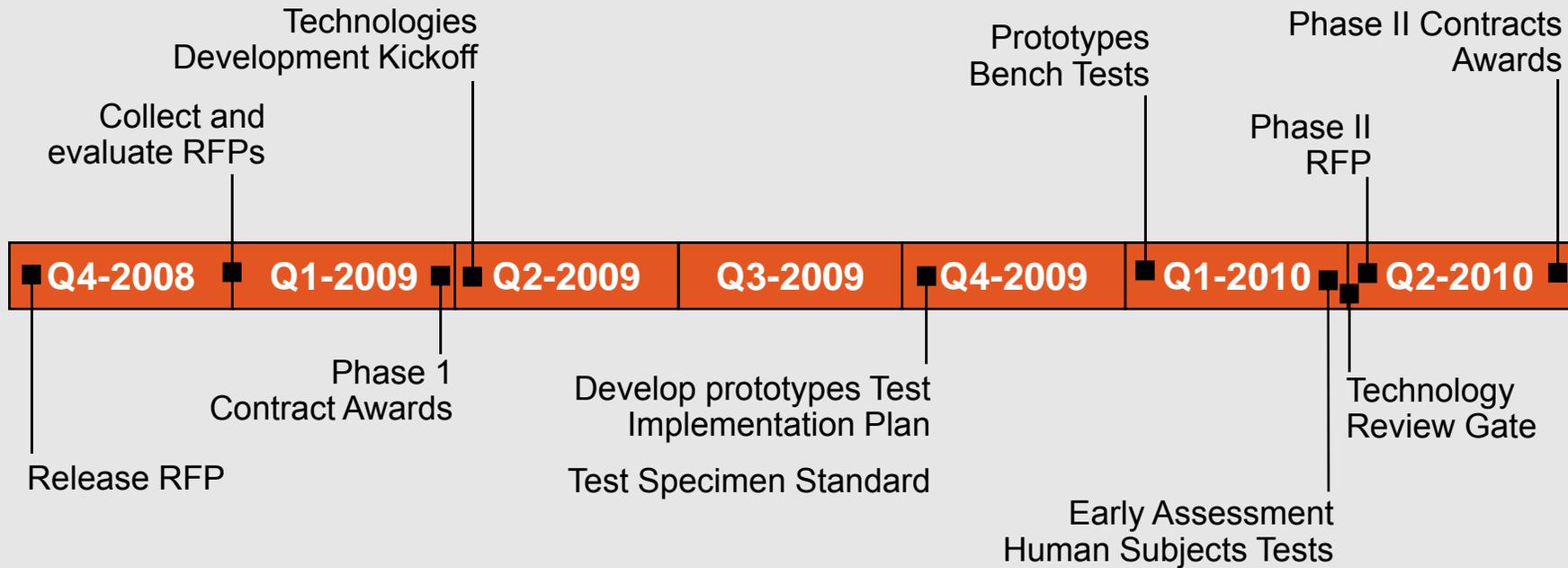
DADSS Phase I RFP Invitation

- ◆ Covers range of potential DADSS technologies
 - Tissue Spectrometry
 - Distant/Offset Spectrometry
 - Electrochemical
- ◆ Covers range of technology providers
 - Tier 1 Automotive Suppliers
 - Technologists partnered with Tier 1 Supplier
 - Independent Technologists (will be required to partner with Tier 1 supplier if to receive Tier II award)
- ◆ Covers range of technology risk (High, medium, low)
- ◆ 8 RFP invitations issued





Next Steps





Public Acceptance Research Agenda





Consumer buy-in is critical

- ◆ Design considerations likely to influence consumer acceptance and mitigate concerns only to a degree
- ◆ Other considerations include:
 - Social norms regarding drinking and driving which likely vary among countries and cultures
 - Knowledge about the affects of alcohol on driving and the relationship of number of drinks to BAC will influence the kinds of interaction with the DADSS system
 - How consumers view the autonomy of the passenger vehicle – their “right to drive”
 - Attitudes toward in-vehicle technologies

But among some consumers philosophical concerns about “big brother” and “freedom of choice” likely will remain





Acceptance among the public and key leaders is critical

- ◆ Technology will be effective only if the driving public welcomes and accepts it:
 - 58 percent of the U.S. public say they support smart technology to prevent driver impairment including alcohol-impaired driving (MADD U.S survey, 2006)
 - 56 percent of the Canadian public agree that all new vehicles should be equipped with a device that can detect alcohol in the driver and prevent starting if the driver is over a preset limit (MADD Canada survey, 2007)
 - 37 percent of U.S. public supports requiring all new drivers to use equipment that tests them for alcohol before starting their car (AAA Foundation survey, 2007)





The challenges

- ◆ Developing a reliable and seamless technology that fulfills all the specifications necessary for use in a vehicle environment
 - Has to work each and every time, over the life of the vehicle, and in a variety of challenging environments
- ◆ Anticipating and addressing likely circumvention strategies by drivers
 - Repeat offenders are highly motivated to beat the system
 - Needs to be addressed as part of the system design
- ◆ Unintended consequences
 - Are there ways in which longer term driver behavior could be affected that would negatively impact safety in the future?





What do we need to do to address consumer acceptance?

- ◆ Public education and media outreach
 - Assess current levels of consumer understanding of DADSS, and levels of acceptance
 - Monitor acceptance levels over time and willingness to adopt the technology on their vehicles
 - Assess what technology solutions might prove the most acceptable and how they might best be implemented
 - Include alternative measurement technology, time to measurement, and accuracy concerns
 - Weigh the importance of different operational features
 - Educate the public about the drunk driving problem and potential technological solutions
 - Work with advocates to build broad public and institutional acceptance





Research Agenda

- ◆ Review the literature on perceptions, attitudes, and practices regarding drinking and driving
- ◆ Undertake additional analyses to establish the relationship of technology acceptability with drinking and drinking and driving patterns
- ◆ Conduct focus groups with relevant stakeholders, e.g. abstainers, social drinkers, heavy drinkers, to assess:
 - Approval of the concept of advanced technology in all vehicles
 - Understanding of advanced technology concepts
 - Acceptability of alternative technological approaches using visual aids to illustrate the various DADDS options





Research agenda

- ◆ Develop a survey instrument to gauge:
 - Public understanding and opinions of driver alcohol detection systems in all vehicles,
 - The state of knowledge about drinking and the relationship to impairment, drinking and driving and legal thresholds, understanding about countermeasures etc.
- ◆ Explore the availability and cost of adding items to various pre-existing survey instruments that administer items related to drinking and driving
- ◆ Other
 - Continue to update the website to include the latest project details, and answer key questions about technology development and drinking and driving





View of Congress





View of Congress

Senate Report 110-131

- ◆ The Committee was pleased that in testimony before the Committee, the NHTSA Administrator spoke of the agency's renewed commitment to reducing alcohol-related fatalities.
- ◆ The Committee encourages NHTSA's involvement in the development of voluntary vehicle-based technologies, as supported under the Campaign, which will accurately detect if a driver is impaired and prevent that driver from operating the vehicle.
- ◆ The Committee looks forward to seeing the recommendations of the newly-established Blue Ribbon Panel for the Development of Advanced Alcohol Detection Technology.





View of Congress

Senate Report 110-418

- ◆ In an effort to increase the effectiveness and use of ignition interlocks, NHTSA is exploring ways to advance interlock technologies. It has therefore partnered with leading automobile manufacturers in the Automotive Coalition for Traffic Safety [ACTS] interlock initiative.
- ◆ The Committee has provided \$1,000,000 as requested for this cooperative research agreement that seeks to develop alcohol detection technologies that are less intrusive than ignition interlocks with the hope of greater public acceptance for installation in vehicles.





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