Driver Alcohol Detection System for Safety (DADSS)

Using Technology to Eliminate Drunk Driving

Hyundai Research Meeting with NHTSA
April, 2010

Why do we need a technological solution?

- 180,000 Ignition Interlocks Installed
- 1 Million DWI Convictions Annually
- 1.5 Million DWI Arrests Annually
- 906 Million driving trips within two hours of consuming alcohol
- 350 Billion Trips Annually by Car and Light Truck

NHTSA, 2003

0.00-.049 BAC → 77%

0.05-.079 → 12%

0.08+ → 11%
Why do we need a technological solution?

Distribution of BAC Levels for Drivers involved in Fatal Crashes With a BAC of .01 or Higher, 2007

Potential Safety Benefits

* Potential lives saved in the U.S. in 2005 if vehicle technologies limited driver BAC to specified levels

Fatalities – Driver BAC ≥ 0.08%  Potential Lives Saved

IIHS, 2007
Current Technology – Breath Alcohol Ignition Interlocks

♦ Drivers provide a breath sample before starting the vehicle
♦ Lengthy time for measurement
  - breath alcohol measurement can take from about 30 seconds to several minutes in colder temperatures
♦ Too intrusive for more widespread use among general public

DADSS Goal and Process

♦ Five-year, cooperative program between NHTSA and Industry (through ACTS, the Automotive Coalition for Traffic Safety) to develop and test prototypes that may be considered for vehicle integration thereafter
♦ End Goal: A non-invasive, seamless technology to measure driver BAC and reduce the incidence of drunk driving
  - Development undertaken as a step-by-step, data-driven process to ensure that effective technologies are developed
  - Intended to support a non-regulatory, market-based approach to preventing drunk driving
DADSS Blue Ribbon Panel

- **BRP appointed by ACTS** and works in an advisory capacity
- **Comprised of experts** from various disciplines, including
  - Auto manufacturers
  - Suppliers
  - Alcohol toxicology
  - Impairment
  - Ignition interlocks
  - Human factors
- **BRP assigned three working groups** to assist in effort:
  - DADSS Program Management Plan
  - DADSS Performance Specifications
  - DADSS Public Acceptance and Public Policy

Criteria for acceptable widespread use

**Minimum requirements:**
- Non invasive
- Quick to use
  - Determine BAC in less than 0.5 seconds from activation and recycle
- High accuracy
- Small
- High reliability
- Repeatable
- Durable, robust
- Low cost
- No or low maintenance
- Virtually invisible to sober drivers
How We Got Here

- JILUT (Japan) begins exploration of in-vehicle alcohol detection technologies
- Ontario, Canada consider legislation to mandate BAIIDs on all vehicles
- Nissan concept car with multiple alcohol detection systems
- Sweden proposes to equip all commercial vehicles with BAIIDs by 2010, all passenger vehicles by 2012
- NM, NY, OK consider legislation to mandate BAIIDs on all vehicles

2004 - 2008

MADD Technology Summit

Volvo’s optional AlcoGuard

2006

NHTSA & ACTS enter into Cooperative Agreement for DADSS Development

DADSS Program Process

2008

Assess Current State of Technology
Perform Detailed Technical Review
Prepare Technology Performance Specifications
Perform Technology Assessment

Phase I Funding

2009 Q2

Phase I Prototype Development
Develop DADSS Subsystem Prototype(s)
Perform Technology Verification
Perform Prototype(s) Lab Testing
Bench Tests, Human Subjects Tests

2010 Q3

Phase II Funding

2013

Phase II Subsystem Development
Implement DADSS Subsystem(s) in Vehicle Interior Mockup
Interior Mockup Testing, Human Subjects Tests

Develop DADSS Demonstration Vehicle
Perform DADSS Demonstration Vehicle Testing
Human Subjects Tests

Perform Interior Mockup Testing
Demo Vehicle Tests

Human Subjects Tests
Phase I: Contracts Awarded to Develop Prototypes

♦ Three subcontracts have been awarded to international companies
  ▪ TruTouch Technology—USA
  ▪ Alcohol Countermeasure Systems—Canada
  ▪ Autoliv Development AB—Sweden

♦ 12-month period of performance (1st phase)
♦ Prototypes to be received June-July, 2010
  ▪ Bench testing and human subjects testing to be performed June-August, 2010

Technology Types Being Developed

1. Tissue Spectrometry
   ▪ 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

2. Distant Spectrometry
   ▪ 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 is required
Tissue Spectrometry Systems

- Illustration shows **one potential adaptation in a vehicle using a stop/start button**

Distant Spectrometry

- Use unobtrusive “sniffer” to detect alcohol in the vehicle
  - Multiple sensors in-vehicle (steering wheel, A-Pillar, etc..)
- Approach is to **identify and quantify small variations of the air constitution**
  - alcohol concentration in exhaled breath
  - One approach determines BrAC of driver using carbon dioxide as correlant
Electrochemical – Transdermal Approach not being pursued

- Measures alcohol in perspiration through contact with the skin
  - Currently used to continuously monitor alcohol offenders to ensure they’re not drinking
- Lag time issues
  - Alcohol levels do not rise as quickly as BrAC and BAC
    - A time delay on the order of 60 minutes
  - Using existing transdermal sensors, alcohol begins to arrive at the skin surface in quantities the sensor can detect in approximately 30-45 minutes

Communicating with the Public

- A website was launched to provide public information: www.dadss.org
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)
  - 64 percent of the U.S. public say they support advanced technology in all vehicles, if its reliable, to prevent anyone with an illegal BAC from driving their car (IIHS, 2009)
  - 78.6 percent of the U.S. public say they support all cars being equipped with devices that won’t let the car start of the driver is drunk (AAA Foundation, 2009).

Attitudes toward requiring alcohol ignition interlocks for convicted DWI offenders

IIHS, July 2009

- Very good idea: 45%
- Good idea: 39%
- Not a good idea: 6%
- Bad idea: 8%
- Don’t know: 2%
Attitudes toward advanced alcohol test technology in all vehicles, if technology shown to be reliable
IIHS, July 2009

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
  ▪ Some drivers 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?
Next steps

♦ Test and evaluate Phase I prototypes, June-August 2010
♦ Phase II Request for Proposals, September 2010
♦ Develop demonstration vehicles, January 2011-November 2013
♦ Demonstration vehicle bench and human subjects tests, November – December 2011

QUESTIONS?
http://www.dadss.org

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Tissue Spectrometry
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Spectroscopy in Tissue

**Stratum Corneum & Epidermis** – thin protective layer, minimal water content → **minimal alcohol**

**Subcutaneous** – deeper layer, mostly lipids (fat), minimal water → **minimal alcohol**

**Dermis** – comprised largely of collagen and water (interstitial fluid), nutrients supplied by capillary bed (blood) → **ISF alcohol**

_The dermis is the critical tissue layer to interrogate_

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**TruTouch Technologies**

**Technology Description**

♦ Previous device: User’s forearm illuminated with NIR light

♦ A new, smaller prototype using a square touch pad has been successfully evaluated and demonstrated
  ▪ Provides 6 times improvement in optical signal-to-noise
  ▪ Reduced measurement time
  ▪ Conducive to BAC measurements using the hand

♦ Proposed technology is based on miniaturizing the Table-Top square optical touch pad device to meet DADSS requirements

♦ Evaluated other locations on the hand for vehicle application