Driver Alcohol Detection System for Safety (DADSS)

REACHING ZERO
Actions to Eliminate Substance-Impaired Driving

National Transportation Safety Board Forum
Washington, DC
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Dr. Bud Zaouk
QinetiQ North America
Cooperative Agreement

- Cooperative Agreement between Automotive Coalition for Traffic Safety and NHTSA (begun February 2008)
- Five-year program to develop and test prototypes that may be considered for vehicle integration
  - Non-invasive, seamless technologies to measure driver BAC and reduce incidence of drunk driving
  - Measure alcohol accurately, precisely, and reliably in a very short time so the sober driver is not inconvenienced
  - Devices intended to prevent alcohol-impaired drivers (BAC ≥ 0.08) from driving their vehicles
- Supports a non-regulatory, market-based approach to preventing drunk driving
- Phased approach
  - Phase I – Proof-of-principle prototype development
  - Phase II – Subsystem development and integration into research vehicle
Participating Manufacturers

- BMW Group
- Chrysler
- Ford
- GM
- Honda
- Hyundai
- Jaguar
- Land Rover
- Kia
- Kia Motors
- Mazda
- Mercedes-Benz
- Mitsubishi
- Nissan
- Porsche
- Toyota
- Volvo

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DADSS Program Process

2008 | 2009 | 2010 | 2013

Assess Current State of Technology
- Patents and Literature Review
  - Performance Specifications
    - Request for Information
      - Request for Proposals

Phase I Funding

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

Phase II Funding

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

- Develop DADSS Research Vehicle
  - Perform DADSS Research Vehicle Testing
    - Vehicle Tests
      - Human Subjects Tests

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Autoliv Breath-Based Technology

- Breath-based system
- Extensive real world experience with breath to measure BrAC
- Alcohol and carbon dioxide measured by IR sensor
- CO$_2$ measures breath dilution
Takata-TruTouch Touch-Based Technology

Concept of Operation

♦ Finger placed on touchpad interface
♦ Known near-IR light introduced into finger
♦ Absorbed (returned) light measured
♦ Interferometer measures light intensity at each wavelength
♦ Alcohol concentration derived and displayed
DADSS Phase I Requirements

- Phase I Prototypes evaluated against the following performance specifications:
  - Measure from 0.01% to 0.12% BAC
  - Measurement time = 325 milliseconds
  - Accuracy and Precision
    - 0.07%-0.09% BAC $\rightarrow$ ±0.0003% BAC
    - Required Standard Calibration Devices (SCD)
      - Breath-based systems
      - Touch-based systems

<table>
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<tr>
<th>% BAC</th>
<th>DADSS Accuracy</th>
<th>58 FR 48705 §4.1</th>
<th>DADSS Precision</th>
<th>58 FR 48705 §4.1</th>
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<td>0.0050</td>
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<td>Greater than 0.090</td>
<td>0.0010</td>
<td>0.0050</td>
<td>0.0010</td>
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More accurate calibration source required for DADSS program
Standard Calibration Devices (SCDs)

Objective
♦ Assess and document the accuracy and precision of the Phase I Proof-of-Principle (PoP) prototypes

Approach
♦ Provide sample sources of “breath” or “touch” to PoP sensor
  ▪ Known and consistent alcohol content
Takata-TruTouch Bench Test Evaluation at 0.080 % BAC

DADSS Accuracy & Precision = 0.0003 % BAC

58 FR 48705 4.1 Criteria = 0.0050 % BAC

58 FR 48705 4.1 Criteria = 0.0042 % BAC

DADSS Accuracy & Precision = 0.0003 % BAC

0.0001 0.0001 0.0005 0.0013 0.0011 0.0016 0.0021 0.0043

Accuracy 60 s 30 s 15 s 5 s 60 s 30 s 15 s 5 s

Precision
Autoliv Bench Test Evaluation

58 FR 48705 4.1 Criteria = 0.0050 % BAC

58 FR 48705 4.1 Criteria = 0.0042 % BAC

DADSS Accuracy & Precision = 0.0003 % BAC

Accuracy

Precision

% BAC Variation

0.0000

0.0020

0.0030

0.0040

0.0050

0.0060

0.080 % BrAC

0.120 % BrAC

0.0004

0.0022

0.0027

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WWW.DADSS.ORG
Human Subject Testing

♦ Subjects dosed to reach a BAC of 0.12 g/dL

♦ Test procedures
  ▪ Blood is drawn at a rate of 1 ml/min
  ▪ Samples taken every 2.5 minutes

♦ Every 5 minutes subjects provide
  ▪ Breath sample into Nanopuls
  ▪ Breath sample into Autoliv prototype
  ▪ Presses finger on touch pad of Takata-TruTouch prototype
Summary and Next Steps

♦ Three DADSS Phase I PoP prototypes have completed bench and human subjects testing
♦ Phase I results indicate there are technologies demonstrating potential to meet DADSS Performance Specifications (meas. time, accuracy, and precision)
♦ Researchers have identified the research work needed to meet the DADSS requirements (gap analysis)
♦ Two technology providers have been selected for Phase II award:
  - Autoliv Development AB
  - Takata-TruTouch Automotive Solutions
♦ Phase II research initiated
Driver Alcohol Detection System for Safety

QUESTIONS?
http://www.dadss.org

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