Mothers Against Drunk Driving

Additional Comments to the Federal Register
Advanced Impaired Driving Prevention Technology
National Highway Traffic Safety Administration
Advance Notice of Proposed Rulemaking
Docket No. NHTSA–2022–0079
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For more information, please contact MADD Government Affairs at policy@madd.org or 877-275-6233

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Introduction

This document is a comprehensive timeline of the development of advanced impaired driving prevention technology by auto manufacturers and their suppliers that could satisfy requirements outlined in Section 24220 (Honoring Abbas Family Legacy to Terminate (HALT) Drunk Driving Act) of the 2021 Bipartisan Infrastructure and Jobs Investment Act (IIJA). The technology cited in this document has been announced publicly by auto manufacturers and suppliers and includes technology in development found using publicly available patents filed by these companies.

Also featured in the is document is a development timeline of the Driver Alcohol Detection System for Safety (DADSS) program, auto manufacturer's technology development, and the passage of the HALT Act.

Request for Information on advanced impaired driving prevention technology for the Advance Notice of Proposed Rulemaking (ANPRM)
This document focuses on three technologies to prevent drunk and impaired driving:

1) Passive breath or touch-based sensors to determine alcohol impairment.
2) Driver monitoring systems to determine alcohol impairment (this technology typically uses a camera to determine driver impairment).
3) A combination of the above systems in one technology.

This document provides information on the following:

- ✓ Brief overview of information companies have made publicly available.
- ✓ Timeline from 2001 to 2024 detailing public policy actions, Congressional hearings, passage of the HALT Act, and developments of advanced impaired driving prevention technology.
- ✓ Detailed descriptions of how publicly announced and patent-only technology approach a result that eliminates impaired driving.

Dating back to 2007, the auto industry and suppliers have made a limited number of public announcements about the development of passive alcohol sensors or driver monitoring systems to determine alcohol impairment. For that reason, MADD researched patents submitted by manufacturers to gauge efforts of technological advancement and engagement by the industry.

Publicly announced passive advanced impaired driving prevention technology by automakers and suppliers

Company	Year announced
Toyota	2007
Nissan	2007
DADSS	2008
AKM/Senseair	2017
Volvo	2019
DYM Sense	2020
Hyundai Mobis	2022
Smart Eye	2022
Bosch	2023
Valeo	2023
Magna	2023
CorrActions	2023

MADD also reviewed patents by the auto industry specific to determining alcohol impairment. Patents are not publicly promoted by automakers but are searchable online. The patents give an insight into technologies the auto industry and their suppliers are developing for impaired driving prevention.

The auto industry has historically emphasized the development of the DADSS program in its messaging as noted during a 2019 Senate hearing.[1] The development of technology and registration of patents for advanced impaired driving prevention technology show potential for additional pathways forward to prevent drunk and impaired driving crashes.

What do patents show in terms of development of advanced impaired driving prevention technology?

Patents provide a resource to show the technologies auto manufacturers deem worthy of protection. Patents are not confirmation that the patented technology is ready for implementation in vehicles, and do not detail the technology's stage of development.

MADD proposes requesting information from each company as to:

1) The current level of development for the technology identified in the patent.
2) Whether testing was done or is planned on this technology to determine its technical readiness level (I.E. are they running tests on this technology in a lab or on the road).

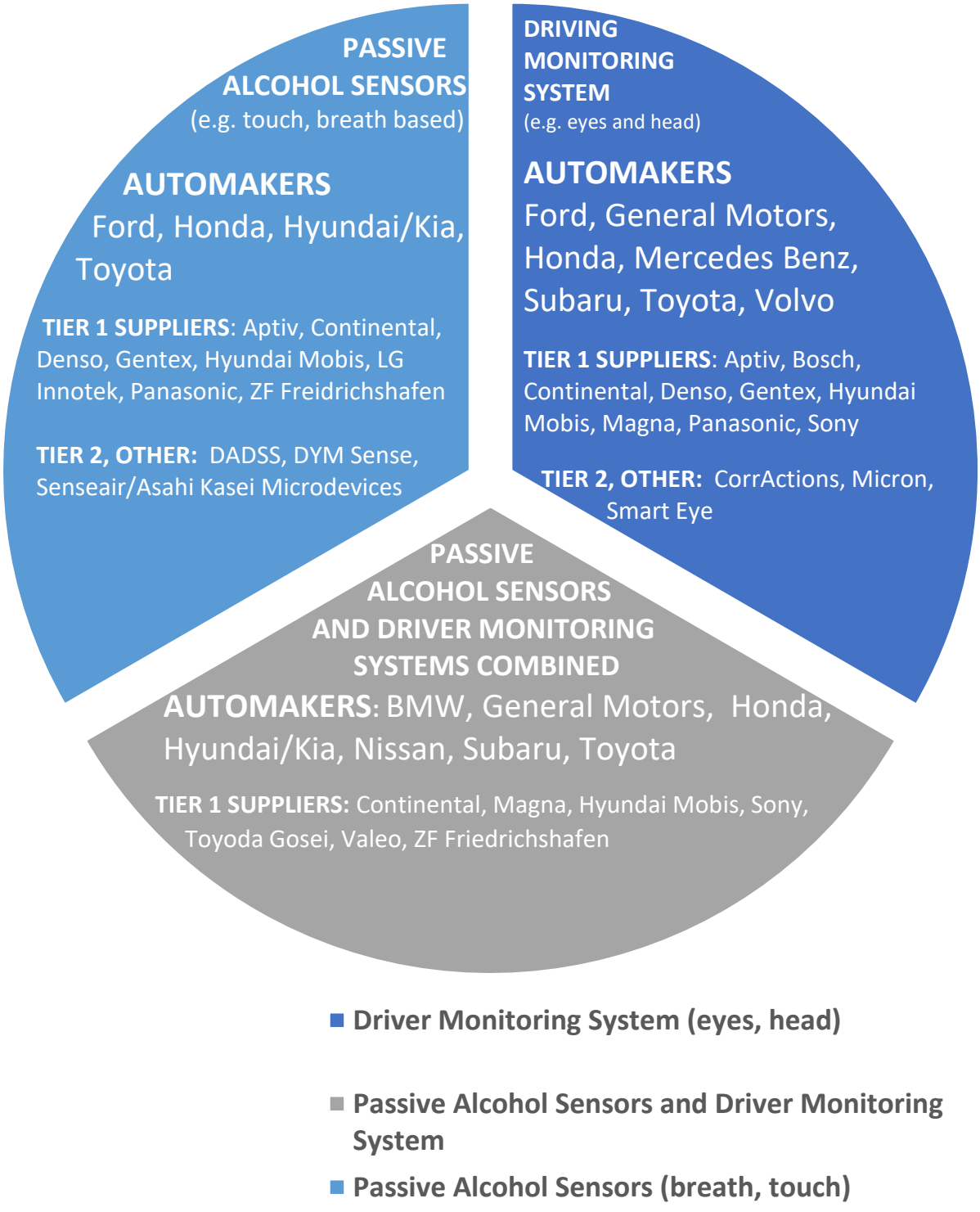
MADD is highlighting specific patents to demonstrate that automakers and their suppliers are investing in the development and deployment of advanced impaired driving prevention technology and that this development is not limited to DADSS.

Patents of passive advanced impaired driving prevention technology publicly announced by automakers and suppliers

Company	Year patents were filed with a patent office (from what MADD could find)
BMW	2018
Ford	2006
General Motors	2009
Honda	2013
Hyundai/Kia	2020
Mercedes Benz	2021
Subaru	2023
Aptiv	2005
Bosch	2007
Continental	2001
Denso	2007
Gentex	2019
Hyundai Mobis	2021
LG Innotek	2016
Magna	2020
Sony	2018
Toyoda Gosei	2022
Valeo	2018
ZF	2021
CorrActions	2021
DADSS	2008
DYM Sense	2020
Micron	2020
Senseair/AKM	2007

In this document, MADD highlights public announcements in addition to patents relating to advanced impaired prevention detection technology.

Companies that have or are currently developing technology to passively detect and prevent substance-impaired driving



Advanced Impaired Driving Prevention Technology Capability by Company Driver Alcohol Detection System for Safety (DADSS)

The Driver Alcohol Detection System for Safety (DADSS) is a joint private-public partnership between the auto industry through the Automotive Coalition for Traffic Safety (ACTS), the National Highway Traffic Safety Administration (NHTSA) and Virginia, Maryland and Connecticut.

Robert Strassburger, CEO of Automotive Coalition for Traffic Safety has stated he is confident that DADSS technology will be ready and available to meet the law's deadline and that at least one version of the technology will be available by 2025.[2]

Test vehicles are in operation in coordination with state highway safety offices of Connecticut and Maryland. The investment in DADSS from 2008 to 2025:

DADSS Funding
NHTSA: $99,222,906
Virginia: $34,503,929
ACTS: $14,900,000
Total: $148,626,835

DADSS Funding Table

	NHTSA	ACTS	Virginia	Total
2008	1,000,000	1,000,000		2,000,000
2009	1,000,000	1,000,000		2,000,000
2010	1,250,000	1,000,000		2,250,000
2011	1,500,000	1,000,000		2,500,000
2012	1,250,000	1,000,000		2,250,000
2013	5,289,000	1,000,000		6,289,000
2014	5,440,000	1,250,000		6,690,000
2015	5,440,000	1,250,000		6,690,000
2016	5,493,906	1,250,000		6,743,906
2017	5,494,000	1,250,000	5,072,928.24[3]	11,816,928.24
2018	5,494,000	1,250,000	5,095,143.10[4]	11,839,143.10
2019[5]	5,494,000	1,250,000	4,149,043.21[6]	10,893,043.21
2020	4,766,000	1,400,000	5,099,042[7]	11,265,042
2021[8]	5,312,000		4,934,700.85[9]	10,246,700.85
2022	11,250,000		5,091,446[10]	16,341,446
2023	11,250,000		5,061,626[11]	16,311,626
2024	11,250,000			11,250,000
2025	11,250,000			11,250,000
Total	**99,222,906**	**14,900,000**	**34,503,929**	**$148,626,835**
% of Total DADSS Funding	**NHTSA: 66.76%**	**ACTS: 10.02%**	**Virginia: 23.22%**	

Notes on the funding table chart: Automotive Coalition for Traffic Safety (ACTS) represents payments made by the auto industry towards DADSS. The ACTS and NHTSA funding levels from 2008 to 2019 are taken from a submission from a June 19, 2019,

Senate hearing where NHTSA Acting Administrator Heidi King answered questions from Senator Maria Cantwell.[12] As of fiscal year 2022, according to NHTSA, $14,900,000 was spent on DADSS by ACTS. The chart puts $1,400,000 for funding towards ACTS in 2020 to represent industry funding towards DADSS from 2020-2022.[13] It is unclear how much the auto industry contributed through ACTS after fiscal year 2022.

The 2020 level for NHTSA DADSS funding is noted in the 2021 Infrastructure Law. From 2017-2021, the total DADSS funding was at $26,560,000 from NHTSA. The 2021 Infrastructure Law increases the funding for DADSS form the federal government for 2022-2025 to $45 million.[14] For funding authorized for DADSS by NHTSA since 2021, it is unclear how much of the total amount has been spent and how much by year. ***The figure for each year is an estimate of how much of the $45 million was spent***. The exact Virginia funding amounts are gathered from yearly reports submitted by Virginia DMV to NHTSA. There is not data yet on how much Virginia committed for 2024, but DADSS is referenced in Virginia's Triennial Highway Safety Plan for 2024-2026.[15]

Original Equipment Manufacturers (OEM)

BMW

BMW filed patents in 2018 and 2019[16] for a combination of driver monitoring and breath-based system to determine alcohol impairment. BMW has not made any public announcements regarding their impaired driving prevention technology.

Detailed description of BMW's technology below.

Ford

Ford filed a patent in 2006[17] and subsequent patents for breath and touch-based sensors, a combination of driver monitoring and breath-based system, and a driver monitoring system to determine alcohol impairment. Ford has not made any public announcements regarding its impaired driving prevention technology.

Detailed description of Ford's technology below.

General Motors

General Motors filed a patent in 2009 on advanced impaired driving prevention technology.[18] relating to driver monitoring systems and systems that combine passive breath-based system with driver monitoring to determine alcohol impairment.

On December 13, 2023, General Motors CEO Mary Barra discussed alcohol-impairment detection technology because of NHTSA's Advance Notice of Proposed Rulemaking (ANPRM) announcement. "we've been working with regulators on that…We have technology to do that…I think that's technology that's coming that I think's going to be good for everyone," she told The Economic Club's David Rubenstein.[19, 20]

Detailed description of General Motors' technology below.

Honda

Honda filed a patent for impaired driving prevention technology in 2013, [21] and subsequent patents for a touch-based system relating to driver monitoring systems and systems that combine passive breath-based system with driver monitoring to determine alcohol impairment.

Honda has not made a public announcement about impaired driving prevention technology. In November 2022, NHTSA officials met with Honda, where "the subject of the meeting included Honda's work on driver impairment technologies."[22]

Detailed description of Honda's technology below.

Hyundai, Kia

Hyundai and Kia applied for patents in 2020[23] for a breath-based and a combination of a breath-based and driver monitoring system to determine alcohol impairment. Hyundai and Kia have not made any public announcements regarding their impaired driving prevention technology.

Detailed description of Hyundai and Kia's technology below.

Mercedes Benz

Mercedes Benz applied for a patent in 2021[24]for a driver monitoring system to determine alcohol impairment. Mercedes Benz has not made any public announcements regarding its impaired driving prevention technology.

Detailed description of Mercedes Benz's technology below.

Nissan

Nissan publicly announced the development of impaired driving prevention technology in 2007. The system announced in 2007 is a combination of driver monitoring, breath and touch-based system and a driver monitoring system to determine alcohol impairment.[25, 26]

Detailed description of Nissan's technology below.

Subaru

Subaru discussed passive impaired driving prevention technology at a Congressional hearing in 2019[27] and registered patents specific to detecting alcohol impairment in 2023.[28]

Subaru made public announcements regarding their impaired driving prevention technology at the Enhanced Safety of Vehicles (ESV) Conference in 2023. During the conference, NHTSA met with Subaru representatives and provided NHTSA with high-level information briefings on their technologies' various capabilities. [29]

Detailed description of Subaru's technology below.

Toyota

Toyota is developing a breath-based, driver monitoring system and a combination of systems to determine alcohol impairment. Toyota has been developing passive impaired driving prevention technology since at least 2007. [30, 31]

Toyota made public statements regarding impaired driving prevention technology in 2007.

Following an April 12, 2019, letter from Sen. Tom Udall (D-NM), Toyota stated its support for the DADSS program and intent to further develop its own technology:

> "The DADSS Program is in the invention phase, with current testing estimated to deliver a technology transfer of a fleet and accessory specification version in 2020 to vehicle integrators. Toyota plans to continue to evaluate this and any other technologies that can address this safety issue. We believe that carefully incorporating technologies in a way that maximizes customer acceptance will also lead to the most safety benefits."[32]

Detailed description of Toyota's technology below.

Volvo

Volvo is developing a driver monitoring system to determine alcohol impairment and has made public statements about the development of passive advanced impaired driving prevention technology since at least 2019.[33] Volvo filed a Worldwide patent in 2004 for a driver monitoring system to determine alcohol impairment.[34]

Volvo made public comments in 2019, 2021 and 2022 supporting the development of advanced impaired driving prevention technology. [35, 36, 37] On November 15, 2022, NHTSA met with Volvo to discuss topics that included potential vehicle impairment technologies.[38]

Detailed description of Volvo's technology below.

Tier 1 Suppliers

Aptiv

Aptiv has been developing passive impaired driving prevention technology since at least 2018[39] from a patent Aptiv acquired from Delphi that was originally filed in 2005. Aptiv is developing breath-based and driver monitoring systems to determine alcohol impairment.

Aptiva made public statements regarding its technology in a 2021 White Paper that acknowledged developing driver monitoring systems to determine alcohol impairment.[40] In 2019, Aptiv noted driver monitoring systems to determine intoxication during an investor's conference.[41] In 2020, Aptiv announced they testing their technology's ability to detect intoxication.[42] Additionally, on October 26, 2022, a representative for Aptiv joined the Automotive Safety Council, and met with NHTSA to discuss potential vehicle impairment technologies."[43]

Detailed description of Aptiv's technology below.

Bosch

Bosch filed a patent related to passive impaired driving prevention technology in 2007.[44] Their technology appears focused on driver monitoring systems to determine alcohol impairment. Although, in 2007, they did investigate developing passive alcohol sensors.

Bosch has made mention of a partnership with the University of Berne and Center for Digital Health Interventions (CDHI) at ETH Zurich and the University of St. Gallen to investigate driver monitoring systems to determine alcohol impairment. In 2024 at CES, Bosch showcased their technology. [45]

Detailed description of Bosch's technology below.

Continental

Continental filed a patent request in 2001[46] for a touch-based and driver monitoring system combination to determine alcohol impairment.

Continental has not publicly announced their technology developments; however, on June 23, 2023, NHTSA met with Continental where "participants discussed information related to alcohol sensing technology."[47]

Detailed description of Continental's technology below.

Denso

Denso's patents date back to 2007[48] for breath and touch sensors plus a driver monitoring system to determine alcohol impairment. Denso has not publicly debuted its technology in development. On October 26, 2022, Denso met with NHTSA where the subject of the meeting "included Denso's work on driver impairment technologies."[49]

Detailed description on Denso's technology below.

Gentex

Gentex filed a patent in 2019[50] for breath-based and driver monitoring systems to determine alcohol impairment.

The Gentex website features a rideshare vehicle that can detect for alcohol vapors noting that their in-cabin sensing can keep autonomous and ride-share vehicles operational and passengers safe with in-cabin sensing units that use a variety of sensing methods to detect smoke, vape, VOCs, alcohol, and airborne contaminants.[51]

Detailed description of Gentex's technology below.

Hyundai Mobis

Hyundai Mobis has been developing passive impaired driving prevention technology since at least 2021.[52] Hyundai Mobis is developing a multitude of systems including: breath and touch-based systems, driver monitoring systems and a combination of these systems together. Hyundai made public announcements regarding their technology developments in 2022. [53, 54]

Detailed description of Hyundai Mobis' technology below.

LG Innotek

LG Innotek filed for a patent for passive touch-based impaired driving prevention technology in 2016.[55] LG Innotek has not made any public statements regarding the development of its technology.

Detailed description of LG Innotek's technology below.

Magna

Magna has been developing passive impaired driving prevention technology since at least 2020.[56] Magna's technology consists of a combination of driver monitoring and breath-based system. Magna publicly debuted its technology at the Consumer Electronics Show (CES) in January 2024. [57, 58]

On September 28, 2023, NHTSA met with Magna to discuss "active safety technologies, thermal system for AEB and PAEB, and Magna in-cabin technology for distracted and impairment driving using both driver monitoring systems and BrAC state estimation tools."[59]

Detailed description of Magna's technology below.

Panasonic

Panasonic has been developing passive impaired driving prevention technology since at least 2008.[60] Panasonic debuted its touch-based and driver monitoring technology at CES in 2022, stating its driver monitoring system seeks to detect drowsiness, impairment, and distraction.[61]

Detailed description of Panasonic's technology below.

Sony

Sony filed for a patent in 2018 [62] for a driver monitoring system and a combination of a breath-based and driver monitoring system to determine alcohol impairment. Sony has not shared public information regarding its technology development.

Detailed description of Sony's technology below.

Toyoda Gosei

Toyoda Gosei filed a patent request for an "alcohol level detection device" in 2022.[63] Unlike other breath-based approaches, Toyoda Gosei's technology uses a gas sensor to determine alcohol impairment next to the skin of a driver and also a driver monitoring system to determine impairment. Toyoda Gosei has not made public statement regarding its technology development.

Detailed description of Toyoda Gosei's technology below.

Valeo

Valeo has been developing passive impaired driving prevention technology since at least 2018. Valeo is a developing a combination driver monitoring system and breath or touch-based system. Valeo debuted their technology developments at CES in January 2024.[64]

Detailed description of Valeo's technology below.

ZF Friedrichshafen

ZF Friedrichshafen requested a patent in 2021,[65] for a breath-based system and a combination of breath-based and driving monitoring system that can detect alcohol and drug-impairment.

ZF has not publicly announced their technology; however, on March 29, 2023, NHTSA met with ZF where they "included the Infrastructure Investment and Jobs Act impaired driving mitigation directive and a ZF prototype that has been developed to help prevent drunk driving deaths on driver impairment technologies."[66]

Detailed description of ZF Friedrichshafen's technology below.

Tier 2 and Other Suppliers

CorrActions

CorrActions has a patent dating back to 2021 for their advanced impaired driving prevention technology.[67] CorrActions is developing a driver monitoring system to determine alcohol impairment based on vehicle movements.

CorrActions has publicly displayed its technology on its website.[68] In April 2023, Volvo invested $6 million in CorrActions technology development.[69]

On December 5, 2022, and again on July 17, 2023, CorrActions met with NHTSA to discuss CorrActions' work on driver impairment technologies.[7071]

Detailed description of CorrActions' technology below.

DYM Sense

DYM Sense has been developing a touch-based passive advanced impaired driving prevention technology since at least 2020.[72] [73]

On November 6, 2023, NHTSA met with DYM Sense to discuss the development of a "non-invasive sensor, which monitors a car driver's blood alcohol level to prevent drunk driving."[74]

Detailed description of DYM Sense's technology below.

Micron

Micron has registered patents relating to driver monitoring systems to determine alcohol impairment dating back to 2020. [75] Micron has not made any public announcement regarding the development of its advanced impaired driving prevention technology.

Detailed description of Micron's technology below.

Senseair/Asahi Kasei Microdevices

Senseair has been developing a breath-based passive impaired driving prevention technology since 2007.[7677]

Sensair has publicly displayed their breath-based passive impaired driving prevention technology on its website.[78] The site contains videos detailing how the technology works.[79] At CES in 2022 and 2024, Senseair's parent company Asahi Kasei Microdevices featured the technology. [80, 81] This breath-based technology is used as part of the DADSS program and used in Magna's system.[82, 83]

Detailed description of Sensair/Asahi Kasei Microdevices technology below.

Smart Eye

Smart Eye first debuted their driver monitoring system to detect alcohol impairment in 2022.[84, 85] The Smart Eye technology is part of the driver monitoring system on some Volvo vehicles, including the EX90.[86]

Detailed description of Smart Eye's technology below.

Timeline of Advanced Impaired Driving Prevention Technology Development

The two-decade road to the Advance Notice of Proposed Rulemaking (ANPRM) for advanced impaired driving technology has seen multiple Congresses, and multiple Administrations. The bipartisan passage and support of the HALT Act was the culmination of years of Congressional hearings, briefings, panels, studies, and support from drunk driving victims and survivors. The bipartisan HALT Act mandated all new vehicles – starting in 2026 – to be equipped with advanced impaired driving prevention technology. Mothers Against Drunk Driving (MADD) has participated in the conversation every step of the way, advocating for technology that would put an end to the drunk driving epidemic by removing the ability to drive drunk. MADD began reaching out to the automotive industry, Congress, and the Administration in 2006 when it convened the International DUI Technology Symposium: A Nation Without Drunk Driving.

The following timeline represents the extensive work by the automotive industry, the Federal Government, and MADD to get to this ANPRM.

2001

October 15, 2001

Continental applied for a patent with the Worldwide Intellectual Property Organization for a driver monitoring system to determine alcohol impairment.[87]

2004

March 22, 2004

Volvo applied for a patent with the World Intellectual Property Organization for a driver monitoring system to determine alcohol impairment. [88]

2005

January 12, 2005

Delphi applied for a patent for a breath-based alcohol detection system.[89]

2006

April 26, 2006

Ford applied for a patent in Germany for a touch-based sensor to determine alcohol and drug impairment.[90]

June 19-20, 2006

MADD convened the International DUI Technology Symposium: A Nation Without Drunk Driving, to explore the role of technology in controlling and eliminating drunk driving. Participants included more than 100 representatives from stakeholder organizations involved in technology and research development, automobile manufacturing, insurance, law enforcement, courts, communications, state legislators, MADD members and staff, and NHTSA officials.

As a result of MADD's Technology Symposium, and to guide the research and development of emerging technologies, the Insurance Institute for Highway Safety (IIHS) agreed to assist in the formation of a Blue-Ribbon Panel on Advanced Alcohol Detection Technology. Traffic safety advocates and members of the automotive industry enthusiastically supported and participated in the Blue-Ribbon Panel. The goal was to encourage and support the development of new technology that could prohibit drivers from operating a vehicle while drunk.[91]

November 2006:

MADD released a summary report from the International Technology Symposium. Based on symposium presentations, the report highlighted "Emerging Technologies," including breath testing technology, tissue spectroscopy technology, transdermal perspiration measurement technology, and eye movement measurement technology. The report concluded:

- "Many steps are needed to bring a promising concept to market which include surveying the potential market to refine product requirements; developing one or more concept devices; building and testing prototypes in the laboratory; integrating

a successful prototype with other vehicle systems; testing an integrated system in the field; and developing production and marketing capacity. ***It is reasonable to imagine that advanced technologies could be ready for testing in selected vehicle fleets in less than 10 years.*** In time, the devices could be refined based on field test experience and introduced to the public as standard or optional equipment on some vehicles. In the future, the devices could be further refined as needed to be ready for full implementation." (page 8)

- "The challenge is great, and success is not guaranteed. But the promise is even greater. With the resources, cooperation, good will and common goals expressed at the Symposium, the vision can be achieved." (page 12)

November 20, 2006

MADD, the US Department of Transportation (DOT), the National Highway Traffic Safety Administration (NHTSA), the Insurance Institute for Highway Safety (IIHS), the Governors Highway Safety Association (GHSA), the Century Council, the Distilled Spirits Council of the United States (DISCUS), and the Alliance of Automobile Manufacturers held a press event to launch the Campaign to Eliminate Drunk Driving, including the exploration of advanced vehicle technologies.[92]

On November 20, 2006, at the announcement of the Campaign to Eliminate Drunk Driving, four technologies investigated by the blue-ribbon panel were referenced:

1) Advanced breath testing, both individual testing and testing for alcohol in the vehicle;
2) using visible light to measure BAC (spectroscopy);
3) using non-invasive touch-based systems to measure BAC transdermally;
4) and eye movement measurement technology, including the involuntary eye movements (or nystagmus) related to BAC, and eye closure that can indicate drowsiness."[93]

U.S. Secretary of Transportation Mary E. Peters said, "Drunk driving is a problem that is painful and persistent, but it's also preventable. Pairing the public and private sectors for the common good is a powerful combination, one that will help us achieve real results in terms of saving lives and preventing injuries."[94]

"The threat of arrest and punishment for decades as the primary tactic against drunken drivers, is no longer working in the struggle to reduce the death toll, officials say, and they are proposing turning to technology — alcohol detection devices in every vehicle – to address the problem."[95]

Charles Hurley, CEO of MADD, said, "Cars are getting smarter all the time. Some even park themselves, electronic stability control. That technology can be applied to detect drunk drivers and make cars inoperable perhaps 10 years from now."[96]

November 25, 2006

The New York Times published an editorial advocating for the future of advanced impaired driving technology.

> "For the future, safety advocates hope to develop passive devices that unobtrusively test all drivers for alcohol, without requiring every soccer mom to blow into a tube every time she gets into a car. Even better would be devices that flash warnings and slow cars at any sign of erratic driving, whether the cause be drink, distraction, fatigue, recklessness or sheer incompetence."[97]

December 18, 2006

LA Times – New roadblocks to drunk driving

"A blue-ribbon panel was launched by MADD and major traffic safety organizations to explore the issue. Unlike interlocks, which are conspicuous and require frequent calibration, technology for the average driver would need to be moderately priced, reliable, unobtrusive and set at the legal blood-alcohol concentration, proponents say.[98]
"Other options under study are devices that would track involuntary eye movements, such as nystagmus -- a jerkiness of the eye that is related to alcohol use and drowsiness. The challenge, says Ferguson, is to refine the technology so that it's completely reliable, quick and convenient. This has to be something that doesn't have you going through hoops to get your car started, she says." (Susan Ferguson was senior vice president of research at the Insurance Institute for Highway Safety and chair of the Blue-Ribbon Panel for the Development of Advanced Alcohol Detection Technology.)

2007

January 3, 2007

Toyota announced the development of a driver monitoring and touch-based system to determine alcohol impairment.[99, 100]

April 19, 2007

NHTSA Administrator Nicole Nason testified before a Senate committee and mentioned advanced impaired driving prevention technology in her written testimony,

> "We believe current research can produce a new generation of the interlocks that will be noninvasive and much more reliable. Large-scale deployment of this technology coupled with continued law enforcement offers the very real prospect that one day drunk driving could be a thing of the past."[101]

June 2007

Alcohol-related traffic deaths were at an all-time high since 1992. MADD called on Congress to address the drunk driving problem by implementing the Campaign to Eliminate Drunk Driving. MADD's National Board of Directors met with Congressional leaders, urging them to support high-visibility enforcement, ignition interlocks for all convicted drunk driving offenders, and support for advanced technology research and development.

July 16, 2007

FY 2008 Senate Transportation Appropriations bill report language contains language in support of MADD's Campaign to Eliminate Drunk Driving and encouraged NHTSA's involvement in the development of "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."[102]

August 2, 2007

Nissan made a public announcement regarding the development of a driver monitoring, touch- and breath-based system to determine alcohol impairment. [103, 104]

October 5, 2007

Bosch applied for a patent in Germany that explored a touch-based sensor and driver monitoring system for alcohol impairment. Bosch stated, "parameters such as eye and head movements as well as the heart rate to be evaluated by the driver determine alcoholization of the driver." [105]

October 25, 2007

The Senate Environment and Public Works Subcommittee on Transportation, Safety, Infrastructure Security, and Water Quality held a hearing on "Oversight Hearing on Effectiveness of Federal Drunk Driving Programs." [106]

MADD National President Glynn Birch testified at a hearing in support of passive alcohol detection technology on new vehicles "These technologies must be moderately priced, absolutely reliable, unobtrusive to the sober driver, and set at the illegal limit of.08."

During the hearing, Sen. Barbara Boxer (D-CA), Chairman of the full EPW Committee, referred to what would later become the DADSS program as the "Manhattan Project" for drunk driving.

U.S. DOT Deputy Secretary Thomas Barrett said, "As a longer-term countermeasure against impaired driving, NHTSA is pursuing more advanced technology. The agency is currently establishing a cooperative research initiative with the automotive industry that could result in technology that would prevent an impaired driver from operating a vehicle. In order to be effective, any technology would need to be passive, requiring no deliberate driver action, and sufficiently accurate, reliable and affordable for widespread use. The timeframe for developing and deploying such technology is estimated to be 10-15 years."

MADD CEO Chuck Hurley said:

> The third and perhaps most important point, Madam Chair and Ranking Member Vitter, is the opportunity for technology 10 years out. The automobile industry, working with the U.S. Department of Transportation and MADD and the insurance industry and others, believe they can make new cars in about 10 years that won't be operable by drunk drivers at .08 and above.
>
> The advanced technology is really extraordinary in that it offers the opportunity if it pans out both in technology and in public acceptance, of literally not allowing cars to start .08 and above. It won't stop drinking, never MADD's goal. It won't stop impaired driving that begins before .08. But .08 and above can be eliminated through that technology. It would make drunk driving the public health equivalent of polio.

In a response from Senator Vitter (R-LA) asked of the potential cost of passive alcohol detection technology on all new vehicles, MADD CEO Hurley said:

> Early estimates are more of what it would have to meet, and it would have to be about $200 or less, probably. Sensor technology breakthroughs may allow that. It obviously cannot hassle sober drivers; 40 percent of the public doesn't drink, and the other 40 percent is responsible. It is really only 20 percent that needs to be affected. It has to be absolutely six sigma reliable and effective. There is a blue-ribbon panel on advanced alcohol detection technology that MADD is proud to serve on, with the U.S. Department of Transportation, with the Alliance for Automobile Insurers, who really need to be thanked for this. Drunk driving isn't their problem. They don't sell alcohol at dealerships. They are stepping up and really all over the world, in Japan,

in Europe and in North America, all the auto companies are looking at this advanced technology, and we thank them for that.

November 23, 2007

Autoliv applied for a patent for a breath-based sensor. The patent is now owned by Senseair.[107]

November 30, 2007

Denso applied for a patent for a driver monitoring system to determine alcohol impairment.[108]

2008

January 30, 2008

Denso applied for a patent for a driver monitoring system to determine alcohol impairment.[109]

February 2008

NHTSA and the Automotive Coalition for Traffic Safety (ACTS) entered into a 5-year $10 million cooperative research agreement, with NHTSA pledging $5 million.[110] The project's goal was 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.[111]

April 13, 2008

Autoweek – Search Starts For In-Vehicle Alcohol Detectors

"Equipping vehicles with devices designed to stop drunken driving would save 9,000 lives a year, officials estimate. Of the 42,000 people who die on U.S. highways each year, about 18,000 are in alcohol-related crashes.

Sue Ferguson, a former senior vice president of the Insurance Institute for Highway Safety, says the research program aims to develop prototype devices within five years. Although the current plan is based on voluntary rather than mandatory installation of the devices, she says, ultimately, we would like them on all vehicles."[112]

June 16, 2008

Panasonic applied for a patent for a touch-based system.[113]

July 14, 2008

FY2009 Senate Transportation Appropriations bill report language provided $1 million for the Driver Alcohol Detection System for Safety (DADSS) cooperative research agreement. The report stated:

> **"**The development of advanced alcohol technologies is one of the key elements of the Campaign to Eliminate Drunk Driving which has brought together Mothers Against Drunk Driving [MADD], major leading auto manufacturers, and responsible distilled spirit companies with a goal to eliminate drunk driving."[114]

July 16, 2008

MADD National President Laura Dean-Mooney testified before the House Transportation and Infrastructure Subcommittee on Highways and Transit and noted MADD's support of the "exploration of advanced vehicle technologies through the establishment of a cooperative research agreement between NHTSA and leading automakers that is assessing the feasibility of a range of in-vehicle technologies intended to prevent drunk driving, and we

also believe increased Federal funding is needed to help with the Cooperative Research agreement between the automotive industry and the Federal Government to support those new technologies that may eventually prevent a vehicle from being started by a drunk driver."[115]

In response to MADD's testimony, Rep. John Boozman (R-AR) stated:

> I want to thank Mr. James and Ms. Mooney for coming and giving your testimony. It is very difficult, and yet it really is very helpful to hear personal stories. My wife was in an accident a month or so ago, and my daughter. It was a very complicated intersection. She broke several ribs, had a collapsed lung and stuff, but it was really the Lord taking care of her in the sense that she could have been injured much, much worse. So, this is something that we are all very, very aware of, and we really do appreciate your advocacy, and it really does make a big difference.

2009

May 5, 2009

General Motors applied for a patent for a driver monitoring, touch, and breath-based system to determine substance-impairment[116]

May 18, 2009

Robert Strassburger, Vice-President, Vehicle and Safety Harmonization, of the Alliance for Automobile Manufactures testified before the House Energy and Commerce Subcommittee on Commerce, Trade and Consumer Protection, stating, "we support MADD's campaign to eliminate drunk driving and its request for $30 million per year to develop advanced in-vehicle technologies that can unobtrusively detect a driver's blood alcohol concentration. Such technologies hold promise for keeping alcohol-impaired drivers off the road by preventing those drivers from operating a vehicle."

At the hearing, Acting Deputy NHTSA Administrator Ron Medford said, "to address nearly 13,000 alcohol impaired driving fatalities in 2007, we are conducting joint research with the auto industry to develop technologies that have the potential to detect and prevent an impaired driver from operating a vehicle without being intrusive to the sober driver."[117]

July 1, 2009

Time Magazine – Coming Soon: A Breathalyzer in Every Car?

"Nissan is now testing various systems that don't even require a Breathalyzer to detect drinking. One system uses a tiny camera to observe facial expressions, another system being tested checks blood alcohol levels though sensors when the driver grasps the shift control, and a third system uses the car's internal computer to calculate if a motorist is steering erratically. Ford already has a system that allows parents to limit the speed of a vehicle driven by a youthful motorist, and Mercedes-Benz's new E-Class comes with a system that issues an audible warning if the driver gets drowsy."[118]

July 30, 2009

Denso applied for a patent for a touch-based sensor. [119]

August 5, 2009

FY2010 Senate Transportation Appropriations bill report language supported the DADSS program and cited MADD's Campaign to Eliminate Drunk Driving. The Committee also provided an increase of $500,000 over the President's Budget request:

"The Committee recommends $1,500,000 to support this work. This funding level is $500,000 more than the budget request and the fiscal year 2009 enacted level. Of the total recommended funding, $500,000 is for research by ACTS on public acceptability of advanced detection technologies. Because the success of the effort depends on its acceptance by the general public, this issue must be addressed as soon as possible."[120]

August 10, 2009

Denso applied for patent for a breath-based alcohol detection system. [121]

August 31, 2009

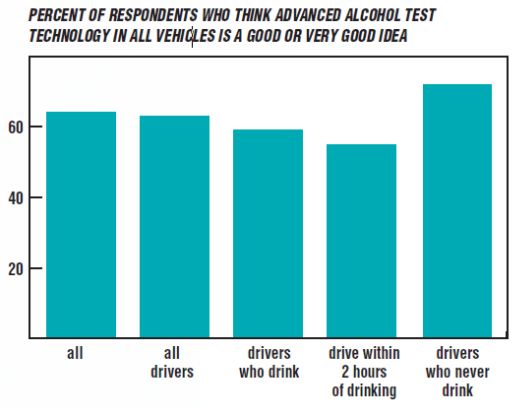
Toyota Motor Corporation Press Release

"Toyota Motor Corporation (TMC) and Hino Motors, Ltd. (Hino) announce that, as part of their efforts to eradicate drunk driving, they will jointly test a breath-alcohol ignition-interlock system* under development by TMC. The system, aimed to aid companies and organizations better manage their fleet-vehicle operations, will be installed on selected trucks and other vehicles of Japanese transport companies, and tested from September 1 to November 30."[122]

"The tests will verify system functionality, particularly ease-of-use in real-world situations. Tests will include drivers conducting self-breath tests before they operate a vehicle and, after vehicle use, fleet administrators monitoring and verifying the test results automatically recorded on the vehicle's digital tachograph. The system features a hand-held unit containing both a breathalyzer that can detect alcohol in a small breath sample and a digital camera that photographs the driver's face for test-taker identification. If the test result is positive, the system either warns the driver or locks the vehicle's ignition, depending on the level of alcohol detected. The system thus prevents drivers from operating vehicles in an inebriated state, while follow-up instructions given by fleet administrators aim to further reduce the possibility of alcohol-related traffic accidents."[123]

September 17, 2009

The Insurance Institute for Highway Safety released survey results indicating that two out of three respondents deemed the DADSS technology a good or very good idea.



**Images taken from the Insurance Institute for Highway Safety report that featured DADSS survey information.[124]

September 25, 2009

Driver Alcohol Detection System for Safety – Phase 1 Press Release

"The Driver Alcohol Detection System for Safety (DADSS) Research Program announces the awarding of Phase 1 proof-of-concept research awards to three technology providers: Autoliv Development AB of Vårgårda, Sweden; Alcohol Countermeasure Systems, Inc. of Toronto, Canada; and TruTouch Technologies, Inc. of Albuquerque, New Mexico."[125]

"Phase 1 awards are for $400,000 each. Awardees that successfully complete Phase 1 will be eligible to compete for Phase 2 funding totaling $2.5 million each. The technology concepts range from passively analyzing drivers' breath to using spectroscopy to estimate BACs by measuring the skin's absorption of light."[126]

"A recent study shows that the public is ready for such a device. The Insurance Institute for Highway Safety (IIHS) research shows that two-thirds of those surveyed considered the use of advanced technology to keep drunk drivers off the roads to be a "good" or "very good" idea."[127]

"An alcohol detector that's suitable for all drivers would have to be all but invisible – it shouldn't hassle sober drivers – and would require virtually no upkeep," said Ferguson. "It would have to be quick and easy to use and provide accurate readings. No such device exists yet."[128]

"The Autoliv in-vehicle alcohol detection system will measure alcohol from the exhaled breath of the driver. The measurement technique which has been under development for several years uses non-dispersive Infra-Red technology. By using the concentrations of carbon dioxide (CO2) as a measure of dilution of the exhaled breath of the driver it is possible to perform a contact free, unobtrusive measurement of the driver's breath alcohol (i.e. without a mouthpiece). The challenge is to identify and quantify small variations in the vehicle cabin air within an arm-length distance to the driver's mouth and nose. Multiple sensors placed in the vehicle cabin will allow the system to determine that the breath sample is from the driver and not other passengers. Infrared spectroscopy, which will be used to sense both alcohol and CO2, has the ability to provide high sensitivity, specificity and system reliability."[129]

"A second prototype is also adopting a breath-based approach. ACS is working with Daylight Solutions (DLS), a company with expertise in the mid IR (MIR) technology for molecular detection. Specifically, sensors based upon DLS patented external cavity quantum cascade laser (ECqcL™) technology will be employed to enable identification and analysis of ethanol. The ACS approach is to use the ECqcL sensor to measure ethanol emanating from the driver by simultaneously measuring the concentration of alcohol and CO2 in the cabin air of the vehicle in the near proximity of the driver. This method allows for rapid, accurate measurements to be taken while simultaneously providing the necessary specificity to allow the system to be immune from common interferants such as gasoline, exhaust fumes and perfume."[130]

"The TruTouch technology employs near-infrared (NIR) absorption spectroscopy to measure alcohol in skin tissue. NIR spectroscopy is the science that characterizes the transfer of electromagnetic energy to vibrational energy in molecular bonds, referred to as absorption, which occurs when NIR light interacts with matter. The specific structure of a molecule dictates the wavelengths at which the electromagnetic energy will be transferred. Thus, the absorbance spectrum of each molecular species is unique. The touch based DADSS prototype will be based on current TruTouch products which are comprised of a light source,

optical touch pad, and spectrometer engine. The measurement begins by shining NIR 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 the optical touch pad. This light contains information on the unique chemical information and tissue structure of the user which can be used to determine the driver's identity. This light is analyzed to determine the tissue alcohol concentration and, when applicable, confirm the identity of the user."[131]

2010

February 25, 2010

Senators Tom Udall (D-NM) and Bob Corker (R-TN) introduced the *ROADS SAFE Act*, legislation that would authorize $12 million annually for five years for the DADSS program.[132] The legislation gained bipartisan co-sponsors including Senators David Vitter (R-LA) and Mike Crapo (R-ID). [133]

> **Sen. Udall:** That is why Senator Corker and I are introducing the ROADS SAFE Act today. New safety technology has already transformed the automobile and saved countless lives. For example, airbags and antilock brakes are now standard features in many vehicles. These safety devices are built into the car and are unobtrusive to the driver. Such technologies are an important reason we have fewer traffic fatalities today. Imagine a future with vehicles that could detect whether a driver is drunk when he or she gets behind the wheel--before he or she even starts their vehicle. That would be no drunk driving crashes if it were impossible for drunk drivers to drive. If such technology were widely deployed in cars, an estimated 8,000 lives could be saved every year.

March 19, 2010

Representatives Vernon Ehlers (R-MI) and John Sarbanes (D-MD) introduced the *ROADS SAFE Act* to fund the DADSS program.[134]

April 14, 2010

MADD National President Laura Dean Mooney testified before the Senate Environment and Public Works Committee, calling for additional funding for the DADSS program, citing the *ROADS SAFE Act*.[135]

> **Laura Dean-Mooney:** I want to thank you, too, Chairman [Senator Boxer], for your referencing advanced technology efforts as the Manhattan Project for drunk driving in a hearing in this Committee in October 2007. The Driver Alcohol Detection System for Safety, or DADSS, is a project to research the possibility of creating a passive and unobtrusive technology which could measure the driver's BAC and render the vehicle inoperable if the BAC is above .08 or greater. Senators Udall and Corker have introduced the ROADS SAFE Act to provide $12 million per year for this project, and I would ask you, Madam Chairman, and all members of this Committee to please cosponsor this legislation.

Sen. Udall (D-NM) asked Laura Dean-Mooney about the *ROADS SAFE* legislation:

> **Laura Dean-Mooney:** First, thank you again for your sponsorship of that bill. We believe that ROADS SAFE is the answer to ultimately eliminating drunk driving. The development of technology is progressing rapidly, and we know that already cars can park themselves. They can do a number of things, including lane departure warnings. So the idea that advanced technology in a car that would set at .08. It

wouldn't hassle a sober driver. It would be unobtrusive to those of us who choose to drive sober, would be the ultimate solution to eliminating drunk driving.

May 19, 2010

The Senate Commerce, Science and Transportation Committee held a hearing on *The Motor Vehicle Safety Act of 2010* (S. 3302) and discussed the DADSS program:[136]

> **Dave McCurdy, President and CEO, Alliance of Automobile Manufacturers:** In addition, we encourage Congress to fund the Driver Alcohol Detection System for Safety, or DADSS, to help identify vehicle technologies that could stop drunks from turning on a car. More people die in alcohol-related crashes every single week than all of the alleged unintended acceleration incidents, combined, over the last decade.
>
> **Senator Udall:** Senator Corker and I introduced the S. 3039, the ROADS SAFE Act, to authorize and increase funding for this exciting research and development effort. I believe our bipartisan legislation falls within the scope of the Committee's current work to improve motor vehicle safety. The goal is to explore the feasibility, potential benefits, and public policy challenges associated with using in-vehicle technology to prevent drunk driving. Drunk driving has direct and indirect economic costs in terms of damaged property, medical bills, and lost productivity. In economic terms, drunk driving costs $129 billion dollars per year. Of course, such monetary costs cannot be compared to the value of saving 8,000 lives every year.

An exchange between Chairman Rockefeller (D-WV) and Dave McCurdy.

> **Chairman Rockefeller:** Can you explain to me some of the things that are going on in this? [touch-base alcohol sensors] Because it's very exciting to me.
>
> **Dave McCurdy:** Yes. Yes, Mr. Chairman, since we're providing about $5 million of funding from my association to support that effort, in partnership with NHTSA. It's a research program. It's exploring technologies, outside the realm of just the automotive sector, looking at aerospace, defense, healthcare, other areas, to see what technology might be available that could help us detect the blood alcohol level, breath, or others--a number of means to prevent a person who's impaired, above a certain level, from
> actually engaging the automobile.
> **Chairman Rockefeller:** It turns itself off.
>
> **Mr. McCurdy:** Well, it would not allow it to be turned on in the first----
>
> **Mr. McCurdy:** I mean, there are a number of things. It could be breath-based. I actually had my key--I think I gave it to one of my staff, because--but, you know, there are tactile--potential technologies. There's breath. There's--and there are ways to sort through the automobile. This is very early stages,
> and is something that we want to explore. What we would encourage the Congress to look at--there is
> legislation, Senator Udall--sorry he's not the chair, but maybe the Chair would like to take it--to increase the funding----
>
> **Mr. McCurdy**:--to actually increase the funding for this research program, to take it beyond just the voluntary effort at the, you know--for us, it's a large amount of money--but, to expand it, to see if there are those out there. There's no immediate fix, but certainly it's--there is some promise out there. And, again, it would address the biggest single cause of fatalities in this country. And that's what we'd like to work

with Congress and with the Administration to try to address. But, we'd be glad to come in and give a very detailed briefing on, again, the exploration, where it is. This is the second year--third year of this effort. And, you know, it's a challenge. It's a--but it's a good, scientific kind of challenge----

Chairman Rockefeller: But, talk to me about what you each, individually, feel about the job that NHTSA is doing and where you think it ought to be stronger, or is--pushing too hard, or whatever. Understanding that we've been through a period, in our last 10 years, where regulation was not a top priority, so that under a new administration, I think, it's a greater priority, one which two of you may not welcome. But, I just--I would be interested to hear.

Dave McCurdy: NHTSA has adopted, recently, the--more of the public health approach. And that is, you address the area of the biggest concern--the biggest problem. And it's like triage, you go and you affect it. That's why we support the DADSS effort for trying to develop technologies to prevent drunk drivers from getting behind the wheel, because that is the principal source of death in this country.

NHTSA Administrator David Strickland sent responses to questions posed by Sen. Udall:

Question 1 [Sen. Udall]: Could you explain to this Committee how NHTSA is working with leading automakers to develop new, in-vehicle technologies to prevent--and potentially eliminate--drunk driving?

Answer [Administrator Strickland]: In February 2008, NHTSA entered into a 5-year Cooperative Agreement with the Automotive Coalition for Traffic Safety (ACTS)--a non-profit organization that is comprised of certain automobile manufacturers (BMW, Chrysler, Ford, General Motors, Honda, Jaguar Land Rover, Mazda, Mercedes Benz, Mitsubishi, Nissan, Porsche, Toyota, and Volkswagen). This cost-sharing agreement, known as the Driver Alcohol Detection System for Safety (DADSS) program, allows NHTSA and ACTS to engage in cooperative research to develop technologies that will quickly and accurately measure a driver's blood alcohol concentration (BAC) in a non-invasive manner. It will assess whether such devices meet acceptable reliability levels, are unobtrusive to the sober driver, and are compatible with mass-production at a moderate price. If these requirements are met, these technologies could 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 grams per deciliter in all U.S. states).

Question 2 [Sen. Udall]: What progress in this research and development effort do you hope to see in the coming months and years?

Answer [Administrator Strickland]: The NHTSA/ACTS Cooperative Agreement supports the development and testing of prototypes and subsequent demonstration hardware. The goal, at the end of the 5-year program, is the practical demonstration of an alcohol detection subsystem in one or more research vehicles. The DADSS effort is following a two-stage process. Phase I, which is almost complete, supports the development of three working proof-of-principle prototypes. These prototypes will begin bench and human subject testing in 2010. Phase II, which is scheduled to commence in 2011, represents a substantial effort that is intended to lead to the development of one or more research vehicles. This effort will focus on ensuring that such devices meet the stringent performance specifications, are reliable, durable,

and virtually maintenance free through the vehicle's life span, while operating in the challenging automobile environment.

May 27, 2010

PR Newswire – MADD Applauds Rep. John Sarbanes (D-MD) in Passage of the ROADS SAFE Amendment

"The device must be fast, accurate, reliable, and repeatable. From the vehicle manufacturer's perspective, it must also be readily integrated into the vehicle's existing systems, be durable, require little or no maintenance, and be tamper resistant. In other words, the device must be seamless to operate. Currently three companies are under contract to develop prototype technologies to meet the goals of the program. The Insurance Institute for Highway Safety (IIHS) estimates that such a system could have saved more than 8,000 lives in 2008. Moreover, a recent IIHS poll found 64 percent of American's believe that advanced alcohol detection technology which is reliable and would prevent an impaired driver from operating a vehicle is a good idea."[137]

Also on May 27, Sen. Chuck Schumer (D-NY) announced his support as a cosponsor to the *ROADS SAFE Act*.[138]

July 23, 2010

The Senate Appropriations Committee provided a $1.25 million boost to DADSS research program.

"The Committee recommends $2,250,000 to support this collaboration in fiscal year 2011. This funding level is $1,250,000 more than the budget request and $1,000,000 more than the fiscal year 2010 enacted level."[139]

August 13, 2010

Continental applied for a patent for a touch-based system. [140]

September 23, 2010

MADD marked its 30th anniversary with a Capitol Hill rally and unveiled a technology-based action plan to eliminate drunk driving and called for "cars to be the cure" through advanced alcohol detection technology.[141, 142]

Quotes from the announcement:

U.S. Secretary of Transportation Ray LaHood: Our roads may be safer than ever, but they are not safe enough," said Secretary LaHood. "There are still far too many preventable deaths on our roadways and an alarming number of people still make the dangerous decision to drive drunk. Safety will always be my top priority, and we will continue to work closely with Mothers Against Drunk Driving and our law enforcement partners to do everything possible to get drunk drivers off the road.

Sen. Bob Corker (R-TN): Drunk driving destroys thousands of lives in our country every year. The ROADS SAFE Act would invest in new technology research to improve highway safety and help put an end to these preventable crashes.

Sen. Tom Udall (D-NM): I am proud to sponsor the ROADS SAFE legislation because by encouraging the development of new technology to keep Americans safe—like we did with seatbelts and airbags—we can help make drunk driving a thing of the past.

September 28, 2010

The Senate Commerce Subcommittee on Consumer Protection, Product Safety, and Insurance discussed the DADSS program during a hearing:[143]

> **MADD National President Laura Dean-Mooney:** Any technology which is developed must be highly accurate, nearly instantaneous, and not hassle the sober driver. If the technology is successful, a sober driver would notice no difference in his or her driving experience. Any technology developed must be set to detect blood alcohol concentrations of .08 or above…ROADS SAFE has been included as part of the Motor Vehicle Safety Act (MVSA) in both the House and the Senate. On behalf of all DUI victims, and potential future victims of this violent crime, MADD urges Congress to pass the MVSA this year with an authorization for this program. The additional funding would provide an essential financial boost to the development of this technology, as well as ensure a greater Federal commitment toward eliminating drunk driving. It is of vital importance that ROADS SAFE be authorized as soon as possible. Every year that we allow drunk drivers to continue to drive on our roads, there are thousands of unnecessary deaths and injuries. MADD urges Congress to provide $12 million a year to address a problem that costs the United States $130 billion each year. This is an excellent return on taxpayer investment.
>
> **Robert Strassburger, Vice President, Vehicle Safety and Harmonization, Alliance of Automobile Manufacturers:** In 2008 the Alliance, working through the Automotive Coalition for Traffic Safety (ACTS), joined NHTSA in a five-year, $10 million cooperative agreement to research in- vehicle alcohol detection technologies that could prevent drivers from even starting a vehicle if their blood alcohol content is at or above 0.08, which is the legal limit. Such technologies hold tremendous promise for keeping alcohol-impaired drivers off the road and reducing their impact on innocent motorists and passengers who lose their lives or are injured in drunk driving crashes. An IIHS analysis reveals that if driver blood alcohol concentrations can be limited to less than 0.08, approximately 9,000 lives might be saved annually. We are pleased to support Senator Udall's legislation, S. 3039, which would aid the funding of this crucial research.

Senator Mark Pryor (D-AR) asked Rob Strassburger questions:

> **Sen. Pryor:** Let me ask about the design of a vehicle--it's something that Ms. Dean-Mooney mentioned a few minutes ago--where there's now technology that's available, that I guess can be put in cars, that might help with distracted driving, or might help, maybe, you know, with some built-ins on a car, that maybe you could put some things that might prevent drunk drivers from using vehicles. Could you talk about that for a little bit?
>
> **Mr. Strassburger:** Sure, Senator. There are a number of technologies, so-called "driver-assist'' technologies, that we're developing currently, to help the driver do their primary job better, which is maintaining the safe control of their vehicle. So, some of these technologies include lane departure warning systems, blindspot warning systems, forward-collision warning systems--all of which can help the driver maintain safe control of the vehicle. And one of the other ones, in that same vein, we are also working--and you heard the Administrator talk briefly about it this morning--working with the NHTSA to develop advanced technology that could monitor the blood alcohol concentration of drivers, noninvasively, so that the sober driver would not be hassled. And that--we are in about the third year of a 5-year program with

the agency. We've just received device prototypes that are being tested up at a lab in Boston, and they are undergoing human-subjects testing, as well, with the help of the Harvard Medical School. And they're showing great promise. *They would probably not be ready for vehicle integration for another 5 or 7 years,* but they are showing tremendous progress. And I think we have benefited--our research has benefited by the research that's being done for homeland security purposes, to sense or sniff chemical precursors of IEDs or other bad stuff. And once you know how to sniff one chemical, it's just a matter of retuning to be able to sniff, in this instance, for alcohol. So, it shows a lot of great promise; and I think, should it come to fruition, we stand a very good chance of eliminating drunk driving.

2011

January 26, 2011

The Wall Street Journal – Key to Next Push for Safter Driving: Technology

"Now, [NHTSA Administrator] Mr. Strickland says he is looking for the next crash-avoidance technology that is ready to be pushed on all cars. Short term, that could mean more cars get technology that warns when a driver lets a vehicle drift out of its lane. A growing number of models offer such systems"[144]

"One experimental system measures the alcohol in the driver's breath, another measures alcohol using a beam of infrared light aimed at the driver's skin. "This is long-term research… a moon shot to end drunk driving, he (David Strickland) said. The agency is a long way from mandating such technology. First, it has to be proven to be accurate, fast and practical to install in a car, Mr. Strickland said. Second, the technology has to win acceptance from consumers. There are 'privacy issues we have to consider' he said."[145]

DADSS Fact Sheet

"When did it start and how much funding is involved? In February 2008 NHTSA initiated the five-year, $10 million cooperative effort, with the cost split between NHTSA and the auto industry's ACTS coalition. Phase I of the program, a proof-of-concept stage, has just been completed and the results of this research are being demonstrated to the public today at the DADSS lab in Waltham, Massachusetts. Phase II of the program will begin in February and will last for approximately two years. Phase II will involve a practical demonstration of one or more of the alcohol detection subsystems suitable for continued development and subsequent installation in vehicles."[146]

"**When do you expect DADSS to be in U.S. automobiles?** The DADSS research is still in the early stages and it is premature to discuss when the technology will be available for general use, although we've heard from the auto industry that it is reasonable to expect that it could begin to be integrated into vehicles in approximately 8 to 10 years."[147]

"How much will DADSS add to the price of a new vehicle? The cost per vehicle hasn't yet been established but has to be in line with other safety systems. As with any new technology, as more and more vehicles are equipped with the system, the price will decrease. Air bags are one example of this."[148]

January 28, 2011

US DOT Secretary Ray LaHood, NHTSA Administrator David Strickland, MADD National President Laura Dean Mooney, ACTS and Qinetiq held a press event in Boston at the DADSS lab, where the group witnessed first working prototypes of systems to prevent drunk drivers from starting their cars.

Quotes from the event gathered from news stories and press releases:

NHTSA Administrator David Strickland:

"There is still much work to be done, but we could have a technology ready for general use and integrated into vehicles in the next 8 or 10 years."[149] "The technology we are seeing here today could quite simply signal a new frontier in the fight against drunk driving," said NHTSA Administrator Strickland."[150] "David Strickland, head of the National Highway Traffic Safety Administration, also attended the demonstration and estimated the technology could prevent as many as 9,000 fatal alcohol-related crashes a year in the U.S., though he also acknowledged that it was still in its early testing stages and might not be commercially available for 8-10 years."[151]

US DOT Secretary LaHood:

"DADSS is being developed under a five-year, $10 million cooperative initiative between NHTSA and the Automotive Coalition for Traffic Safety (ACTS), an industry group representing most of the world's auto makers."[152] "The next stage of development, which would include practical demonstrations of one or more of the alcohol detection technologies, could begin later this year."[153] "An alcohol-detection prototype that uses automatic sensors to instantly gauge a driver's fitness to be on the road has the potential to save thousands of lives, but could be as long as a decade away from everyday use in cars, federal officials and researchers said Friday. U.S. Transportation Secretary Ray LaHood visited QinetiQ North America, a Waltham, Mass.-based research and development facility, for the first public demonstration of systems that could measure whether a motorist has a blood alcohol content at or above the legal limit of .08 and — if so — prevent the vehicle from starting."[154]

Shane Karr, Vice President of Federal Government Affairs at the Alliance of Automobile Manufacturers

"What we're doing is developing technology that won't interfere with sober drivers, will require virtually no maintenance or upkeep and will have such precision that it only stops a driver when their blood alcohol content is .08 BAC or higher, which is the illegal limit for drunk driving in every state," said Shane Karr. "Now that we have actual prototypes, a tremendous feat in itself, we'll be working to identify the gaps in performance between these prototypes and the precise standards we've identified as true technology requirements. This will point the way forward for the next phase of research."[155]

MADD National President Laura Dean-Mooney:

"MADD President Laura Dean-Mooney, who was left a widow and single mother when a drunk driver killed her husband, Mike Dean, welcomed the progress of the DADSS research effort, saying, 'Auto makers have stepped up to help turn cars into the cure. This project has made substantial progress and this technology could one day be an important step in our efforts to eliminate drunk driving.'"[156]

March 8, 2011

Senators Tom Udall (D-NM) and Bob Corker (R-TN) reintroduced the *ROADS SAFE Act*.[157] Quotes from the press release below:

> **Sen. Udall:** Drunk driving is still a leading cause of fatal car crashes across the country and in my home state of New Mexico. This legislation is designed to help keep our roads safe by investing in new technology that will prevent Americans from driving if they've had too much to drink.
>
> **Sen. Corker:** More than 10,000 people are killed each year in drunk driving crashes. By Americans choosing to utilize these types of safety measures, my hope is that we can ultimately help prevent those crashes and save lives.
>
> **Shane Karr, Vice President for Federal Government Affairs, Alliance of Automobile Manufacturers:** This research is significant to anyone who drives or has family on the road. This research opens up the possibility of eliminating fatalities and injuries caused by drunk drivers, while not hassling people who are okay to drive. The only drivers who would notice this technology are the ones who shouldn't be behind the wheel in the first place.

March 28, 2011

USA TODAY – Alcohol detection devices could be option on new cars

"'As long as you are under the legal limit of .08, it will operate seamlessly, and you won't even know it's in the vehicle,' says Robert Strassburger, safety chief for the Alliance of Automobile Manufacturers. He says the funding would help automakers offer the devices as options in eight to 10 years."[158]

March 29, 2011

MADD National President Jan Withers testified before the House Transportation and Infrastructure Committee where she requested a $10 million appropriation to continue the existing DADSS research program."[159]

June 23, 2011

Representative Shelley Moore Capito (R-WV) introduced the *ROADS SAFE Act* to fund the DADSS program.[160] The proposal gained bipartisan support.

June 25, 2011

A highway safety group sent a coalition letter to House Transportation and Infrastructure Committee Chairman John Mica (R-FL) and Ranking Member Nick Rahall (D-WV). The letter called for inclusion of the *ROADS SAFE Act* which would, "authorize the transfer of currently unused safety funds at a rate of $12 million annually for five years to support and expand the ongoing DADSS research program currently being undertaken by the National Highway Traffic Safety Administration and leading automakers."[161]

July 27, 2011

The Senate Subcommittee on Consumer Protection, Product Safety, and Insurance held a hearing entitled, "Improving Highway Safety: Reauthorization of the National Highway Traffic Safety Administration."[162] Below are prepared remarks from panelists that mention DADSS:

Nicole Nason, former NHTSA Administrator: As a former NHTSA Administrator and current National Board Member of Mothers Against Drunk Driving, I commend the Committee for including funding for advanced alcohol detection technology in the draft legislation. The Driver Alcohol Detection System for Safety (DADSS) program is a result of a cooperative research agreement between NHTSA and the Automotive Coalition for Traffic Safety, which is composed of the world's leading auto manufacturers. This work is critical, as 2009 fatality numbers make clear: 10,839 people were killed in drunk driving crashes. The technology to prevent drunk driving crashes already exists in an imperfect form, but with funding to perfect it, we can prevent nearly a third of all fatalities on our roads. Just last week, over twenty diverse organizations sent a letter to Just last week, over twenty diverse organizations sent a letter to Congress in support of DADSS. I have included this letter with my testimony and ask that it be made a part of the hearing record.

David Strickland, NHTSA Administrator: I want to thank the Committee for including several helpful provisions that expand the agency's capabilities. These included support for collaborative research in developing and deploying in-vehicle alcohol detection systems.

Robert Strassburger, Vice President, Vehicle Safety and Harmonization, Alliance of Automobile Manufacturers: The Alliance also supports the provisions in Section 111, which would formally authorize the cooperative research program the industry voluntarily entered into and is jointly funding with NHTSA. The Driver Alcohol Detection System for Safety, commonly referred to as ``DADSS,'' is a five-plus-year research effort created to develop in-vehicle technology that will quickly and accurately measure a driver's blood alcohol concentration (BAC) in a non-invasive manner. If the system detects that a driver is drunk, the vehicle's starting capabilities are disabled. The Insurance Institute for Highway Safety projects that successful implementation of this kind of technology has the potential to prevent more than 8,000 deaths each year.

An exchange between former NHTSA Administrator Nicole Nason and Sen. Mark Pryor (D-AR) regarding DADSS:

Sen. Pryor: And just for the Subcommittee's benefit, could you tell us briefly how you envision that--I know the technology may not be completely there, but it sounds like we're close, but could you indicate for the Subcommittee how you would envision that actually working and how that might be deployed around the country?

Ms. Nason. Yes. Thank you, Mr. Chairman. I think most importantly, the idea is to make a passive technology that doesn't in any way hassle the sober driver. So, it needs to be better than 6 Sigma reliable. It needs to be set at 0.08 and then effectively, you could eliminate drunk driving by stopping the drunk driver from having the vehicle start. However, if I am home with my three children and everyone's finally in the car and they have all of their equipment and all of their backpacks and everyone has shoes on, and I go to start the car and it says, oh, have you been drinking again?
[Laughter.]

Ms. Nason. I am going to bring that car right back to the dealer and say, get this junky technology out of my car. So, it needs to be really better than 6 Sigma which is why it needs more time. If--the technology in a very bulky comprehensive form really exists right now, this is not being invented out of whole cloth. You can test

with a finger. You can test with breath, but it needs to be flawless for the driver, otherwise, the target demographic, a 41-year-old mother of 3 is not going to want to purchase the technology if every few days the car tells me I'm drunk and it won't let me get where I need to go. So, that's why having a funding stream over the next 5 years is so critical to this technology, but I would just remind the Committee that it is still a third of all fatalities. Alcohol-related deaths are still a third of all fatalities. And it was 39-40 percent when I was NHTSA administrator compared to, say, seat belt use, which has gone from nothing to 85 percent. So this has really been an incredible challenge for NHTSA and the Department of Transportation and MADD, and we think that the DADSS technology holds enormous promise.

An exchange between NHTSA Administrator David Strickland and Sen. Tom Udall (D-NM) regarding DADSS:

> **Sen. Udall:** Mr. Strickland: I know that you and Secretary LaHood have previously stated support for the Research and Development Program which my legislation, the ROADS SAFE Act, would authorize and sustain. Could you explain to the Committee how NHTSA is working with leading automakers to develop new in-vehicle technologies to prevent and potentially eliminate drunk driving?
>
> **David Strickland.** Mr. Udall, you have highlighted the driver alcohol detection systems for safety work that we have been working on for the past 3 years with the manufacturers. This year is actually the fifth year anniversary of Mothers Against Drunk Drivers campaign to eliminate drunk driving. And this is one of the hallmarks of this work, which is to create an auto grade seamless unintrusive and variably accurate system for a vehicle to see if a person is driving over the legal limit, which is 0.08. And if the car detects that, to interlock the vehicle from actually being driven. We are in the third year of our work in Phase 2 of the research and from--frankly, when I was still working for Mr. Pryor, working on this Committee, I frankly as a staffer did not think that it was a possibility to have an in-vehicle technology which could be seamless to prevent a car from being driven by an impaired driver. The work that we have seen so far has shown that it is entirely possible. We have a long way to go. We have two more years' worth of work and more resources to expend, along with the manufacturers, but this really is our moon shot. It is an opportunity to make sure that no car with this type of technology can ever be driven by an impaired driver. We think there is huge promise in that, which is the reason why the Secretary and I have supported your legislation.
>
> **Sen. Udall:** Well, I think that it is very promising what you say. And as we know, every new development and every step we make forward, we save lives, so that is---
>
> **David Strickland:** Yes, sir.
>
> **Sen. Udall:** Tremendously important.

August 10, 2011

The Senate Commerce Committee held a field hearing in New Mexico entitled, "Fighting Drunk Driving: Lessons Learned in New Mexico."[163]

> **NHTSA Deputy Administrator Ron Medford:** Advanced technology could also play an integral role in reducing impaired-driving. NHTSA is working to develop vehicle-based alcohol detection technologies. Such technologies have the potential to prevent drunk drivers from operating vehicles, and if widely deployed, could be

invaluable in our efforts to eliminate drunk driving. The goal is to develop a non-invasive, seamless technology that accurately measures driver BAC and prevents a legally-impaired driver from operating a motor vehicle.

Senator Udall and Ron Medford had the following exchange:

> **Sen. Udall:** Mr. Medford, I am going to start my questioning with you. As you mentioned, the Driver Alcohol Detection System for Safety, which is--we call, I guess, the acronym DADSS--has the potential to save nearly 8,000 lives annually. This program is a joint effort, or you could call it a public/private partnership between the automakers and NHTSA. Some may feel this technology should be developed solely by automakers, but could you talk more about the importance of the Federal role in developing this critical technology, and why--why it is important that the automakers and NHTSA work with each other?
>
> **Mr. Medford:** Mr. Chairman, we--at NHTSA, we have a number of cooperative research programs with auto companies where we share--we think we share the responsibility for finding technical solutions to difficult problems. And the truth is that this problem is related to the driver and the condition of the driver. And we think the technology, which has to work well in the vehicle, has to include the vehicle manufacturer as part of understanding how to incorporate a technology into their vehicle. So, this is not a new model for us in terms of cooperative research programs. We are developing safety systems. We do it frequently. We have got a number of ongoing joint cooperative research programs and other safety technologies. This is one that gets a lot of visibility, but it is probably one of the most important things that we are doing. So, we think it is a perfectly appropriate and not an uncommon way for us to jointly do research to solve a difficult technical problem.

September 21, 2011

The Senate Appropriations included funding for DADSS in FY2012 and stated:

> "To date, NHTSA and ACTS have completed preliminary device performance specifications, a rigorous technical review of candidate technologies, and proof-of-concept research to investigate those technologies that hold the most promise. Funding for fiscal year 2012 will be used to test the full set of performance specifications and to begin integrating competing technologies into a research vehicle for further testing and evaluation. The Committee recommends a total of $6,000,000 to support this collaboration in fiscal year 2012, $5,000,000 of which is repurposed from the seat belt performance grant program. This level of funding is $5,000,000 more than the budget request and $4,500,000 more than the fiscal year 2011 enacted level."[164]

November 1, 2011

PR Newswire – Ambitious Drunk Driving Prevention Research Program Moves Forward

"The national research effort to develop publicly acceptable technology that will prevent the illegal operation of a vehicle by a drunk driver (0.08 or above blood alcohol content) is entering a new phase in which it will move out of the laboratory and onto the road with a drivable test vehicle expected to be ready in two years."[165]

"Autoliv Development AB of Sweden and Takata-TruTouch of Auburn Hills, Michigan and Albuquerque, N.M., are both involved in the next research phase. Each company has been

awarded $2.25 million after successfully demonstrating during the proof-of-concept phase that they have the potential for ultimately meeting stringent performance criteria established for DADSS."[166]

"The DADSS Program has identified two technological approaches as having considerable promise in measuring driver BAC noninvasively: (1) Tissue Spectrometry, a touch-based approach allowing assessment of alcohol in the driver's skin, and (2) Distant Spectrometry, a breath-based approach that will allow assessment of alcohol concentration in the driver's exhaled breath. Each technological approach is described briefly below.

Touch-based Approach
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 driver's skin before returning back to the skin's surface where it is collected by the optical touch pad. This light contains information on the skin's unique chemical properties which can be analyzed to determine the driver's alcohol concentration.

Breath-based Approach
The breath-based approach makes it possible to perform a contact free, quick, unobtrusive measurement of the driver's breath alcohol by using the concentrations 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."[167]

November 1, 2011
The DADSS program announced the start of Phase II research, with the **stated goal of a drivable test vehicle in two years**.[168]

November 15, 2011
NTSB Board Member Mark Rosekind visited the DADSS lab.[169]

November 28, 2011
DADSS was named one of TIME Magazine's 50 Best Inventions of 2011.[170] The article stated, "the devices are in testing now and will be embedded into a research vehicle by the end of 2013. **If all goes as planned, they could be on the road in eight to 10 years**."

2012

January 11, 2012
Autoliv – Autoliv Alcohol Sensor Enters Next Phase

"Autoliv Inc. – the global leader in automotive safety systems – today announced that it has been selected as a partner to participate in the second phase of the Driver Alcohol Detection System for Safety (DADSS) research program co-sponsored by the U.S. National Highway Traffic Safety Administration (NHTSA) and Automotive Coalition for Traffic Safety (ACTS), representing many of the leading automakers."[171]

"'We are excited to be selected by ACTS and NHTSA to apply our technology in demonstration vehicles for real-world testing,' stated Hakan Pettersson, Project Manager for Autoliv. 'We are not yet ready for prime-time, however we are confident that we will overcome the challenges with applying advanced technology in the automotive environment,' added Pettersson. This phase of the project is expected to be completed within two years."[172]

March 8, 2012

As part of the DADSS program, the Automotive Coalition for Traffic Safety applied for a patent for a touch-based and driver monitoring system to determine alcohol impairment.[173]

March 21, 2012

Washington Examiner – 'Booze control' for future cars

"A spokesman for Sen. Tom Udall, D-N.M., a sponsor of the initiative, cautioned that installation of car alcohol detection systems are years off and that the plan now is to simply find the easiest and most accurate technology. What's more, he said that the goal is not to stop responsible drinkers from downing a beer at dinner, but target drunks responsible for thousands of deaths annually."[174]

March 22, 2012

Times Union – Alcohol sensors as standard equipment for cars?

"Wade Newton, director of communications for the Automotive Coalition for Traffic Safety, said the research is to see if the technology would work. It's estimated that a drivable test vehicle will be ready within about two years."[175]

March 29, 2012

The Hill – The Ultimate Crash Avoidance System

"The parameters for the DADSS project are clear. The technology will be set to detect drivers who are at or above a .08 BAC -- which is the illegal limit in all 50 states. In order to reach .08, men must typically consume five or more drinks, and women must typically consume four or more drinks, in about two hours."[176]

"Advancements in vehicle technology are happening every day. Cars can now park themselves and sophisticated lane departure systems alert the driver when veering out of their lane. DADSS, while still in the research phase, holds the promise of becoming the ultimate crash avoidance system, by stopping a legally drunk driver from operating their vehicle. The goal of DADSS is to create an inexpensive, unobtrusive, reliable technology to automatically detect a drunk driver with a BAC of .08 or above, without hassling a sober driver."[177]

April 3, 2012

The Wall Street Journal – After the Party, a Car That Takes Away Your Keys

"'We've made more progress, faster, than we expected,' says Rob Strassburger, vice president for vehicle safety at the alliance. Contributing to advances is national-security research aimed at developing remote sensors that can detect biological or other chemical agents. Also, researchers say that fingertip sensors used in hospitals to monitor blood-sugar levels and other physical indicators are useful in detecting blood-alcohol levels, too. It sounds futuristic and it will likely be years—eight to 10 by Mr. Strassburger's estimate—before cars and trucks with built-in blood-alcohol detectors are for sale. The next phase, additional years off, is a commercially produced vehicle with the technology to drive a tipsy owner home autonomously."[178]

April 19, 2012

FY 2013 Senate Appropriations report language included DADSS funding:

> **"**To date, NHTSA and ACTS have made significant progress towards achieving this goal. They have completed preliminary device performance specifications, conducted a rigorous technical review of potential technologies, and finalized proof-of-concept research to identify technologies which hold the most promise. This has led to identification of two technologies--breath-based and touch-based--which are now being developed for installation in a research vehicle for on-the-road testing and evaluation starting in fiscal year 2013. The Committee is strongly supportive of this promising research, which has the potential to prevent thousands of drunk driving deaths annually. The Committee recommends a total of $7,000,000 for ACTS vehicle testing and continued research. This level of funding is $6,000,000 more than the budget request and the fiscal year 2012 enacted level."[179]

June 7, 2012

MADD National Board of Directors held a board meeting in Boston and toured the DADSS lab.

June 27, 2012

Representatives Sarbanes (D-MD) and Wolf (R-VA) discussed support for DADSS funding during committee discussion on the Transportation, Housing, and Urban Development, and Related Agencies Appropriations Act of 2013. [180]

> **Rep. Sarbanes:** I thank the chairman. As the gentlemen are aware, the National Highway Transportation Safety Administration, NHTSA, has been working on a public-private research program known as the Driver Alcohol Detection System for Safety, or DADSS, that would develop a passive technology to detect if a driver's blood alcohol content is above the legal limit. I would urge the chairman to consider funding for the DADSS program as this bill moves forward, and I yield to the gentleman from Virginia.
>
> **Rep. Wolf:** I thank the gentleman from Maryland and rise to support his initiative. Mr. Chairman, too many times a mother or a father or a loved one has gotten that dreaded call in the middle of the night that someone has been killed in an accident involving a drunk driver. And I appreciate my friend from Maryland raising the DADSS program, and also urge my good friend, the chairman, to look at this program as the bill moves forward.

June 29, 2012

USA Today – Alcohol-sensing technology could become standard in all cars

"Newton said researchers are 'looking at whether technology exists' that could potentially shut a vehicle down or take some other action if a driver's BAC rose above the legal limit while the vehicle was in motion. 'We're still looking at how to check for a situation where the driver starts exceeding the legal limit once the vehicle is in motion, and also what to do with the vehicle,' he said."[181]

Researchers expect to have a 'drivable test vehicle' within about two years.[182]

June 29, 2012

The DADSS program was authorized in federal surface transportation legislation, *Moving Ahead for Progress* (MAP 21). On July 6, President Obama signed MAP-21 into law.[183]

July 2, 2012

The DADSS program was authorized for $10.7 million over two years to develop alcohol detection technology for vehicles.

PR Newswire – Congress Fully Endorses Campaign to Eliminate Drunk Driving On Eve of July 4th Holiday

"The Federal transportation legislation (Moving Ahead for Progress, or MAP-21) approved June 29 by Congress sets in motion federal safety policy that could lead to the elimination of drunk driving as the leading cause of highway fatalities."

"'Drunk driving crashes increase significantly during the July 4th holiday making it one of the most deadly times to travel. MAP-21 is an historic opportunity to advance highway safety because we now have congressional approval on a blueprint for our nation to eliminate drunk driving,' said MADD National President Jan Withers. 'MADD thanks Senators Jay Rockefeller, Barbara Boxer, Tom Udall, Frank Lautenberg, and Bob Corker along with Representatives John Mica, Shelley Moore Capito, John Sarbanes, and Heath Shuler for championing this legislation.'"

"The legislation authorizes the Driver Alcohol Detection System for Safety, or DADSS. 'This authorization is critical,' said Withers. 'Not only does it guarantee the research for this project will continue to take place, but it also has the potential to greatly accelerate lifesaving technology from the lab to the showroom where it can protect our families.' DADSS is the result of a public/private partnership between the auto industry and the federal government with the goal of creating a passive in-vehicle detection system that can stop a drunk driver from operating a vehicle. This new technology would be unobtrusive and unnoticed by a sober driver. The legislation does not contain a specific dollar amount for the DADSS program, but a total of approximately $10.7 million could be available for the program over the next two years."[184]

"The federal government is being asked by Rep. Steve Israel (D-NY), to step up its research on ways to stop people who are intoxicated from driving cars. 'I'm asking Department of Transportation Secretary Ray LaHood to put his foot on the gas and get the funding for this program distributed as quickly as possible,' Israel said at a news conference Monday."[185]

September 27, 2012

Hundreds of MADD volunteers and supporters gathered at the U.S. Capitol for meetings with their Congressional delegations. MADD National President Jan Withers met with Members of Congress and committee staff to discuss the importance of advanced vehicle technology.

October 9, 2012

Businesswire – TruTouch Technologies Announces Next-Generation Alcohol Intoxication Detection System to Counter $220 Billion Annual Costs

"TruTouch Technologies, a pioneer in non-invasive workplace sobriety assurance systems, unveiled the latest technology to detect and deter alcohol abuse in the workplace… The TruTouch 2500 is a non-invasive sensor that quickly and accurately measures alcohol intoxication, and also has the option to simultaneously verify user identity using light through the skin.

The TruTouch 2500 is a tabletop instrument that can detect tissue alcohol concentration by measuring alcohol levels through the skin, using a safe near infrared light and an optical

touch pad. The device also features biometric capability to verify user identity to ensure integrity of the testing process. The TruTouch 2500 is the first practicable solution for large-scale, inexpensive and frequent testing of employees at point of need. Unlike a breathalyzer, the TruTouch device can accurately scan nearly 200 employees per hour, on site, in a self-administered manner, eliminating the need for supervisory staff."[186]

December 4, 2012

The Senate Commerce Committee held a Nomination hearing for Polly Trottenberg to be Under Secretary of Transportation for Policy, Department of Transportation.[187] Trottenberg answered written questions from Senator Tom Udall (D-NM):

> **Question [Sen. Udall]**: If confirmed, will you continue to support efforts to combat drunk driving nationwide?
>
> **Answer [Polly Trottenberg]**: Drunk driving is a nationwide tragedy, and as you point out, it is entirely preventable. That is why reducing drunk driving has been a priority for the National Highway Traffic Safety Administration (NHTSA) and the Department for many years…Because of the complexity of the drunk driving problem, this comprehensive approach is necessary to achieve lasting gains. However, with more than 10,000 alcohol-impaired driving fatalities each year, it is essential that we also keep investigating innovative new strategies such as the technology utilized in the Driver Alcohol Detection System for Safety (DADSS). Secretary LaHood has identified impaired driving as a key Departmental priority and if confirmed I will work diligently to implement the Secretary's vision.

December 11, 2012

The National Transportation Safety Board (NTSB) approved new drunk driving recommendations, including the development of new in-vehicle technologies which could one day prevent a drunk driver from operating a vehicle.

CNN – NTSB looks to technology to end drunken driving in the U.S.

"The board (NTSB) encouraged continued research in DADSS – driver alcohol detection system for safety – which tests drivers through either touch or breath. If the government and automakers overcome technological hurdles and win public acceptance, the DADSS system could be installed as standard equipment on cars and essentially eliminate drunken driving, saving more than 7,000 lives a year, the board said."[188]

2013

January 3, 2013

NY Daily News – Alcohol detecting technology could save 10,000 a year from drunk driving death: scientists

"'We have about 10,000 fatalities every year from drinking and driving,' project leader Bud Zaouk told the Daily News. 'This technology could reduce 7,000 of those fatalities every year.' Similarly, he said on CBS This Morning, that the project could create 'the equivalent of the seat belt of our generation.'"[189]

"'We identified what technologies are out there that could potentially be applied,' Zaouk said. 'It's meant not to inconvenience the driver, so it has to be extremely accurate and very very fast. It will be able to tell you, in less than half a second, whether the driver is above the legal limit or below the legal limit.'"[190]

"'The technology is designed for the legal limit in the United States,' he (Zaouk) said. 'Not for any less, not for anymore.'"[191]

"The DADSS project started in 2008 but the organization says that the technology will not be implemented for about eight to 10 years."[192]

January 5, 2013

WCBV - In-car alcohol sensors aim to stop drunken drivers in their tracks

"'In that button itself there's an infrared light that will shine into the finger. And the reflection contains an optical signature of the alcohol. That's how we figure out how much alcohol there is,' said Zaouck."[193]

"'I call it the seat belt of our generation because it's the single biggest opportunity to save lives today on the roads,' said Zaouck."[194]

March 15, 2013

Honda applied for a patent for a driver monitoring system that also can utilize touch-based steering wheel sensors to determine drunk driving.[195]

March 2013

Congress passed its FY13 Federal Appropriations bill that provided over $5 million to continue research and development of advanced technology that will one day prevent a drunk driver from operating a vehicle.

Congress reauthorized the DADSS program as part of the surface transportation bill.

May 15, 2013

Mitch Bainwol, President and CEO of the Alliance of Automobile Manufacturers, testified before the Senate Commerce Committee and testified to the promise of the DADSS technology:

> "Impairment is a leading cause of driver error. Eliminating impaired driving would reduce by one-third the number of people who die on our roads each year. The Alliance supports requiring alcohol interlock devices for convicted drunk drivers. In addition, for the past five years, Alliance members have been working in partnership with NHTSA to research advanced in-vehicle technology called "DADSS" – technology that holds promise to help eliminate drunk driving one day. The Alliance appreciates the leadership role taken by this Committee last year in continuing to fund this critical research during the reauthorization of surface transportation."[196]

May 22, 2013

The Senate Commerce Committee held a confirmation hearing for Anthony Foxx for Secretary of Transportation. Senator Lautenberg (D-NJ) received the written response in regard to the DADSS program[197]:

> **Question 15 [Senator Lautenberg]:** Since 2008, the auto industry has collaborated with NHTSA to invest in emerging technologies that would stop drivers from operating a vehicle if drunk, such as Driver Alcohol Detection System for Safety technology. The Insurance Institute for Highway Safety estimates the project, once fully realized, could save 7,000 lives each year. How can DOT expedite the technology development?
>
> **Answer [Anthony Foxx]:** I understand that DOT is currently in discussions about a new research and development agreement with auto industry partners. The new

agreement could represent a significant increase in the Department's investment in technologies that would prevent drunk drivers from operating vehicles. This increased investment should allow additional technology development and testing. If confirmed, I will ensure that DOT remains committed to these types of efforts and to the development of vehicle technologies that reduce the problem of drunk driving.

June 27, 2013

FY2014 Senate Appropriations report language included funding for DADSS***:***

> **"**To date, NHTSA and ACTS have made significant progress…They have completed preliminary device performance specifications, conducted a technical review of potential technologies, and finalized proof-of-concept research to identify technologies which hold the most promise. This has led to identification of two technologies--breath-based and touch-based--which are now being developed for installation in a research vehicle for on-the-road testing and evaluation starting in fiscal year 2014. The Committee strongly supports this promising research partnership, which has the potential to prevent thousands of drunk driving deaths annually. The Committee recommends a total of $5,440,000 for ACTS to continue this research, which is consistent with the authorized level under MAP-21 and the budget request. This level of funding is $140,000 more than the fiscal year 2013 enacted level."[198]

August 2013

MADD National President Jan Withers and MADD North Carolina Volunteer Kevin London met with Secretary of Transportation Anthony Foxx and NHTSA Administrator David Strickland to discuss the Campaign to Eliminate Drunk Driving, and specifically the importance of the DADSS program.

August 8, 2013

NHTSA Administrator David Strickland sent a letter to every automaker CEO, thanking them for their commitment to DADSS, and urging their continued support:

> "I commend your company for supporting this important initiative and the substantial progress that has been made to date due to your support. A tangible result of that work will be demonstrated later this year when a research vehicle including both touch-based and breath-based detection technologies is available for further evaluation. The DADSS program is a high priority for me. I have referred to it as a "moonshot" for traffic safety…it is incredibly exciting that, in a few years, we may have a car available to the public that will prevent a drunk driver from endangering others on our Nation's roads…I urge you to continue to support this important program."

April 6, 2013

Honda applied for a patent for a touch-based system to determine drunk driving.[199]

August 20, 2013

Detroit News – Auto technology targets drunken driving

"NHTSA Chief David Strickland wrote the CEOs of major automakers on Aug. 8 telling them the research backed by automakers and the federal government to develop an in-vehicle system that could prevent drunken drivers from starting a car shows great promise. He thanked those who are helping fund the project –including Detroit's Big Three automakers— and urged them to keep supporting the project and asked others to join the effort."[200]

"'We probably have another five years of work to go,' Strickland said, before it's possible one of these cars could be on the roads."[201]

"'A tangible result of the work will be demonstrated later this year, when a research vehicle including both touch-based and breath-based detection technologies is available for further evaluation,' he [Strickland] wrote. 'I have referred to it as a moonshot for traffic safety with initially long odds but the potential for dramatically powerful results if we are successful.'"[202]

August 23, 2013

As part of the DADSS program, the Automotive Coalition for Traffic Safety applied for a patent for a breath-based alcohol sensor. [203]

As part of the DADSS program, the Automotive Coalition for Traffic Safety applied for another separate patent for a breath-based alcohol sensor. [204]

August 26, 2013

Remarks prepared for David Strickland, Administrator NHTSA "The Road Ahead"

"At this point, the Agency, with full acknowledgement of the promise of automated driving, does not see current technology that would allow removing the human completely from the control loop. The car – no matter how automated – is not yet ready to be more than a co-pilot. And every co-pilot needs a pilot."[205]

"The work on these technological advances continues apace. But we can never lose focus that three persistent and unfortunate facts remain in traffic safety. 1. Fifty-two percent of all occupant fatalities are unbelted. 2. Thirty percent of all highway fatalities involve an impaired driver. 3. Ninety percent of all crashes involve an element of human error."[206]

"I am announcing a new initiative at NHTSA, called the 'Significant and Seamless Initiative.' Why? Because our greatest safety technologies have all addressed a broad-based, significant threat, and they all have supported driver and passenger safety with either no or minimal intervention by the driver. The best example of this is electronic stability control***. I am asking the Agency for a three-year research and prioritization plan to move these three technologies forward to get them poised for fleet adoption as soon as possible***."[207]

Administrator Strickland introduced his "Seamless and Significant Initiative" focusing on key areas to reduce traffic crashes and fatalities. DADSS was a major component of this initiative. Administrator Strickland referred to DADSS as "the moonshot to stop drunk driving."

He also shared with GHSA, "I recently sent letters to every automaker CEO, thanking the members of ACTS that have partnered with us, and updating the other CEOs of our progress and the potential way forward. Just last week, Chrysler's CEO, Sergio Marchionne, personally conveyed his company's continued support of DADSS."

November 13, 2013

PHYS.ORG – US speeds research on care safety system

"The innovations—collision avoidance, seat belt interlocks and driver alcohol detection systems—hold the potential of dramatically reducing traffic fatalities, according to the National Highway Traffic Safety Administration."[208]

"'We need a new vision and a new blend of technological research to address some of the most significant and persistent threats to American motorists,' the agency's head, David Strickland, said in a statement. 'We must look to technological intervention to make the next great leap, and get them poised for fleet adoption as soon as possible.'[209]

"The 'driver alcohol detection system' differs from devices already required by some states for drivers arrested or convicted of drunken driving. In those cases, drivers usually have to take some step—often breathing into a tube—to test their blood alcohol content before starting the car.[210]

Detection systems such as those NHTSA is researching with automakers don't require any action on the driver's part except putting his hands on the steering wheel or pushing a start button with a finger. The idea is to eventually include the systems as standard or optional equipment in new vehicles, regardless of whether the driver has a history of drunken driving.[211]

'The automatic system would be enabled every time the car is started, but unobtrusive so it would not pose an inconvenience to the non-intoxicated driver,' the agency said.[212]

The collision avoidance systems address one of the most common types of auto accidents. Last year, one-third of all police reported crashes started with a one vehicle striking the rear-end collision with vehicle, the agency said."[213]

December 23, 2013

DOT and ACTS was announced a new five-year cooperative agreement. NHTSA Administrator David Strickland said, "In this age of innovation, smart technology may be the breakthrough we need to prevent drunk drivers from getting behind the wheel and endangering the safety of others on our roads. The DADSS Research Program has shown significant promise to date, offering real potential in the future to prevent several thousand deaths annually."

The press release stated "***By early 2015, a research vehicle that incorporates two different technological approaches to measuring BAC, touch-based and breath-based, will be available for testing in a pilot field trial.*** Research using laboratory-scale prototype detection devices is already underway, while testing with on-road prototype devices is expected within the next few years."[214]

December 26, 2013

Automotive Fleet – Video: NHTSA, ACTS Extend Alcohol Detection Research Project

"Under the partnership, NHTSA is working with ACTS to develop a Driver Alcohol Detection System for Safety (DADSS) that's noninvasive and poses no inconvenience to sober drivers. The goal is to create a system that can accurately and reliably detect when a driver is above the legal alcohol limit of 0.08 BAC. The automatic system would be enabled whenever the vehicle is started."[215]

"The DADSS program was authorized under The Moving Ahead for Progress in the 21st Century (MAP-21) Act. During the first year of the extended agreement, NHTSA and ACTS are contributing a combined total of $6,539,400 to help advance long-term research into DADSS.[216]

"By early 2015, a research vehicle that incorporates two different technological approaches to measuring BAC - touch-based and breath-based - will be available for testing in a pilot field trial. Research using laboratory-scale prototype detection devices is already underway, while testing with on-road prototype devices is expected within the next few years."[217]

2014

January 2014

MADD public policy staff accompanied Congressional staff and NHTSA staff to the DADSS lab in Waltham, MA.

February 11, 2014

It's 2018. Your car knows you're drunk[218]

"'There's a lot of promise if a system can be developed that would stop any driver that's been drinking from getting on the road,' says Russ Rader, senior vice president for communications at the Insurance Institute for Highway Safety (IIHS)."[219]

"The aim is to 'stop a drunk driver from getting on the road in the first place, rather than arresting them after the fact, or worse yet, after a crash,'" he [Rader] says."[220]

"J.T. Griffin, chief government affairs officer for Mothers Against Drunk Driving, says the DADSS project stems from a five-year, $10 million cooperation agreement signed in 2008 between NHTSA and the Automotive Coalition for Traffic Safety (ACTS), made up of 15 auto manufacturers. The program was extended for five years at the end of 2013 and the groups committed $6.5 million more to support the research."[221]

"'The hope is to have a research vehicle, equipped with both the touch-based technology and the breath-based technology, completed in early 2015.'"[222]

"Griffin says researchers hope the technology will be commercially viable by the time the latest five-year agreement between NHTSA and auto manufacturers expires in 2018."[223]

March 31, 2014

Honda applied for a patent for a breath- and touch-based sensor that utilizes a driver monitoring system to determine drunk driving.[224]

June 5, 2014

FY2015 Senate Appropriations report language:

> **"**During fiscal year 2015, these technologies will be installed in research vehicles for pilot field testing. The Committee continues to strongly support this promising research partnership, which has the potential to prevent thousands of drunk driving deaths annually. The Committee recommends $5,574,000 for ACTS to continue this research, which is consistent with the budget request and $134,000 more than the fiscal year 2014 enacted level. The Committee expects work will be accelerated during the coming fiscal year on consumer acceptance and public policy issues that are essential elements of the project and must be addressed in concert with technology development and testing."[225]

June 2014

MADD National President Jan Withers led a group of national board members to meet with House Transportation Appropriations Committee leadership to discuss the importance of the DADSS program.

June 10, 2014

Representative Jim Gerlach (R-PA) to Rep. Tom Latham (R-IA) regarding the DADSS program:

> "The current operating plan for the program runs through 2018, and the goal at this time would be to have ready a commercially viable technology by then. While great progress has been made, more research must take place. Full funding for this research should be a priority for this Congress because each year, over 10,000 Americans are killed due to drunk driving--nearly one-third of all traffic fatalities. Madam Chairman, Mothers Against Drunk Driving has called the DADSS program its highest legislative priority. The Insurance Institute for Highway Safety has looked at the potential of this technology and said it could save over 7,000 lives per year. Every major traffic safety group in this country supports this, including the National Transportation Safety Board. The National Highway Traffic Safety Administration has identified this project as one of its highest priorities."[226]

October 23, 2014

General Motors applied for a patent for a driver monitoring system to determine substance-impaired driving.[227]

2015

January 2015

The DADSS Consumer Acceptance Online Survey was conducted.

March 3, 2015

The Senate Commerce Committee held a hearing on the Department of Transportation budget request.[228] Secretary Foxx responded to questions from Sen. Udall (D-NM) regarding DADSS:

> **Question 14 [Senator Udall]:** Do you foresee changes to NHTSA's research operations, in particular to its DADSS work or drunk driving data collection?
>
> **Answer [Secretary Foxx]:** Given the more than 10,000 highway deaths involving alcohol impairment that occur each year, NHTSA remains committed to research operations to reduce drunk driving and the resulting deaths. NHTSA expects to continue the Driver Alcohol Detection System for Safety (DADSS) cooperative research program to develop technology that could passively detect a driver's blood alcohol content and prevent impaired driving through at least 2017. The current DADSS research program, which built upon previous cooperative research, started in 2013. It is a 5-year Cooperative Agreement between NHTSA and the Automotive Coalition for Traffic Safety (ACTS), which includes 17 automakers. Funding for the DADSS program has been authorized and appropriated to the program for the first 3 years of the new Cooperative Agreement, and if funding is authorized and appropriated for the remaining two years of the agreement, the research program is expected to continue making significant progress toward integrating and testing the technology in real vehicles by 2016.

March 19, 2015

Reuters – Sobriety tests in all new cars might prevent most drunk driving deaths

"Over 15 years, as older cars without a so-called alcohol ignition interlock come off the roads, sobriety-screening systems in new vehicles could avert more than 59,000 crash fatalities, more than 1.25 million non-fatal injuries and over $340 billion in injury-related costs, the study in the American Journal of Public Health concludes."[229]

"Over the 15-year implementation period, interlocks may eliminate about $343 billion in costs from fatalities and injuries related to drunk driving, the researchers estimate. Assuming the device costs $400 per vehicle and is 100 percent accurate, the interlock would pay for itself after three years by way of avoided injury costs."[230]

"'The technology is at this point pretty strong, and when implemented at a population level will be negligible in terms of the sticker price of a car,' said Jacob Nelson, director of traffic safety advocacy and research for AAA. To be widely adopted, it will need to be a rapid test that's reliable and doesn't inconvenience drivers, added Nelson, who wasn't involved in the study.'"[231]

"The screening tool to do this is still in development and may not be road-ready for another five to eight years, said Dr. Bud Zaouk, who is working to develop the technology, known as the driver alcohol detection system for safety, or DADSS."[232]

"'Unlike the alcohol ignition interlocks which require you to blow into a devise and are used for convicted drunk drivers, DADSS is a driver assist system that would be seamless, take less than half a second, and use infrared light to measure a driver's blood alcohol content in the breath or through the fingertips, which is far more reliable,' said Zaouk, DADSS Program Manager and Group Director for QinetiQ North America, who wasn't involved in the study."[233]

"'It's so hard to catch everybody,' said Lund [Adrian Lund, president of the Insurance Institute of Highway Safety], who wasn't involved in the study. 'With this, we can stop them from driving in the first place, and we can catch a broader group of people who are getting behind the wheel because they think they're not impaired.'"[234]

"'There have been a lot of surveys about how socially acceptable the costs are, and I believe in one survey 40 percent of people said they'd want an alcohol interlock device in their car if it were under $500,' he [Jonathan Rupp, TRI Research associate professo] said."[235]

May 22, 2015

Toyota applied for a patent for a driver monitoring and voice-based sensor to determine alcohol impairment.[236]

May 28, 2015

The Automotive Coalition for Traffic Safety hired its own lobbyist to lobby for the DADSS program.[237]

June 4, 2015

My Arklamiss – Department of Transportation Hopes to Install Tech in New Cars to Target Drunk Drivers

"'We can keep drunk drivers off the road,' says New Mexico's Senator Tom Udall, 'it's not impossible and we can get it done.'"[238]

"'I refer to it typically as the seat belt of our generation,' said Udall."[239]

"***In 2013, NHTSA said it had reached a deal with 15 major automakers to continue researching the effort***. Research using laboratory-scale prototype detection devices has been underway for several years. The 2013 deal extended the agreement with automakers to continue working on it for another five years. The program was authorized by Congress in 2012. During the first year of the extended agreement, NHTSA and automakers contributed a combined $6.5 million to help advance long-term research."[240]

"'Touch-based could happen faster because we know how to package it,' said Rob Strassburger, head of the Automotive Coalition for Traffic Safety and vice president of the Alliance of Automobile Manufacturers, a trade group for the world's major auto companies."[241]

"The goal is to produce a device that will react in less than a second and function without maintenance for at least 10 years or 157,000 miles. Sensors that detect alcohol levels in the air can react in less than a second after a driver gets into the vehicle."[242]

June 4, 2015

The DADSS concept car was unveiled at the U.S. DOT headquarters during a press event in tandem with MADD's national conference. Several hundred MADD victims and volunteers were present. Speakers included U.S. Transportation Deputy Secretary Victor Mendez, NHTSA Administrator Mark Rosekind, Senator Tom Udall (D-NM), Representative Nita Lowey (D-NY), MADD President Colleen Sheehey-Church, and ACTS President Rob Strassburger.[243, 244, 245, 246, 247]

The Washington Post – *New Technology Could Put an End to Drunken Driving*:

"The message today is not 'Can we do this?' but 'How soon can we do this?' said Mark Rosekind, administrator of the National Highway Traffic Safety Administration (NHTSA). 'It is a huge step forward.' Eager to introduce an advance that would rival seat belts or air bags in saving lives, Rosekind said he would push to get the technology finalized, field tested and put into use before the five to eight years anticipated by researchers."[248]

June 8, 2015

The Boston Herald – Booting Up: Sensor could end drunken driving

"The breath-based system, developed by Swedish automotive tech company Autoliv Development, allows drivers to enter a vehicle and breathe as they normally would. The driver's breath is pulled into sensors located in the driver's side door or steering column. A beam of infrared light is then directed at the molecules in the breath. Since carbon dioxide and alcohol molecules absorb different amounts of light, the sensors can compare the two, making it easy to measure precise levels at even small concentrations."[249]

June 8, 2015

Newsweek – Drunk Driver-Proof Cars Could Be Sold by 2020

"*The DADSS system will not be compulsory in all cars and will also cost drivers around $400*."[250]

June 8-11, 2015

DADSS was unveiled at the International Technical Conference on the Enhanced Safety of Vehicles (ESV) in Gothenburg, Sweden.[251]

June 18, 2015

The Detroit News printed an OpEd by MADD National President Colleen Sheehey-Church on the DADSS program[252]

June 25, 2015

FY2016 Senate Transportation and Housing and Urban Development, and Related Agencies Appropriations report language:

> **"**To date, progress has been significant, including the identification of two competing technological approaches which are being installed in research vehicles for pilot field testing. The Committee continues to strongly support this promising research partnership, which has the potential to prevent thousands of drunk driving deaths annually. The Committee recommends $5,440,000 for ACTS to continue this research, which is $134,000 less than the budget request and equal to the fiscal year 2015 enacted level. The Committee directs the agency to submit the annual report required by subsection 403(h)(4) of title 23, United States Code to the House and Senate Committees on Appropriations."[253]

July 8, 2015

WTHR – Your next car won't let you drive drunk

"'It's complicated. I don't want to call it rocket science, but it's pretty close,' said Bud Zaouk, project manager for the DADSS program. He recently took 13 Investigates on a behind-the-scenes tour of the DADSS research lab at QinetiQ North America, a tech company specializing in defense and transportation programs that federal officials hired to oversee development of an alcohol detection system in vehicles."[254]

"'The challenge that we have is to measure alcohol content or blood alcohol concentration very accurately, very precisely and very fast,' Zaouk explained. 'Our goal is less than half a second – 325 milliseconds to be specific – less than the blink of an eye … to do the measurement, the reading and decision whether this person can move the vehicle or not move the vehicle. It has to be fast. We do not want to inconvenience the driver.'"[255]

"The federal government – and your tax dollars – are funding development of the technology. Congress and major automakers have partnered to pledge a combined $45 million to develop a vehicle alcohol detection system – and 13 Investigates has learned the final bill will be much higher. 'It's expensive. You're looking somewhere around $80- to $100-million, who knows?,' said Zaouk. 'But that's what it takes to develop technology.'"[256]

"The eventual cost to consumers who want a DADSS system will be an estimated $300 to $500 added to the cost of a new vehicle. Some studies suggest consumers would quickly recover that cost in lower insurance premiums and discounts, as well as lower repair costs and medical bills associated with drunk driving."

"Engineers have now been working on the DADSS project for more than seven years, focusing their current efforts on how to make the alcohol detection systems smaller and more accurate. 'We've come a long way. We've made a lot -- a lot -- of progress,' Zaouk said, smiling."[257]

"***Zaouk hopes to begin road testing a DADSS-equipped vehicle sometime next year***, although he says a commercially-viable version likely won't be ready before 2020. 'It's no longer a question of 'Can we do this?' he said. 'We all know we can do it. It's just a matter of time and effort to get it into the vehicle. I have three little kids. For me, personally, I want to see this system in vehicles before my kids start driving.'"[258]

July 14, 2015

Rep. Rice Calls for DWI-Prevention Technology in All New American Cars

"'Advancing the progress we've made combating drunk driving demands bold action,' said Representative Kathleen Rice (D-NY). 'It demands that we take a stand and say we refuse to keep letting drunk drivers take 10,000 lives each year. We refuse to keep seeing families torn apart when we know we can do more to prevent it. Strict enforcement is important, holding drunk drivers accountable is important, but we can and must do more to stop drunk drivers from ever hitting the road in the first place. That's why I'm working on legislation to require ignition interlock devices in all new cars. This technology saves lives, it saves money, and I'm going to fight to make it standard equipment in American cars.'"[259]

July 26, 2015

The Saratogian – Schumer backs Anti-DWI technology

"'Use of sensible technology like DADSS could spare lives and families in the future. That's why I'm putting my full weight behind this legislation and urging Congress to commit to making sure this technology is fully developed in due time. Increased funding will make sure the technology can fit into cars and be affordable for everyone to use,' Sen. Schumer (D-NY) said in a press release."[260, 261]

"Schumer pointed out that the cost of this technology would equate to about $150-$200 per vehicle, according to estimates…Schumer added that without this legislation, the implementation of this potentially lifesaving technology would take even longer to implement and that in an age of new advancements each day, there is no excuse or time to waste when it comes to the acceleration of availability for this already developed anti DWI technology."[262]

August 11, 2015

Bosch applied for a patent for a driver monitoring system to determine alcohol impairment.[263]

October 2015

MADD National President Colleen Sheehey-Church met with NHTSA Administrator Mark Rosekind to discuss MADD's Campaign to Eliminate Drunk Driving and to follow up after the June 4 event.

November 2015

ACTS and GMMB conducted a DADSS stakeholders briefing attended by MADD.

December 3, 2015

USA Today – Congress approves $305 billion highway bill

"Safety provisions in the bill include…$21 million for NHTSA to develop in-car alcohol sensors in an effort to reduce drunken driving by disabling vehicles of impaired motorists."[264]

Senator Tom Udall (D-NM) spoke on the Senate floor[265]:

> "I believe new technology will help. That is why I have pushed for the Driver Alcohol Detection System for Safety, or DADSS. This technology is critically important and will make a critical difference. We all know this. The National Highway Traffic Safety Administration knows it. The auto industry knows it. And they are working together to make it happen. DADSS would be built into new vehicles. It would analyze a driver's breath or blood alcohol content. It would stop drunk drivers from turning on the engine. If you are drunk, you will not drive, period.
>
> This could save 59,000 lives over 15 years. It could save up to $343 billion. The highway bill includes continued funding for DADSS research over the next 5 years. I am grateful the conference committee supported this vital technology."

December 4, 2015

DADSS was reauthorized as part of this five-year surface transportation bill, the Fixing America's Surface Transportation (FAST) Act, signed into law by President Obama. The reauthorization guaranteed over $21 million in federal funding for the program through FY2020.[266]

2016

January 12, 2016

NHTSA Administrator Mark Rosekind accepted an award from Automotive News World Congress. In his speech Rosekind noted, "The work has progressed to the point where the question is not can DADSS work, but how quickly can it be offered it to the American public."

February 24, 2016

House Subcommittee on Appropriations held a hearing on the 2017 budgets for federal agencies including the Department of Transportation.[267] Representative Nita Lowey (D-NY) and Secretary Foxx exchange regarding the DADSS program:

> **Rep. Lowey**: Thank you, Mr. Chairman. Mr. Secretary, I introduced legislation supporting further development of the Driver Alcohol Detection System for Safety, called DADSS, which will produce technology to identify drunk drivers, prevent them from getting on the road. And last June I joined hundreds of drunk driving victims and supporters, as well as members of your leadership team, at DOT headquarters, to celebrate advancements in the program. At the ceremony, your Deputy Secretary Victor Mendez was very enthusiastic and said we need to do it faster. NHTSA Administrator Rosekind has also demonstrated strong support for DADSS advancements. Will you provide us with an update of this vitally important program which has the promise of saving thousands of lives annually in light of the action by Congress and the FAST Act to continue through fiscal year 2020? And I am particularly interested in knowing a plan to accelerate the development of this technology, including the possibility of applying more resources from the Department and from NHTSA's partner in these efforts such as leading auto manufacturers. Can you tell us what is happening with the program?
>
> **Secretary Foxx:** Well, first of all, thank you so much for your leadership in pushing this. This technology we believe will be game changing in reducing drunk driving risks to the public. We plan to continue working to accelerate the research on this to make it usable. And in fact, in fiscal year 2017, NHTSA plans to focus on the critical components of the breath-based and touch-based sensors that are necessary to

implement this technology so that they are ready for in-vehicle use. And we also hope to initiate a pilot field operational trial for both sensors in the fiscal year 2017 year. We feel like this technology is very close to being ready for prime time, and we want to put the last finishing touches on our research and ensure that that is the case.

Rep. Lowey: Thank you. Actually, I actually sat in one of those cars, and it is very exciting, and I appreciate your work.

February 25, 2016

LG Innotek applied for a patent for a touch-based system.[268]

March 2016

MADD National President Colleen Sheehey-Church met with NHTSA Administrator Mark Rosekind to discuss MADD's Campaign to Eliminate Drunk Driving and DADSS.

March 17, 2016

Ford applied for a patent for a driver monitoring system to determine alcohol impairment.[269]

April 5, 2016

As part of the DADSS program, the Automotive Coalition for Traffic Safety applied for a patent for a touch-based alcohol sensor.[270]

April 21, 2016

FY2017 Senate Transportation and Housing and Urban Development, and Related Agencies Appropriations report language:

> **"**To date, progress has been significant, including the identification of two competing technological approaches which were demonstrated at DOT headquarters in June 2015. The FAST Act provides $21,248,000 between fiscal year 2017 and 2020 for in-vehicle alcohol detection device research. The Committee continues to strongly support this promising research partnership, which has the potential to prevent thousands of drunk-driving deaths annually. The Committee recommends $5,312,000 for continuation of this research in fiscal year 2017 and encourages NHTSA to take steps in fiscal year 2017 to accelerate the program, including field tests of the research vehicles."[271]

May 19, 2016

Representative Nita Lowey (D-NY) sent a letter to Secretary of Transportation Anthony Foxx, requesting an update on the DADSS program since the previous year's DOT press event (at which Rep. Lowey spoke). Rep. Lowey also asked what steps had been taken to accelerate the program, including additional resources for the program from DOT and auto manufacturers.

On NHTSA's website (as of May 2016):

"The research program began in 2008 with the goal of assessing the effectiveness and feasibility of alcohol-detection technologies. The program is now in Phase II, with planning underway for Phase III.

- **Phase I** – Research and analysis of two different technological approaches to measuring driver alcohol levels - a touch-based approach allowing assessment of alcohol in human tissue and a breath-based approach allowing assessment of alcohol

concentration in the driver's exhaled breath focused on speed, accuracy and precision. Completed 2011.

- **Phase II** – Additional Research and testing of touch-based and breath-based sensors to improve accuracy and precision performance, and decrease measurement time to meet or exceed DADSS performance specifications. The prototypes will then be installed in a research vehicle. This phase is expected to be completed early 2016.
- **Phase III** – Phase III and subsequent phases of research will permit further refinement of the technology and test instruments as well as basic and applied research to understand human interaction with the sensors both physiologically and ergonomically – that is, how these technologies might operate in a vehicle environment. This phase began in late 2013 and is being conducted in parallel with the Phase II research."

June 7, 2016

FY2017 House Transportation and Housing and Urban Development, and Related Agencies Appropriations report language:

> "Driver alcohol detection system for safety (DADSS).—The FAST Act includes a total of $21,248,000 million through fiscal year 2020 for the ongoing advanced drunk driving detection technology pro-gram known as DADSS. The DADSS program is an ambitious public-private research effort to develop a publicly-acceptable and commercially-viable technology that will prevent a drunk driver (at or over 0.08 BAC) from operating a vehicle. Technology development progress to date was demonstrated at DOT headquarters in June 2015. The accompanying bill includes $5,494,000 for continued re-search, the amount requested by NHTSA for fiscal year 2017. In light of the significant life-saving potential of the program, approximately 7,000 lives annually, the Committee urges NHTSA to take steps to accelerate the program, including additional support from the auto industry partners in this activity."[272]

June 8, 2016

The Senate Commerce Committee held a hearing on the "Implementation of the Fast Act." After the hearing, U.S. DOT Secretary responded to questions posed by Sen. John Thune (R-SD) noted below[273]:

> **Question 15 [Sen. Thune]:** NHTSA has a new plan for the Driver Alcohol Detection System for Safety (DADSS) Program, to create alcohol-detection technologies that offer the potential to prevent impaired driving. What is the rationale for restructuring the DADDS Program and cooperative agreement? How will this accelerate development, testing, and deployment of the technologies?
>
> **Answer [Secretary Foxx]:** Over the past 20 years, nearly 250,000 Americans have been killed in drunk driving crashes. Successful implementation of the DADSS technology has tremendous potential to reduce this carnage. The Department appreciates Congress's continued support of the government and industry collaborative research activities that have led from feasibility to the potential for reality. Given that progress, it is time to start a new track of work focused on deployment. To begin the shift toward deployment, NHTSA is implementing the terms in its existing cooperative agreement that expand the opportunity for public input into the program and allowing for additional transparency. In 2015, the program achieved significant milestones. For example, the DADSS demonstration vehicle incorporating new alcohol detection technology was displayed publicly for the first time in a press event at the DOT Headquarters on June 4, 2015. Public and

media response to this unveiling, which featured members of Congress and several hundred members of Mothers Against Drunk Driving, was very positive. Late in 2015, partially in response to calls to accelerate deployment, NHTSA instructed the DADSS program manager to develop activities focused on deployment. These activities include additional test vehicles, consumer acceptance testing, human factors, and many others that would ready the technology for deployment at the end of the current cooperative agreement in 2022.

Question 15a [Senator Thune]: How will the new DADSS cooperative agreement and Board be structured? Will the role of the existing Automotive Coalition for Traffic Safety members change under the agreement? What do you expect the role of states to be going forward?

Answer [Secretary Foxx]: NHTSA is working with our current cooperative agreement partner, the Automotive Coalition for Traffic Safety (ACTS), on a modification to the existing cooperative agreement. The modification is necessary to implement an existing provision in the agreement that creates a Stakeholders Team to allow for more representation. The modification would expand membership of the Stakeholders Team to include representation from states and public interest organizations, while keeping in place the existing NHTSA and ACTS roles.

Question 15b [Sen. Thune]: When does NHTSA expect that the breath-based system and the touch-based system will be ready for commercial deployment? What method, if any, is the DADSS Program using to objectively quantify that the technologies are ready for deployment?

Answer [Secretary Foxx]: Under the current program of work, assuming no additional funding to accelerate activities, the technology is expected to be ready for vehicle integration (commercially feasible) by 2022. The DADSS program uses Technology Readiness Level (TRL) and Manufacturing Readiness Level (MRL) to objectively quantify readiness for deployment. The TRL and MRL measures, originally developed by NASA and the Department of Defense and adapted for automotive use, are used to assess maturity of new technologies. Technology is ready for deployment at TRL=8 MRL=7. Currently the breath-based system is at a TRL=4 and MRL=4 and the touch-based system is at a TRL=3 and MRL=3.

June 15, 2016

Toyota applied for a patent for a driver monitoring and breath-based sensor to determine alcohol impairment.[274]

August 5, 2016

Continental applied for a patent for a combination breath-based and driver monitoring system to determine alcohol impairment. [275]

August 10, 2016

Denso applied for a patent for a driver monitoring system to determine alcohol impairment.[276]

December 16, 2016

Federal and Virginia state officials announced $5.1 million in funding to continue to develop and deploy DADSS technology.[277]

December 23, 2016

As part of the DADSS program, the Automotive Coalition for Traffic Safety applied for a patent for a breath-based alcohol sensor. [278]

December 26, 2016

CBS Evening News - 2016 may go down as one of the worst years for drunk-driving deaths

Virginia announced plans to begin testing the drunk driving prevention technology in 2017 and could be a safety option in new cars by 2020.[279]

2017

January 11, 2017

The Senate Commerce, Science and Transportation Committee held a confirmation hearing for Elaine Chao for Secretary of Transportation. Senator Capito (R-WV) noted her support for DADSS in the exchange below:[280]

> **Sen. Capito:** One last thing I would like to talk about, something I worked on when I was actually on the House Transportation Committee, and I worked with then Senator Udall, he is still a Senator, and I was a Congressman, Congresswoman, at the time, the concern of the 10,000 lives that we lost through impaired drunk driving and driving under the influence of drugs. We were able in the FAST Act to get the driver alcohol detection system for safety to try to get some innovation to try to work on prevention of--to prevent the massive loss of life that we have that people get behind the wheel when they shouldn't. So I would encourage you and your Department to keep moving forward on the research and development in this area. I think there is a lot to be done and there are a lot of good ideas out there, and I would just like your commitment. I'm sure you would be committed to that as well.
>
> **Secretary Chao:** We certainly will do that.

June 14, 2017

MADD National President Colleen Sheehey-Church testified at a Senate Commerce, Science Transportation Committee hearing urging support for the implementation of DADSS.

> "We have been pleased to work with this Committee in support of the Driver Alcohol Detection System for Safety, also known as DADSS, and progress has been steady, and I would ask this Committee to help expedite DADSS by encouraging program partners to have the technology ready for vehicle integration as soon as possible"[281]

May 25, 2017

In 2017, General Motors applied for a patent for a driver monitoring and breath-based system to determine substance impairment. [282]

July 21, 2017

FY2018 Senate and House Transportation and Housing and Urban Development, and Related Agencies Appropriations report language:

> "Driver alcohol detection system for safety (DADSS).--The FAST Act includes a total of $21,248,000 through fiscal year 2020 for the ongoing advanced drunk driving detection technology program known as DADSS. The DADSS program is an ambitious public-private research effort to develop a publicly-acceptable and commercially-viable technology that will prevent a drunk driver (at or over .08 BAC)

from operating a vehicle. Technology development progress to date was demonstrated at DOT headquarters in June 2015. The accompanying bill includes $5,494,000 for fiscal year 2018. In light of the significant life-saving potential of the program, approximately 7,000 lives annually, the Committee urges NHTSA to take steps to accelerate the program, including additional support from the auto industry partners in this activity."[283]

Driver alcohol detection system for safety (DADSS).--The FAST Act includes a total of $21,248,000 through fiscal year 2020 for the ongoing advanced drunk driving detection technology program known as DADSS. The DADSS program is an ambitious public-private research effort to develop a publicly-acceptable and commercially-viable technology that will prevent a drunk driver (at or over .08 BAC) from operating a vehicle. Technology development progress to date was demonstrated at DOT headquarters in June 2015. The accompanying bill includes $5,494,000 for fiscal year 2018. In light of the significant life-saving potential of the program, approximately 7,000 lives annually, the Committee urges NHTSA to take steps to accelerate the program, including additional support from the auto industry partners in this activity.

September 26, 2017

General Motors applied for a patent for a driver monitoring and breath-based system to determine substance-impairment. [284]

2018

January 2, 2018

Ford applied for a patent in Germany for a breath-based sensor that can determine alcohol impairment.[285]

January 3, 2018

Toyota applied for a patent for a driver monitoring and breath-based system to determine alcohol impairment.[286]

January 5, 2018

Sony applied for a patent for a driver monitoring system to determine alcohol impairment. [287]

January 17, 2018

Among other recommendations to fight drunk driving, the National Academies of Sciences, Engineering, and Medicine recommended the following support of DADSS as mandatory on all new vehicles:

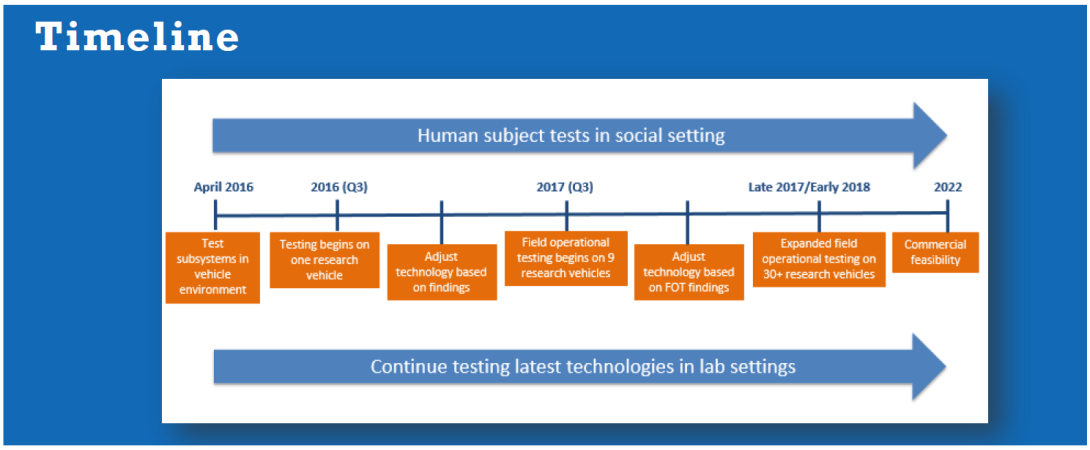
> Recommendation 4-3: When the Driver Alcohol Detection System for Safety (DADSS) is accurate and available for public use, auto insurers should provide policy discounts to stimulate the adoption of DADSS. Once the cost is on par with other existing automobile safety features and the technology is demonstrated to be accurate and effective, the National Highway Traffic Safety Administration should make DADSS mandatory in all new vehicles.[288]

February 1, 2018

Asahi Kasei Microdevices acquired Senseair,[289] a company developing a breath-based alcohol sensor to determine alcohol impairment. [290, 291,292,293] A 2018 video from Senseair demonstrated the technology in practice.[294] The breath-based technology component was used as part of the DADSS program. Asahi Kasei Microdevices featured the passive breath-

based system to determine alcohol impairment at CES in 2022. [295,] In 2023 the technology was demonstrated in Magna's system[296] and featured at CES in 2024.[297]

Additionally, on February 1, NHTSA released a DADSS timeline, (pictured right). The report also contained other information on the status of the program.[298]



February 22, 2018

ABC13 News – Revolutionary technology could soon stop all drunk drivers

"There are two systems that we are developing, one touch-based and one breath-based," Robert Strassburger, President and CEO, Automotive Coalition for Traffic Safety."[299]

"Robert Strassburger oversees the Driver Alcohol Detection System for Safety, also known as DADSS. We asked the question about how it tells the difference between the driver and someone who is in the backseat who may have had a few drinks. 'We certainly don't want to discourage the use of a designated driver,' Strassburger said. 'So, we must assume there could be passengers in the car that may have been drinking and that is why we are looking at the CO2. The CO2 levels confirm to the system that the air coming into the system is from a human. If the level is high, then the system will detect that is the driver. We also look at the proportion of CO2 with alcohol,' Strassburger said."[300]

"Eventually the technology would only be on the driver side. But just how expensive would all of this be? 'We don't have a figure yet, but it will affordable,' Strassburger said."[301]

June 7, 2018

FY2019 Senate Transportation and Housing and Urban Development, and Related Agencies Appropriations report language:

> "Drunk Driving Prevention.--NHTSA has partnered with leading automobile manufacturers in the Automotive Coalition for Traffic Safety on an ambitious research program to develop in-vehicle technology to prevent alcohol-impaired driving that is publicly acceptable, unobtrusive for drivers below the legal limit of .08 BAC, reliable, and relatively inexpensive. The FAST Act provides $21,248,000 between fiscal years 2017 and 2020 for in-vehicle alcohol detection device research. The Committee continues to strongly support this promising research partnership, which has the potential to prevent thousands of drunk-driving deaths annually. The Committee recommendation includes $5,312,000 for continuation of this research in fiscal year 2019."[302]

June 12, 2018

FY 2019 House Transportation and Housing and Urban Development, and Related Agencies Appropriations report language:

> "Driver alcohol detection system for safety (DADSS). -- For several years, NHTSA has partnered with leading auto manufacturers on DADSS to develop reliable and relatively inexpensive in-vehicle technology to prevent alcohol-impaired driving. Progress to date has been significant, and Congress showed its continued support for this life-saving program by authorizing $21,248,000 for fiscal years 2017 through 2020 in the FAST Act. The Committee also continues to strongly support this promising and vital program, with its potential to save 7,000 lives annually, and includes $5,494,000 for accelerated research, development, and robust field testing in fiscal year 2019. Further, the Committee commends NHTSA for steps it has recently taken to accelerate DADSS, by partnering with the Commonwealth of Virginia to assist in bringing the technology closer to commercialization and for the creation of a multi-disciplinary oversight panel to guide the program. The Committee encourages NHTSA and its program partners to work diligently toward making this technology ready for vehicle integration by the end of the FAST Act authorization in fiscal year 2020."[303]

September 7, 2018

ABC8 News – Virginia to launch new anti-drunk driving partnership

"Virginia will be home to a real-world testing of new technology aimed at blocking would-be drunk drivers from operating a vehicle. Gov. Ralph Northam plans to launch a new partnership next week between a Virginia transportation company and a public-private group that's developing alcohol-detection prototypes that uses automatic sensors to instantly gauge a driver's fitness. The technology is designed to be unobtrusive, unlike current alcohol ignition interlock systems often mandated by judges for convicted drunken drivers. The sensors would prevent a vehicle from starting if the motorist has a blood alcohol content level at or above the legal limit of .08 percent."[304]

September 10, 2018

WTOP – Virginia becomes testing ground for new drunken driver sensor

"'The concept behind it is you get into the car and you're breathing normally — you're not providing a forced exhalation,' said Bud Zaouk, with KEA Technologies and the program manager of the Driver Alcohol Detection System for Safety program."[305]

October 19, 2018

Valeo applied for a patent for a touch-based and a driver monitoring system to determine alcohol impairment.[306]

December 7, 2018

Toyota applied for a patent for a driver monitoring system to determine alcohol impairment.[307]

December 14, 2018

BMW applied for a patent for a driver monitoring and breath-based system to determine alcohol impairment. [308]

2019

January 6, 2019

The Abbas family was killed in Kentucky when a wrong-way drunk driver struck their SUV head-on while they were driving home to Northville, Michigan from a vacation. Rima was 38 and a physician. Issam, Rima's husband, was 42 and a lawyer. Their children were: Ali 13 years old; Isabella 12; and Giselle 7. The crash resulted in Rep. Debbie Dingell (D-MI) introducing the ***Honoring Abbas Family Legacy to Terminate (HALT) Drunk Driving Act***.[309]

January 7, 2019

General Motors applied for a patent for a driver monitoring, touch and breath-based system to determine substance-impairment.[310]

February 12, 2019

Representative Nita Lowey (D-NY) discussed the DADSS program with US DOT Secretary Chao during an appropriations hearing in the Subcommittee on the Departments of Transportation, and Housing and Urban Development and Related Agencies:[311]

> **Chairwoman Lowey:** Drunk driving is another issue that I have been really working on. It is a very important issue for me over the years, including the national .08 BAC standard which saves several hundred lives each year. But even with the progress we have made, drunk driving is still the leading cause of highway deaths, with nearly 11,000 fatalities a year. In fact, motor vehicles is still high, as a result of the population, than they were in 2009. To see that these fatalities are still going up in number is just amazing to me. Do we have basic research on impaired driving? What is the Department doing to focus on drunk driving, in 33 seconds?
>
> **Secretary Chao.** I know that you are very concerned about this, and the DADSS program works to address this issue. So the issue becomes how do we save these lives? How do we prevent these tragedies? I think your staff and my staff, we have talked a lot about continuing to work along that route, and there are obviously breathalyzer devices, and instruments that will, upon touch, fail to turn on the ignition. These are all elements that we are working on.

March 14, 2019

MADD testified at a House Subcommittee on Consumer Protection and Commerce hearing entitled, "Enhancing Vehicle Technology to Prevent Drunk Driving."[312] The video of the hearing is recorded.[313]

Relevant highlights include:[314]

> **Subcommittee Chairwoman Jan Schakowsky (D-IL):** "NHTSA can and should be pressing automakers to develop and deploy this technology faster, these different technologies faster, and let's stop wasting time and start to take meaningful steps to turn back the tide on these tragedies."
>
> **Rep. Debbie Dingell (D-MI):** "Congress needs to step up and do something about it [drunk driving crashes]. Their deaths [Abbas family], and the thousands just like them each year, are avoidable and preventable. The technology exists to save lives. A little girl at the funeral came up to me -- she was a classmate -- and said, ``There is technology. Why are you not using it? Why won't Congress act? My friend should

be here today." That statement is my heart. So, my question to each member, witness, and all the public watching today is simple: why aren't we using it? We need to explore every possible solution, including giving law enforcement the resources that they need to get drunk driving off the roads. Institute mandatory first offender interlock laws across the country and get the DADSS technology in cars as fast as we can."

Additionally, in response to an industry comment, Rep. Debbie Dingell stated "...we still to this day hear about that campaign to require seat belts being buckled. And it is used as an excuse for everything. And we have got to stop using it. It is now 2019, not the 1970s. And people are dying and the technology exists."

MADD National President Helen Witty: "I represent drunk driving victims who want this killing to end now. Our goal is to get this technology into vehicles for consumers to purchase as soon as possible. Therefore, I issue a challenge to the auto industry, including OEM suppliers and the government, to make DADSS commercially available and for NHTSA to begin a rulemaking on DADSS as soon as possible."

Robert Strassburger, President and CEO, Automotive Coalition for Traffic Safety: "While the DADSS program is currently still in the invention phase, we estimate that, in 2020, we will release the breath-based DADSS technology for fleet vehicles and accessory applications. ***And in 2024, we are targeting the release of both the breath-based and touch-based DADSS technologies for consumer vehicles, depending on resource availability in 2020 and beyond***. While continued research is needed to achieve our 2020 and our 2024 objectives, I am more optimistic than ever that we will be successful."[315]

Detroit Free Press – Congress considers devices on cars to prevent drunken driving after death of Abbas family

"For more than a decade, the Automotive Coalition for Traffic Safety — an organization funded by domestic and international automakers — has been working on technology that could result in devices that keep a car from starting based on more passive testing, such as automatically measuring the blood-alcohol of a driver as he or she breathes naturally behind the wheel, or a touch-based system that "measures blood alcohol levels by shining an infrared–light through the fingertip of the driver."[316]

"Robert Strassburger, the president and CEO of the coalition, said the technology is still being developed and is only being tested on less than a half-dozen vehicles in Virginia. But he hopes it will be available for a wider fleet of vehicles — such as government agency vehicles — for testing by next year and for commercial purchase by 2024."[317]

"Automakers aren't, at this point, advocating making such technology — or the available interlock devices — mandatory, however, and are generally loathe to have federal regulators or Congress force requirements on them, especially if there are fears that the public isn't ready to accept them or they could result in unacceptably high costs."[318]

"'Where is this system?' she [Joan Claybrook] continued. 'It didn't take this long to produce [the technology for] air bags and air bags are a lot more complicated than this. Why is this not in every car?'"[319]

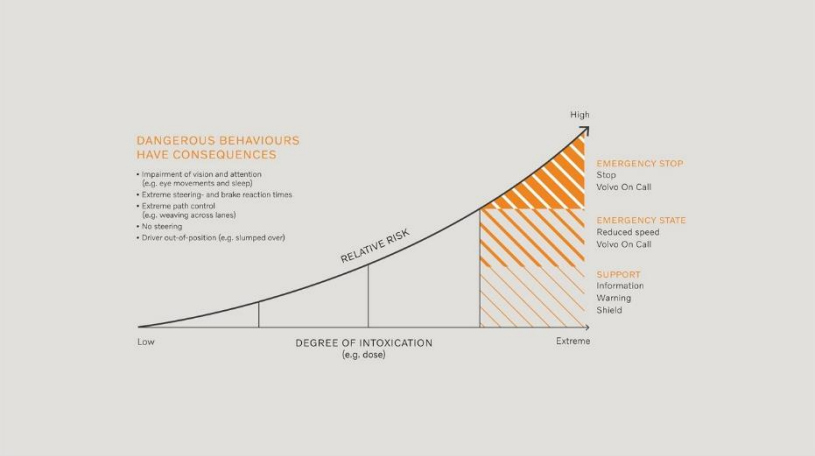
"Dingell, however, said that the promises of technology that will end drunken driving still seem to keep getting pushed off. 'We keep funding it, but it doesn't get there.'"[320]

"Robert Strassburger, president and CEO of Automotive Coalition for Traffic Safety Inc., which is developing the Driver Alcohol Detection System for Safety technology that will allow cars to test the blood-alcohol content levels of drivers by touch or breath, said it would be effective if it is offered voluntarily initially like other driver-assistance systems like automatic emergency-braking or lane-departure warnings. 'DADDs technology holds the greatest promise and likely the fast pathway to reversing the drunk driving trends in the United States,' he said."[321]

March 20, 2019

Volvo announced the development of a driver monitoring system to determine alcohol impairment. [322, 323, 324,325] In 2021 and 2022, Volvo mentioned continued development of this approach.[326, 327]

The image on the right is from the 2019 Volvo press release and the image below is from their video showing the technology concept.



March 27, 2019

Detroit News – Letter: Improve drunken driving technology

"The focus of the hearing was a joint industry-government research and development program known as DADSS, Driver Alcohol Detection System for Safety, which began in 2008 after being conceived at a Mothers Against Drunk Driving technology conference two years earlier. After 10 years of work, there are indications the program has matured to the point that it needs to be moved out of the current labs and into the hands of industry experts who know how to integrate vehicle technology into cars and sell them to the public."[328]

April 6, 2019

The Washington Post – Coming soon: If you're not sober you won't be able to start the car

"Officials behind the public-private effort to develop the technology — known as the Driver Alcohol Detection System for Safety (DADSS) — say the device will be ready for commercial fleets next year. Virginia's Department of Motor Vehicles became the first state agency to use it in its fleet last year, and a private company, James River Transportation, is road-testing them in its fleet of Ford Flex crossovers."[329]

"**Q:** Can you (Robert Strassburger) update us on DADSS?
A: We intend to release by the end of 2020 a breath-based device for use in fleet applications and as a dealer-installed accessory. That is an important milestone in a couple different ways. It's along a pathway toward our ultimate goal, which is a device that can largely be deployed in all vehicles. We are beginning to prepare for the handoff of the technology from DADSS to other [automakers] and other manufacturers who may want to use the technology."[330]

"**Q:** You're also testing human subjects. Why?
A: All of this testing will help us to develop — for lack of a better word — a blood library. That is one of the most significant challenges facing us in the development of this technology: How we, as individuals, absorb and eliminate alcohol is a function of our gender, our ethnicity, underlying health problems, [and] what we might be doing before or after we've consumed alcohol. All of that we have to understand. Then we're analyzing data to make to our measurement algorithms really robust."[331]

"**Q:** You've said those difficulties represent the kind of driver "hassle" that DADDS must avoid. Can you explain?
A: DADDS recognizes that 99.9 of drivers in the U.S. are not the problem and therefore won't tolerate any inconvenience. We want to make sure our system is very easy to use, doesn't hassle sober drivers, doesn't require a lot of maintenance, etc. So in the case of the breath-based system, you simply sit in driver's seat and breathe normally. That's all that's required."[332]

"**Q:** What about the touch-based system?
A: The concept with the touch-based [interlock] is you would touch a vehicle control, and, with the mere act of pushing the starter button, we would know what the driver's blood alcohol concentration would be. If you've ever been to the doctor or the hospital and they clip that thing on the end of your finger that measures your pulse and the oxygen content of your blood, that's a similar kind of concept. We're looking below the surface of the skin at your capillary bed and measuring how much alcohol is in your blood that way. [But] we're not asking to clip anything on the finger. You just push the starter button or, say, grab hold of the gear shift to change gears. Some may choose to integrate this into the steering wheel."[333]

"**Q:** When you were testifying before a congressional panel recently, former NHTSA administrator Joan Claybrook — who helped lead the campaign to install air bags in cars — took you and the auto industry to task for dillydallying on technology that could save thousands of lives. She suggested that you worry more about hassling consumers than saving lives. What was your reaction?
A: Frankly, my reaction was — unfortunately, Joan often has this habit of being dismissive of concerns the industry has raised, and that comes at our detriment. She did that in the

context of air bags, and that led to the first generation of air bags not being beneficial for some occupants."[334]

"**Q:** You also mentioned that the project must avoid a rerun of the interlock rebellion that occurred after the federal government ordered automakers to install seat-belt ignition interlocks, which prevented the vehicles from starting until drivers buckled up. Can you explain the controversy and why you think it's instructive here?
A: In the mid-1970s seat belt usage was between 10 and 15 percent. Not many people used their seat belt. The [seat-belt interlock] systems that were put on vehicles for just one year, the 1974 model year — my dad had one, and I knew how to disable it because it performed so poorly — were not well-designed, and they did hassle drivers. And there was such an outrage just from that single model year that Congress in 1974 enacted legislation prohibiting manufacturers from using seat-belt interlocks. And that prohibition stood until a couple years ago, when it was lifted because we do have technology now to make a more intelligent system, and the industry is researching more intelligent [seat-belt interlock] systems."[335]

"**Q:** What's the biggest hurdle that remains?
A: Quite literally, the performance [specifications] that we set for DADSS fill a ring binder about six inches thick. Our focus has really been on speed, accuracy and precision of measurement and the overall size of the technology."[336]

"**Q:** How much has been spent on DADSS so far?
A: Thus far it's been roughly $65 million. [The funding breakdown is 60 percent from the federal government, 27 percent from industry and 14 percent from the commonwealth of Virginia, a spokeswoman for the coalition says.]"[337]

April 12, 2019

Senator Tom Udall (D-NM) sent a letter to automakers requesting information on the implementation of anti-drunk driving technology developed through the DADSS program in vehicles.

Sen. Udall asked the following questions:[338]

- What plans does your company have to incorporate the DADDS technology, or other similar technology to prevent the intoxicated operation of a motor vehicle, into your commercially available vehicles?
- How has your company worked with NHTSA to test such technology?
- When could your company deploy this technology in all of your commercially available vehicles?
- If your company does not have a current plan for mass deployment, please cite the reasons why and other efforts you are undertaking to reduce drunk driving fatalities.

Responses to Sen. Udall's letter:[339]

> **BMW:** Supports the ACTS letter and ``BMW NA has been a supporter of its research into the development of noninvasive technologies to prevent alcohol-impaired driving fatalities on U.S. roadways. The DADSS program research has made progress in the development of two technologies: a touch--based and a breath--based system. BMW is closely monitoring the progression of these technologies towards commercially viable solutions.''

"For successful deployment in privately owned and operated vehicles, several years of additional research will be required beyond 2020 for the technologies to mature to achieve DADSS performance specifications. Continued joint funding of the DADSS program, in part through extending the FAST act authorization is important to bringing the years of research to a successful culmination. BMW NA will continue to support and actively monitor the research and development of DADSS research program.''

Ford: Supported the ACTS response as well as provided a very detailed response to the questions posed. While they have been an active participant in the testing program--they do not have any plans for integration into their vehicles. Their Ford Fusion vehicles will be used in the Maryland trials and Ford is providing technical and program guidance to the DADDS team. They believe that the software should be available for private cars by 2023 or 2024.

General Motors: Support the ACTS letter. They have donated 41 Chevrolet Malibu cars to the field-testing program for DADDS.

Honda: Stated they have been a long supporter of the DADDS program and participated directly with the ACTS coalition, but does not detail their contributions. Additionally, they used the same language that the ACTS response did as it relates to concerns about public rejection of the technology if it is done incorrectly. `Once the research on these technologies is completed, the next issue will be how best to deploy it. We are mindful of the strong public backlash in the 1970s to ignition interlocks that prevented a vehicle from being started without the front seatbelts being buckled. In fact, the outcry was so great that Congress passed a law prohibiting the Department of Transportation from mandating those systems in future vehicles. Before deploying DADSS technology, or other similar drunk driving protection technology in every vehicle, we need to be certain that the public will not reject them.''

Kia: Their affiliate company, the Hyundai-Kia Technical Center in Ann Arbor has committed over a million dollars and technical resources to the DADDS program. They believe that the integrated system should be
ready by the end of 2024. They cautioned against forced integration with the following language: ``We will need to study the technology and understand its shortcomings before committing to a plan for mass deployment. We are mindful of the public backlash created when the Federal government mandated seatbelt interlocks, which undermined the rollout of that technology. We support a voluntary deployment of a commercially viable program that is driven by consumer demand. We are proud of our participation in DADSS and believe our efforts in that regard will reduce drunk driving fatalities.''

Mazda: Participates in the ACTS coalition but does not specify the amount of money or time they have given to the testing.

Mercedes Benz: "The development of DADSS technologies is moving forward. Significant progress has been made, but much work is left to do to ensure technologies are accepted and used by consumers.''
`MBUSA fully aligns with the sentiments expressed by Automotive Coalition for Traffic Safety (ACTS)--[of which MBUSA is a member] --in their letter.''

Nissan: `While DADSS has made significant progress on developing the base alcohol detection and measurement technology, important development steps remain to prove the technology's operation and reliability in the automotive environment. Additionally, the footprint of the existing prototypes must be reduced given automotive packaging considerations, and the ability of the supply chain to manufacture the technology at scale must be proven out.''

"Nissan supports the letter submitted by ACTS--[of which Nissan is a member]--in response to your request, and requests that strong consideration is given to the legislative options offered in that submission. In particular, it is imperative that Congress continue to support budgetary measures that ensure the continuation of the ongoing work of the DADSS program; this includes lifting the FAST Act 2020 funding cap for the DADDS Program, as well as supporting the extension of the current budgetary authorization for at least four years.''

Subaru: `Subaru is a member of the DADSS Program, a collaborative project with National Highway Traffic Safety Administration, and has contributed funding as well as in-kind manpower from our engineering staff to support the DADSS Program.'' At this time, we [Subaru] have no concrete deployment plan for the technology as further research is necessary for widespread deployment of the technology and consumer acceptance has not yet been proven to be sufficient level to influence driver behavior.''

Toyota: The DADSS Program is in the invention phase, with current testing estimated to deliver a technology transfer of a fleet and accessory specification version in 2020 to vehicle integrators.'' Toyota plans to continue to evaluate this and any other technologies that can address this safety issue. We believe that carefully incorporating technologies in a way that maximizes customer acceptance will also lead to the most safety benefits.'' We support the content of the enclosed letter from ACTS. . .''

Volvo: Volvo Cars believes intoxication and distraction should be addressed by installing in-car cameras and other sensors that monitor the driver and allow the car to intervene if a clearly intoxicated or distracted driver does not respond to warning signals and is at risk. That intervention could involve limiting the car's speed, alerting the Volvo on Call assistance service and, as a final course of action, the car would eventually intervene and safely park on the side of the road.'' ``Volvo Cars is part of the ACTS which has been working with NHTSA to research, test and validate the DADSS technology. Volvo Cars fully informs NHTSA on our current and future technology and research plans on a regular basis.'' ``Volvo Cars will continue to evaluate the DADSS technology, once the necessary verification and validation testing and research are complete.''

Subaru: "Although the current system does not directly address drunk drivers, various literatures and studies link behavioral similarities between drowsy drivers and drunk drivers and with additional safety features provided by EyeSight, e.g., Lane Departure and Sway Warning, we are making efforts to raise drivers' situational awareness so that he or she may realize that it is not suitable to continue driving.

Currently, we are working on the next generation of the DriverFocus which enhances driver monitoring capabilities to expand the scope of the impaired driving."[340]

June 6, 2019

FY 2020 House Transportation and Housing and Urban Development, and Related Agencies Appropriations report language:

> "Advanced drunk driving technology. --The Driver Alcohol Detection System for Safety (DADSS) program is vitally important, as drunk driving continues to claim more than nearly 11,000 lives annually. An effective technology like DADSS has the potential to save 70 percent of those lives. As funding for the research program comes to an end this fiscal year, the next step must be to transfer the results to auto manufacturers and suppliers who have the real-world expertise to integrate technologies into vehicles as part of the ongoing product development process. NHTSA is directed to focus future work under the DADSS program on technology transfer so the DADSS technology can be made available to the driving public as soon as possible. The agency is further directed to provide a plan on accomplishing this transfer to the Committee within 180 days of enactment of this Act."[341]

June 19, 2019

The Senate Committee on Commerce, Science, and Transportation held a hearing entitled, "FAST Act Reauthorization: Transportation and Safety Issues."[342] During the hearing, Sen. Udall (D-NM) entered into the public record responses his office received as a result of an April 12 letter he sent to individual automakers regarding the DADSS program.

Acting NHTSA Administrator Heidi King wrote the following to Sen. Roger Wicker (R-MS) regarding a question on the DADSS program:

> **Question 13. What is NHTSA doing to ensure that the DADSS program continues along its path to develop and test technology to reduce deaths due to drunk driving?** NHTSA is and always have been actively engaged in the development of the Driver Alcohol Detection System for Safety (DADSS) program to facilitate the development of driver alcohol detection technology towards commercial deployment. NHTSA continues to actively engage with the DADSS program in the development of in-vehicle technologies that accurately and quickly measure blood or breath alcohol levels of the driver. NHTSA is engaged in Technical Working Group meetings on technology development. These are held every few months and include active participation from 17 major vehicle manufacturers. Recent technical evaluations include field operational trials of prototype DADSS technologies that began in Virginia late last year. Additional tests in more controlled settings (using test drivers) started last month and are expected to include up to 50 vehicles in multiple locations. These tests will provide a better understanding of real-world operations in varying environmental conditions.
>
> NHTSA also provides direction and feedback to DADSS on public policy, deployment, and public education considerations. In early 2017, NHTSA modified its Cooperative Agreement to create a Stakeholder Team to allow various stakeholder groups to provide direct input to the DADSS program on deployment and policy issues. The Stakeholder Team includes representation from automakers, States, and auto safety groups. As the technology development is reaching maturity, NHTSA is working to accelerate the transfer of the DADSS technology to the auto industry. NHTSA staff, as well as the DADSS program team, have engaged in outreach efforts to encourage private fleet operators to partner in deploying the technology. In addition, NHTSA distributed guidelines to States regarding how they might use their NHTSA highway

safety grant funds for DADSS technology deployments, as part of an effort to educate States on opportunities to expand their participation in the DADSS program.

Acting NHTSA Administrator Heidi King wrote the following to Sen. Maria Cantwell (D-WA) in regard to a question on DADSS.

> **Question 10**. **Given the potential of DADSS technology to save 7,000 lives each year from drunk driving (estimate from the Insurance Institute for Highway Safety), what additional steps can NHTSA take that will lead to this technology becoming standard equipment in vehicles?**
> NHTSA continues to work cooperatively with the DADSS program in the development of in-vehicle technologies that accurately and quickly measure blood or breath alcohol levels of the driver to address alcohol-impaired driving risks and related fatalities.
>
> As part of NHTSA's cooperative agreement with Automotive Coalition for Traffic Safety (ACTS), NHTSA continues to be engaged in Technical Working Group meetings on technology development. These are held every few months and include active participation from 17 major vehicle manufacturers. Recent technical evaluations include field operational trials of prototype DADSS technologies that began in Virginia late last year. Additional tests in more controlled settings (using test drivers) started last month and are expected to include up to 50 vehicles in multiple locations. These steps will provide better understanding of real-world operations in varying environmental conditions. NHTSA will continue to work with States, ACTS and automakers, and other stakeholders to encourage tests of the technology and to identify fleet partners to deploy the DADSS technology.[343]

August 15, 2019

Maryland Governor Larry Hogan (R-MD) participated in a press announcement regarding DADSS technology testing on state vehicles in Maryland.[344, 345, 346]

September 10, 2019

Automotive Coalition for Traffic Safety applied for a patent in the United States for a driver monitoring, breath- and touch-based alcohol sensor.[347]

September 17, 2019

Congresswoman Debbie Dingell (D-MI) introduced the *Honoring Abbas Family Legacy to Terminate (HALT) Drunk Driving Act* that would require the commercialization and standards for passive alcohol detection systems in all new cars.[348] The *HALT Act* is known as H.R. 4354.[349]

September 19, 2019

FY 2020 Senate Transportation and Housing and Urban Development, and Related Agencies Appropriations report language:[350]

> "Drunk Driving Prevention. -- The Committee continues to be concerned about the rate of drunk driving fatalities on our highways. In 2017, alcohol-impaired driving was the leading cause of highway fatalities, playing a role in 10,874 out of 37,133 deaths. The Committee continues to provide substantial support for the ``Drive Sober or Get Pulled Over'' high visibility enforcement campaigns and encourages the Department to further engage with law enforcement and other stakeholders to make these campaigns more pervasive and effective.

To further address this problem, NHTSA has partnered with leading automobile manufacturers in the automotive Coalition for Traffic Safety to develop in-vehicle technology to prevent alcohol-impaired driving. The Committee continues to strongly support this promising research partnership, which has the potential to prevent thousands of drunk-driving deaths annually. The Committee recommendation includes $5,447,000 for the continuation of this research in fiscal year 2020. These additional general funds will ensure that there is stable funding during the final year of the FAST Act (Public Law 114-94) for the continued development of the Driver Alcohol Detection System for Safety [DADSS] technology.

The Committee also provides $4,000,000 for grants, pilot program activities, and innovative solutions to reduce impaired driving fatalities, a portion of which shall be used for field testing of the DADSS technology in different climates and sites that would be scientifically informative for accelerating the commercial availability of this technology. This funding is in addition to the previously discussed contract authority and general funds.

The Committee is pleased that the research and development of the DADSS technology is progressing and that the first derivative of the breath-based technology could be released for licensing for use in business fleet applications by the end of 2020. However, the last official report made available to the Committee summarizing the activities of the program is from fiscal year 2016. The Committee directs NHTSA and the Automotive Coalition for Traffic Safety to submit to the House and Senate Committees on Appropriations a report describing the progress made by the DADSS program in fiscal year 2017 and each year thereafter. This report should discuss the progress made in research and a general accounting of the Federal funds obligated or expended since fiscal year 2016 in carrying out the effort.

Finally, the Committee directs the Department to ensure the testability of the DADSS technology for the purposes of future incorporation into the New Car Assessment Program. The Committee directs NHTSA to work with vehicle manufacturers and developers of the DADSS technology to begin considering whether and what kind of standardized testing could be conducted on this technology upon its commercial availability in new vehicles as standard or optional equipment."

October 11, 2019

Denso applied for a patent for a driver monitoring system to determine alcohol impairment.[351]

October 16, 2019

Senators Rick Scott (R-FL) and Tom Udall (D-NM) introduced the *Reduce Impaired Driving for Everyone (RIDE) Act of 2019* (S. 2604), that would promote the research and development of advanced alcohol detection software and require the implementation of such technology in new motor vehicles. The Senators joined Rep. Debbie Dingell (D-MI) and advocates at a press event that is recorded.[352] [353]

Sen. Scott: It is heartbreaking that we have lost so many to the irresponsible actions of drunk drivers. Now is the time to act so we never have to experience another tragedy. I'm proud to join Senator Udall to introduce the RIDE Act, which promotes the development of critical alcohol detection technology that could save 7,000 lives every year. One life lost is too many, and this technology will go a long way in protecting our families and communities.

Sen. Udall: The fact is that deaths from drunk driving are completely preventable – so we have an obligation to do everything we can to prevent such senseless tragedies. I've been in this fight for a long time, and we've made real progress. But we are still losing thousands of lives each year to drunk driving crashes. Every drunk driving death is one too many – and one too many family who is forced to confront unimaginable pain. With this legislation, we have the opportunity to help end drunk driving for good by putting alcohol detection technology in all new motor vehicles. We owe it to those we've lost—to honor them with action.

Rep. Dingell: Drunk driving has brought pain to my community in Dearborn and the country. Change needs to come faster and we need to do everything we can to ensure what happened to the Abbas family never happens again. The bills introduced in the House and Senate represent a way to do that and I'm committed to continuing to work with advocacy groups, industry, federal regulators, and those who have lost loved ones, including relatives of the Abbas family who are with us here today, so we can stop drunk driving and ensure the tragedy of the Abbas family never happens again.[354]

Additionally, Sen. Udall entered the bill introduction into the Congressional Record and noted "I appreciate the support of my colleague, Sen. Scott. The RIDE Act should have strong bipartisan support. Drunk drivers don't discriminate on the basis of political party. I urge all our colleagues to join us in this important fight against drunk driving and the devastation that it causes."[355]

November 20, 2019

Senator Udall (D-NM) and Acting NHTSA Administrator James Owens discussed the DADSS program during a Senate Commerce Committee hearing:[356]

> **Sen. Udall:** It's totally unacceptable that DUIs kill around 10,000 people every year in this country. Nearly 30 percent of all traffic fatalities. The Federal Government has been spending tens of millions of dollars on technology to stop drunk driving and it's time to get moving. Senator Rick Scott and I recently introduced the RIDE Act, which requires the National Highway Traffic Safety Administration to initiate and finalize a rulemaking to require technology to detect impaired drivers and stop them from driving in all new vehicles by 2024. Our bill does not require one specific technology, such as federally funded driver alcohol detection system for safety to be used, but allows any technology that keeps impaired drivers off the roads. Dr. Owens, this is a question on DUI. This is an important question, particularly given the lack of movement on required rulemakings that are so long overdue. When this bill becomes law, do you believe that NHTSA has the necessary resources to work with the auto manufacturers and other interested parties to complete a rulemaking on DUI technology in a timely manner?
>
> **Dr. Owens**: Thank you, Senator. We take alcohol impaired driving very seriously at NHTSA. As you say, far too many of our citizens are being killed on our roads because drivers are driving in an impaired state. I've had the opportunity to visit the DADSS facility here in Virginia and their research facility up in Massachusetts over the past month and a half. And I can tell you that the technologies are very promising, but they're not quite there yet. We certainly want to see these technologies get into cars as soon as possible, but we also need to make sure that when these technologies are rolled out and if there's a standard in place, that the technology is not premature because we also don't want to see a public backlash if there are too many people who have to walk home in the snow late at night because

their vehicle accidentally said or had a mistaken false positive. Having said that, we support the states who are demonstrating, who have pilot programs. We stand ready to support any state who wants to expand on these pilot programs. And we stand ready to do the research necessary. We have the resources necessary to do the research to determine what technologies are effective and what technologies will not have too many false--so many false positives that we'll have a backlash.

Sen. Udall: I would just note that many states are moving very aggressively in this area and they're having very good success in terms of their numbers on bringing down the deaths from drinking and driving. I have a great deal of respect for the employees of NHTSA, but I'm concerned the agency does not have the resources necessary to perform essential oversight over the design, manufacture, and installation of impairment technology. I think this is a concern many of us share. If NHTSA is enabled to push rules out in a timely manner, how can we be assured that the Agency can conduct adequate oversight, including over something as complex and unprecedented as self-driving cars?

Dr. Owens: Thank you, Senator. We have the resources to oversee matters within our purview. We do an enormous amount of rulemaking, and an enormous amount of research underlying that rulemaking. All of our rules, when we proceed with standards, they're very technical standards. They require clear evidence and sound science in order for us to proceed. So we take our mission very seriously. And you know, we are with respect to impairment devices, impairment reduction devices--working closely, we are funding the effort, and we're closely overseeing the research efforts that are going on right now.

December 2, 2019

BMW applied for a patent for a driver monitoring and breath-based system to determine alcohol impairment.[357]

2020

February 6, 2020

Micron applied for a patent for a driver monitoring system to determine alcohol impairment.[358]

February 26, 2020

Hyundai and Kia applied for a patent for a breath-based and driver monitoring system to determine alcohol impairment.[359]

March 4, 2020

Senator Capito (R-WV) asked DOT Secretary Chao questions about the DADSS program during an appropriations hearing in the Transportation, Housing and Urban Development, and Related Agencies Subcommittee:[360]

Sen. Capito: I am going to ask you quickly because this is an issue I am very concerned about drunk driving. We have the DADSS Program that I have been working with them, which is a detection system within the car. There has been research and development on that. Where do you see the technology on this as the Department, and I am getting conflicting information. We are a year away from this. We could do it right now. And, so, I would like to hear the Department's or your perspectives on this.

Secretary Chao: Well, we are certainly very focused on this new technology because it would certainly help. As for the timeline, unfortunately, that is part of the reality of new technology. We are just not quite sure. I think 1 year is a little bit optimistic, but we have current developments already included. For instance, we have field testing of operational prototypes. We have stakeholder teams for overall program direction. We are engaging in outreach efforts to encourage fleet operators to partner with us in deploying this technology because we need to test drive it with them.

Sen. Capito: Right.

Secretary Chao: Also, we are distributing updated guidelines to States' departments of transportation regarding how they might use their grant dollars for, you know, DADSS technology deployment.

Sen. Capito: I appreciate that.

Secretary Chao: All of this is ongoing.

Sen. Capito: Yeah, I mean, you mentioned safety first, and obviously, the attribution of alcohol to many of accidents and deaths on our highways is way too high, so I am glad to be working with the Department, and thank you for your work in this area.

March 17, 2020

General Motors applied for patent for a driver monitoring system to determine alcohol impairment.[361]

April 1, 2020

Hyundai and Kia applied for a patent for a breath-based system. [362]

April 21, 2020

Micron applied for a patent for a driver monitoring system to determine alcohol impairment.[363]

May 8, 2020

Acting NHTSA Administrator James Owens wrote to Rep. Sam Graves (R-MO) with an update on the DADSS program stating:

> "The ***DADSS Program continues to make significant progress towards the goal of developing in-vehicle technologies that could reduce or eliminate alcohol-impaired crashes***, improving upon both existing technologies and exploring new technologies."[364]

June 9, 2020

Senseair applied for a patent for a breath-based sensor to determine alcohol impairment.[365]

June 24, 2020

Senseair applied for a patent for a breath-based sensor to determine alcohol impairment.[366]

June 25, 2020

Representative Debbie Dingell proposed provisions of the HALT Act be included in the bipartisan infrastructure bill:

> **Rep. Dingell:** We need the installation of advanced drunk driving prevention systems in all passenger vehicles. For decades, working together with MADD and other advocates we've pushed for legislation. Including my drunk driving legislation in House Democrats' comprehensive infrastructure package is a huge step forward in curbing drunk driving on American roads.
>
> **Rep. Schakowsky:** No family should have to suffer the loss of a loved one to drunk driving. But for decades, drunk driving accidents have plagued the nation – inflicting death and destruction at intolerable, unacceptable levels. I am proud to support my friend and colleague Debbie Dingell to ensure that no family suffers the tragedy the Abbas family has suffered.[367] We want to make sure that every car, regardless of its price or size, will have these kinds of protections in them.[368]

June 29, 2020

Micron applied for a patent for a driver monitoring system to determine alcohol impairment.[369]

June 30, 2020

The Senate Commerce Subcommittee on Transportation and Safety held a hearing where the *RIDE Act* and DADSS program were discussed.[370] Below is an exchange between Sen. Rick Scott (R-FL) and John Saunders, Virginia Director of Highway Safety, representing the Governors Highway Safety Association:

> **Sen. Scott**: I want to thank Senator Udall for cosponsoring the RIDE Act. And it basically--it is finally going to get to the point where we say you have to do this. And so what is--do you think--do you all think it is realistic that we can implement alcohol detection systems, passive alcohol detection systems within the next 4 years on new passenger cars?
>
> **Mr. Saunders.** Senator, thank you so much. We do. Again, and I am looking at the--the current schedule in front of me right now that would have us on a track to be able to do that. It looks to me to be a new vehicle safety option in 2025. So that would put us right at that four to five year point to be able to have that technology where we believe it will be at the level that we could have it in all new vehicles.
>
> **Sen. Scott:** But do you believe it is doable? Do you believe that, just to make sure it is going to happen, that we ought to have a very specific date that is mandated by law?
>
> **Mr. Saunders:** I have a saying that I say we move at the speed of success. I would go back to what I mentioned earlier. It is very critical to ensure that there cannot be any false positives. And I think that takes a lot of testing, whether it be climatic testing, getting it in cars and all type of weather situations, all kinds of climates that takes a little time and tweaking. I would not--I would have to maybe get back with you on a final. I would think that we want to give that a lot of thought before we would mandate a date, because in the end, we have come so far, we have come so far that we would be right at the precipice of being able to move forward in a successful manner that I would not want to waste all of the work that we have done

to get us to that point. So I will get with the Board of Governors Highway Safety Association and we will give you a response back to that.

Sen. Scott: So I think what you are saying is--I think, you know, you are saying the right thing because you want to have success and you want to do something that is going to implement our ability to have success. But I think all of us who, you know, think about our lives and the more we have deadlines, we move faster and, you know, good things happen. Right. So do you think it makes sense? And whether the deadlines, 4 years, 5 years, 6 years or 7 years--I mean, do you think there is a value of having a deadline saying we are going to do it by this date?

Mr. Saunders: Senator, again, I sure agree with you. I think when we have a deadline, it sure gives us a target goal to be set. Here again, I do not want to go on record speaking for the organization on a mandated date. We could quite possibly be talking about an area where DADSS could come back and give us a written estimated completion date. Again, I have DADSS materials here in front of me. We could surely get that back to the Committee for their review. And maybe we could start from there.

Sen. Scott: Do you think there is any limitations that we can get something done in the next four or five years? Is there any--do you see any hindrance that we will be able to get this done? And do you think there is enough commitment by the private sector to get this done?

Mr. Saunders: I do believe there is enough commitment by the private sector and also by the individuals who are working on this DADSS project. They are totally committed to it. They have been moving forward at a wonderful speed and really not that heavily funded. But they are getting it done. And I do believe that we will meet that date of 2025, if not before.

Sen. Scott: Alright. One more thing. I want to thank each of you for what you are doing to try to keep people safe. So thank you. Thank you very much. Again, I want to thank Senator Udall and Senator Capito for all their commitment to stop drunk driving.

After the hearing, John Saunders answered Sen. Scott's question "How important is it to have a deadline for the DADSS program?" in the response below:

John Saunders: Answer. No highway-safety program will succeed without public trust. The history of highway safety features a number of countermeasures that failed to win or maintain public trust, including seat belt interlocks, and to a certain extent motorcycle helmets and automated enforcement, though we continue to work to convince the public to use and accept the latter two. It is imperative to ensure that passive alcohol detection works before offering it in vehicles. If not, public outcry may cause the auto industry and policymakers to discard this technology. GHSA urges Congress to continue to fund the DADSS research program and warns against imposing an arbitrary deadline that would jeopardize the lifesaving promise of this technology. GHSA also urges U.S. Congress to focus more on what it can do today. Between now and any deadline years in the future, about ten thousand Americans every year may continue to be killed in impaired driving crashes. To most effectively combat impaired driving, Congress should increase investment in today's proven countermeasures and remove administrative constraints that limit the implementation of highway safety programs.

Below is an exchange between Sen. Tom Udall (D-NM) and John Saunders, Virginia Director of Highway Safety, representing the Governors Highway Safety Association and Jane Terry of the National Safety Council:

> **Sen. Udall:** Mr. Saunders, in your testimony, you discussed DADSS and your state's pilot program implementing alcohol detection technology. DADSS was first created in 2008. I have been working to make sure the program remains authorized and funded. After 12 years, I am glad to see the technology in cars, but I am concerned by ongoing challenges to implementing new technologies and expanding a pilot. What will it take to get drunk driving prevention technology into cars in every state?
>
> **Mr. Saunders:** Again, Senator, thank you so much for your question regarding DADSS. Again, I think we must take the opportunity to be sure that we are doing all of the testing and all of the work that we need to do to prepare this equipment to ensure that we have a device that we feel is ``foolproof.'' Once we can get to that level, and, of course, that takes funding for us to get to that level, I think to be able to sell it and to be able to get it for our manufacturers. I think there will be an outcry from the public to have such equipment the same way that there is for the other types of safety options that we are talking about in vehicles right now. Especially for those parents who may have a teenager: they can have a device like this in a vehicle that is an option that they can use and have available. So I just think that we have to continue to work our plan. I think we have to continue to educate the public, to make them aware of what we are doing, and to get them comfortable with what we are doing with this technology. And also, I believe, if we can do that, I believe that politically, the political climate will also allow us to be able to move it to every state.
>
> **Sen. Udall**: Right. Thank you for that answer. Now is the time to finally make sure new vehicles are equipped with technology to stop drunk driving before it starts. Requiring drunk driving prevention systems is no different than requiring airbags, technology that we have all come to accept, in fact, demand that saves tens of thousands of lives. Tragic losses, the 10,000 Americans killed every year from drunk driving can be stopped. Senator Scott and I have proposed legislation to reduce impaired driving for everyone, the RIDE Act, which could save 10,000 lives a year by requiring technology in all vehicles to prevent drunk driving, the leading cause of highway deaths. The rulemaking we are proposing in our bill would likely be the most significant life saving measure ever implemented by NHTSA. Ms. Terry, I want to thank you and the National Safety Council for your support of the RIDE Act. In your testimony, you mentioned similar legislation in the House. Is this the right approach and should this committee consider and pass a bill that requires car manufacturers develop and deploy a technology standard to end drunk driving?
>
> **Ms. Terry:** Senator, as you stated, NSC is supporting the RIDE Act. We do believe that passive alcohol detection technology that doesn't even allow a car to start, if somebody is behind the wheel and they have had too much to drink, can save lives and prevent some of the 10,000 deaths that we see each and every year on our roads due to alcohol impaired driving. Having a mandate for that to be installed in vehicles is absolutely the right way to go to save lives.

Below is an exchange between Sen. Capito (R-WV) and John Saunders, Virginia Director of Highway Safety, representing the Governors Highway Safety Association:

> **Sen. Capito:** Since 2008, ACTS and NHTSA, National Highway Traffic Safety Administration, have been collaborating on research and development on driver

alcohol detection systems for safety called DADSS program. Since its inception, DADSS has made significant progress toward developing in-vehicle technologies that could reduce or eliminate alcohol impaired crashes. I believe this technology holds great promise. I have worked with several of the other members of this committee on that and could have a significant impact on the number of drunk driving fatalities we experience each year. My colleagues and I are having ongoing conversations about this program. Mr. Saunders, as you noted, Virginia was the first state to partner with DADSS in implementing the Driven to Protect Pilot program. How has that pilot been implemented in Virginia? And as the pilot program been successful in educating the public about the benefits of this technology? What have you discovered?

Mr. Saunders: Thank you, Senator, for the question. We have been the leaders of supporting the DADSS program in partnership with NHTSA and also with the State of Maryland who was also on board with us in this program. We in Virginia have had a wonderful experience. The DADSS program has been very progressive. The mission of the Driver Acohol Detection System for Safety, which is the DADSS program, is to develop--of course as all of you know in the Subcommittee--a kind of alcohol detection technology that can passively detect when the driver is impaired with blood alcohol content (BAC) above that legal limit of 0.08. Since the DADSS program was founded, it has grown from its oldest conceptual iteration on the dinner napkin into a viable suite of alcohol detection technologies that has significant potential for saving lives on and off the road. Among other things, the program is developing two viable technology approaches, a breath-based technology and a touch-based technology, that are on track to becoming effective, consumer-friendly safety options.

Also, they are inventing devices and developing procedures to test these prototypes to ensure that they are providing consistent accurate and precise BAC readings. We really cannot have any room for false positives in this process. Building partnerships with the OEMs and the Tier 1 automotive suppliers,
they have also ensured the technology can be manufactured at the automotive production scale and at a cost to ensure that it is a viable consumer safety option. The word is getting out as we work to take vehicles equipped with this system out to the public to let them touch it, see it, see how it works, and get
an understanding of what DADSS is all about. So, I believe what we are doing in Virginia is to take the
first steps as this technology comes about. I was looking at the program just as we are now looking forward to where are we going. As we look to 2021, hopefully, we will be able to market this to some fleets as accessories. We are currently working with James River Transportation in Richmond area and we have some of their--many of their vehicles equipped with this technology as a pilot project. In 2024, we hope to be see new vehicle safety options, and hopefully by 2025, we will have this ready for it to be placed in all new vehicles. So we are on track in Virginia. It is a very progressive program. With the COVID-19, we have slowed it down a little bit. A lot of the outreach that we planned on doing, we have had to reschedule, but as far as where we are going to, I think we are on a clear path.
Senator Capito: Well, that sounds really, really good. Encouraging. I would encourage you to speed up, because obviously I think it will save lives in the end.

July 1, 2020

Senseair applies for a patent for a breath-based sensor.[371]

July 1, 2020

H.R. 2 passed the House of Representatives. Section 32005 of the measure of the proposed Infrastructure law contained the HALT Act provisions to make advanced impaired driving provisions a standard feature on all new vehicles.[372, 373, 374]

July 9, 2020

Magna applied for a patent for a driver monitoring system to determine alcohol impairment.[375]

July 16, 2020

FY 2021 House and Senate Transportation and Housing and Urban Development, and Related Agencies Appropriations report language:

> "Impaired driving detection. -- The Committee is concerned that available technology to detect impaired driving has changed since funding began for the DADDS program in 2011 and is encouraged by the development of a variety of sensor- and camera-based technologies in vehicles to detect impaired, drowsy and distracted driving. While the DADDS program has made significant progress, it has been almost 15 years since NHTSA last reviewed the available technology for detecting drivers impaired by alcohol. Within 60 days of enactment of this Act, the Committee directs NHTSA to contract with the Volpe National Transportation Systems Center to update the 2007 Review of Technology to Prevent Alcohol-Impaired Crashes. The Committee directs NHTSA to brief the House and Senate Committees on Appropriations within 30 days of receipt of the Volpe study.
>
> Because additional technologies to detect drivers impaired by alcohol or other substances are emerging, the Committee is concerned about their ability to work in a repeatable manner and sees a need to eventually develop minimum performance standards for such technologies. As a result, the Committee directs that $3,000,000, to remain available until expended, be available for NHTSA to acquire such technology, to develop a research plan and to collect data with the goal of eventually developing a test standard. In addition, NHTSA is directed to convene a public forum of national and international technology developers who have expertise in technologies that detect impaired driving in order to increase awareness of such technologies and to facilitate technology transfer from previously federally funded efforts.[376]"

July 23, 2020

The Insurance Institute for Highway Safety (IIHS) released a report that stated, "alcohol-detection systems that stop people from drinking and driving could prevent more than a quarter of U.S. road fatalities and save upwards of 9,000 lives a year."

Additionally, the report said, "The fastest way to reach any of those milestones would be through federal regulation, and bills designed to eventually make alcohol-detection systems mandatory safety features have been introduced in both the House and Senate over the past year. For now, the DADSS project envisions that some manufacturers will begin offering the ambient-air-based system as an option as early as 2025."[377]

September 25, 2020

A group of insurance companies sends a letter of support for S. 2604 (RIDE Act) by Senators Tom Udall (D-NM) and Rick Scott (R-FL) and H.R. 4354 (HALT Act) by Rep. Debbie Dingell (D-MI).

The insurance companies who signed the letter included: Allstate Insurance Company, American Family Mutual Insurance Company, Amica Mutual Insurance Company, Farmers Insurance, Independent Insurance Agents & Brokers of America, Liberty Mutual Insurance, National Association of Mutual Insurance Companies, National Association of Professional Insurance Agents, Nationwide Mutual Insurance Company, NJM Insurance Group, Selective Insurance Group, State Farm Mutual Automobile Insurance Company, and USAA.[378]

September 28, 2020

Hyundai and Kia applied for a patent for a breath-based system.[379]

October 2, 2020

DYM Sense applied for a patent for a touch-based system.[380]

October 21, 2020

Ford applied for a breath-based patent to determine alcohol-impairment.[381] The patent's goal appeared related to implementing the Driver Alcohol Detection System for Safety (DADSS) program.

October 28, 2020

Hyundai and Kia applied for a patent for a breath-based system.[382]

November 12, 2020

NHTSA released a "Request for Information (RFI): Impaired Driving Technologies."[383] The public was given 60 days to comment on the RFI. MADD submitted two separate comments detailing developing and available technologies. The Alliance for Automotive Innovation urged NHTSA's continued support and focus on the DADSS program.[384]

November 23, 2020

Hyundai and Kia applied for a patent for a breath-based and driver monitoring system to determine alcohol impairment.[385]

December 15, 2020

Bosch filed for a patent for a driver monitoring system, based on vehicle movements, to determine alcohol impairment. [386]

2021

January 4, 2021

Gentex applied for a patent for a driver monitoring system to determine alcohol impairment.[387]

January 7, 2021

Representative Debbie Dingell (D-MI) joined MADD and drunk and impaired driving advocates to commemorate the two-year anniversary of the drunk driving crash that killed the Abbas family. ***Rep. Dingell announced the reintroduction of the Honoring Abbas Family Legacy to Terminate (HALT) Drunk Driving Act***.[388, 389]

January 11, 2021

The Alliance for Automotive Innovation responded to the November 12 NHTSA public comment RFI and urged NHTSA's continued support for the DADSS program. The letter stated:

"Research on the DADSS Program is forecasted to conclude no later than 2025 assuming sufficient resources are provided…. we believe that DADSS research should be supported and completed as an agency priority."[390]

January 21, 2021

The Senate Commerce Committee held a nomination hearing for Pete Buttigieg for Secretary of Transportation. Senator Rick Scott (R-FL) wrote questions on DADSS and the RIDE Act[391]:

> **Question 3. [Sen. Rick Scott]:** Last Congress, I introduced legislation called the RIDE Act, with Senator Udall, which would require DOT, through National Highway Traffic Safety Administration (NHTSA), to implement a timeline that would require blood alcohol testing technology in all new vehicles.
>
> a. The Driver Alcohol Detection System for Safety Program (DADSS) has received around $50 million from Congress each year since around 2008 to develop technology like this. I believe it's far past time to let the private sector come up with a solution that could save 9,400 lives a year. What are your thoughts on this?
>
> **Answer [Pete Buttigieg]:** If I am confirmed, safety will be my top priority at the Department. DADSS has the potential to save thousands of lives each year, and I support the use of technology and other safety initiatives to address impaired driving. I consider it important to engage industry and make use of all appropriate tools to ensure that the safest technologies are being employed in our transportation system.

January 29, 2021

Senseair applied for a patent for a breath-based sensor.[392]

March 10, 2021

ZF Friedrichshafen applied for a patent for a combination breath-based and driver monitoring system to determine alcohol and other drug impairment.[393]

March 16, 2021

MADD released an Ipsos poll on support for advanced impaired driving prevention technology.[394] Below were key survey findings:

- The survey found that 9 out of 10 Americans support technology that is integrated into a car's electronics to prevent drunk driving (89% say it is a good or very good idea).
- 3 out of 4 (77%) back Congressional action to require this technology in all new vehicles.
- More broadly, 8 out of 10 (83%) believe that new auto safety features should be standard in vehicles as they become available, not part of optional equipment packages.

Additionally on March 16, Honda applied for a patent for a driver monitoring and breath-based system to determine alcohol impairment. [395]

March 19, 2021

The Distilled Spirits Council of the United States (DISCUS) and the Foundation for Advancing Alcohol Responsibility (responsibility.org) noted their support in a press release for the HALT Act stating:

> "DISCUS and Responsibility.org are dedicated to eliminating drunk driving, and with recent increases in multiple substance impaired driving, we know we must support bold and innovative approaches to save lives. Technology holds tremendous promise and all types of technology, including alcohol detection technology, camera technology and driver monitoring systems, must be explored as effective ways to prevent impaired driving."[396]

March 23, 2021

Representative Debbie Dingell (D-MI) introduced H.R.2138 - Honoring Abbas Family Legacy to Terminate Drunk Driving Act of 2021.[397] Representatives David McKinley (R-WV) and Kathleen Rice (D-NY) originally cosponsor the bill. By September 2021, eight lawmakers cosponsored the proposal.

March 27, 2021

Advocates for Auto and Highway Safety testified before the Senate Commerce Committee and urge support for the RIDE Act. Their testimony stated:

> "We commend Committee Members Senators Ben Ray Luján (D-NM) and Rick Scott (R-FL) for their leadership and dedication to curb impaired driving by introducing the Reduce Impaired Driving for Everyone (RIDE) Act. This bipartisan legislation will ensure that verified technology to passively detect impairment and prevent driving is standard in new cars. We urge this Committee and Congress to advance this legislation."[398]

April 9, 2021

Sony applied for a patent for a driver monitoring system to determine alcohol impairment.[399]

April 12, 2021

Hyundai Mobis applied for a patent for a driver monitoring and breath-based system to determine alcohol impairment.[400]

April 22, 2021

Senators Ben Ray Luján (D-NM) and Rick Scott (R-FL) introduced *Reduce Impaired Driving for Everyone Act of 2021* (RIDE) (S. 1331). Senators Gary Peters (D-MI) and Shelley Moore Capito later joined as cosponsors.[401]

Sen. Luján stated "Drunk driving has brought pain into the homes of too many New Mexicans. Across the country, thousands of families mourn the loss of loved ones in drunk driving crashes that can be prevented with the deployment of cutting-edge technologies. This can change if Congress takes action, and that's what the RIDE Act sets out to do. This bipartisan legislation is a major effort to end drunk driving, keep our highways safe, and prevent needless deaths."[402]

Sen. Rick Scott stated, "It is heartbreaking that we have lost so many to the irresponsible actions of drunk drivers, and it's time to take real, significant action to prevent any further loss. I'm proud to continue leading this effort and promote the development of critical alcohol and impaired driving detection technology, which will be a huge step to protect our families and communities."

MADD National President Alex Otte stated, "The RIDE Act holds the potential to eliminate drunk driving forever and it is one of the most important initiatives in MADD's 40-year history. Drunk driving is the leading killer on America's roads, accounting for more than a

quarter of all traffic deaths and injuring 300,000 people every year. On behalf of the nearly 1 million victims MADD has served, I thank Senator Luján and Senator Scott for leading this effort in the Senate."[403]

April 26, 2021

Anheuser-Busch sent a letter of support for the RIDE and HALT Act to Sen. Ben Ray Luján (D-NM).[404]

April 27, 2021

Victim survivor Rana Abbas Taylor testified virtually before the Senate Committee on Commerce Subcommittee on Surface Transportation, Maritime, Freight and Ports in support of the passage of the RIDE Act.[405]

MADD victims and victim survivors sent a letter of support to Senate Commerce Committee to supplement the testimony of Rana Abbas Taylor.[406]

Below are highlights from the hearing.[407]

> **Rana Abbas Taylor:** MADD is technology-neutral and is committed to NHTSA's development of standards and thresholds to determine the best solutions through a rulemaking process.
>
> **Rana Abbas Taylor:** Senator Lujan and Senator Scott--thank you. You are one of us. You are victims and survivors yourselves, and you understand our pain. To have you lead this effort in the Senate is comforting to me and my family. We are unstoppable. Your stories--our collective stories--are our power. Senator Scott--thank you for being with us since the beginning of the last Congress.
>
> **Sen. Deb Fischer (R-NE):** And Ms. Rana Abbas Taylor, I want to especially thank you for your willingness to share your story with us today. I had the opportunity to talk with a constituent earlier this year who shared the story of his daughter, Alexis Victoria Caffee, who was killed by a drunk driver. What happened to your family is a tragic reminder that there is more to do to address drunk and impaired driving.

Below is an exchange between Sen. Luján and John Bozzella, President and CEO, Alliance for Automotive Innovation:

> **Sen. Luján:** Now the bill that I introduced with Senator Rick Scott would require rulemaking for automakers to include drunk or impaired driving prevention technology in all new vehicles. The technology would detect when a driver is impaired and prevent the car from operating. Mr. Bozzella, have you ever been hit by a drunk driver?
>
> **Mr. Bozzella:** No, I have not.
>
> **Sen. Lujan.** I have. I got hit head on by a drunk driver 29 years ago and there were many nights that I'd be driving home after that accident or driving anywhere and all I would see were headlights coming at me and it scared me to death. Couldn't sleep many nights because as soon as my eyes closed and there was darkness, two headlights would light it up. Do you drive a car?
>
> **Mr. Bozzella:** Yes, I do.

Sen. Luján: So you may have this shared experience with me sometimes where you've been in a vehicle and you see a car driving a little erratically. You see the vehicle go across the middle lane and maybe they go back over and they hit the rumble strip and then they accelerate and then they brake and then maybe you've seen it, I know I have, where they go into the oncoming lane. You're nodding yes, you've seen that?

Mr. Bozzella: Yes, I have.

Sen. Luján: Mr. Bozzella, today, just today, the Alliance for Automotive Innovation announced, I quote, ``Driver Monitoring Principles.'' These standards clearly show that you believe the technology is there, that every new car should include driver monitoring as a standard feature, the capability to issue driver warnings and the ability to re-engage the driver, is that correct?

Mr. Bozzella: That is correct.

Sen. Luján: And just this week, your member companies were calling on this committee to pass an amendment that gave an exemption to autonomous vehicles, self-driving cars, is that correct?

Mr. Bozzella. Yes.

Sen. Luján: Now my question to you, Mr. Bozzella, if your members believe AVs are good enough drivers to be exempt from liability in some cases, how many warnings should a car make before taking the wheel on pulling over, on calling the Ride Share for help? How many driver warnings should a car give before it knows that something is wrong and the car should pull over?

Mr. Bozzella: Yes. So, Senator, thank you for your question. First of all, I can't imagine what it must have been like to have that experience and I said the same to Ms. Abbas Taylor, and my deepest sympathies to you and especially to Ms. Abbas Taylor for what she went through. That is why we're working as hard as we can to do a number of things. First, we're working on passive alcohol detection technologies. We should detect blood alcohol content in people before the vehicle ever even gets underway and we're working to commercialize that technology. In addition, we're working on, as you point out, opportunities for driver behavior monitoring and driver state monitoring to be able to add to that overall situational awareness. All of these technologies have an opportunity to address this, and we want to work with you, with NHTSA, and with MADD to get this done.

Sen. Luján: Mr. Bozzella, are you prepared today through the Alliance for Automotive Innovation to support the RIDE Act?

Mr. Bozzella: We are looking forward to working with you, with NHTSA, with MADD to help address and ultimately help eliminate drunk driving in this country.

Sen. Luján: So you're not a yes yet today?

Mr. Bozzella: We want to work with you on----

Sen. Luján: I heard you. Look. I'm out of time now to ask important questions to Rana who has an incredible story to tell about the loved ones that she's lost. All of

the other witnesses here, Mr. Chairman. The simple answer is yes. We're asking for exemptions to have cars drive themselves. That means that somebody thinks it's OK that those technologies are watching what the driver is doing because they don't have to do a thing. This is easy. This technology exists today. So, Mr. Chairman, I hope we can sit down soon. I hope we get to an answer to yes. There's no reason that the United States of America can't lead, that we can't save more lives. If that's what I'm hearing out there, that's what shareholders are being told, then let's tell those families that were victims, those of us that were in cars that were hit head on by drunk drivers that we can stop this and we can get to yes on the RIDE Act.

Additionally, on April 27, The Distilled Spirits Council of the United States (DISCUS) and the Foundation for Advancing Alcohol Responsibility submitted testimony in support of the RIDE Act in the Senate.

> "The RIDE Act is a technology-neutral approach that mandates a rulemaking process at the National Highway Traffic Safety Administration. This will allow the best technologies to be tested and to determine their feasibility, and ultimately help ensure installation of this lifesaving technology throughout new vehicles."[408]

May 13, 2021

MADD submitted a second response to a NHTSA's request for public comments regarding information regarding passive advanced impaired driving prevention technology.[409]

May 18, 2021

Victim Survivor Rana Abbas Taylor submitted written testimony in support of the HALT Act before the U.S. House Energy and Commerce Committee Subcommittee on Consumer Protection and Commerce.[410]

During the hearing, Rep. Debbie Lesko (R-AZ) and panelist `Raj'' Rajkumar, Ph.D., Department of Electrical and Computer Engineering, Carnegie Mellon University discussed advanced impaired driving prevention vehicle technology[411]:

> **Rep. Lesko:** Mr. Rajkumar, my first question is for you. In your opinion, what are the hurdles remaining for the automobile vehicle industry to overcome, to continue the development of this technology as we shift from driver assist functions to fully autonomous systems?
>
> **Dr. Rajkumar:** Congresswoman, thank you for the question. The basic technology for doing that is available or can be made available fairly quickly. There are so-called driver monitoring systems, where a camera can be mounted above the steering wheel, say, looking at the driver's face, and then monitor whether the driver's eyes are closed or not, that the head is drooping or not. And therefore the technology is there to detect whether the driver is opiated, drowsy, or drunk. And whether the vehicle is driving itself or not, even with the level 2 systems and beyond as well, you can monitor. And if things are not looking good, the vehicle can take action, generate alerts, and if they are not being responded to, slow down, turn the flashers on, pull over, and stop.
>
> **Rep. Lesko:** Yes, that is very interesting that--you know, of course, with the introduction--there is drunk driving and then, of course, with the introduction of more legalization of marijuana, that is causing a problem as well. So I could see how that would be very beneficial.

May 28, 2021

Hyundai and Kia applied for a patent for a driver monitoring system that also includes breath-based alcohol sensors.[412]

June 16, 2021

Senator Capito (R-WV) applauded passage by Senate Commerce Committee of the infrastructure bill:

> "The legislation passed today would increase funding levels for the safety programs that are consistent with the increased funding levels that our surface transportation legislation in the EPW Committee provided for roads and bridges. Finally, I want to thank the committee for working with me to include language that would increase investments to address substance-impaired driving, drunk driving, and innovative transportation technologies." The press release also noted that Senator Capito provisions included: "The Reduced Impaired Driving for Everyone (RIDE) Act, which is legislation that Senator Capito co-sponsored to prevent drunk driving."[413]

June 24, 2021

The Beer Institute sent a letter of support for the HALT Act and RIDE Act to the authors of the legislation.[414]

June 30, 2021

Mothers Against Drunk Driving (MADD) joined Consumer Protection and Commerce Subcommittee Chair Jan Schakowsky (D-IL) and Representatives Debbie Dingell (D-MI), Kathleen Rice (D-NY) and Paul Tonko (D-NY) to urge the House to pass the auto safety provisions in the proposed Infrastructure Law.[415]

July 8, 2021

In 2021, Senseair applied for a patent for a breath-based sensor to determine alcohol impairment. [416]

July 20, 2021

FY 2022 House and Senate Transportation and Housing and Urban Development, and Related Agencies Appropriations report language:

> "Drunk and impaired driving detection.--Drunk driving is the number one cause of traffic fatalities, costing the United States $194 billion annually and accounting for roughly one-quarter to one-third of motor vehicle fatalities each year. To address the scourge of drunk driving, the Committee has continually supported the Driver Alcohol Detection System for Safety (DADSS) research under this heading. The DADSS system specifically aims to detect the presence of a certain level of alcohol in a driver. NHSTA and staff of the DADSS program estimate they will complete their work by the end of fiscal year 2025. The Committee expects NHTSA will continue to support the program with funds made available under this heading.
>
> The Committee is also encouraged by the development of camera-based driver monitoring systems. These developing, probability-based systems aim to detect a variety of behaviors that are not conducive to safe driving such as distraction, drowsiness, or impairment. The Committee believes that these technologies, in combination with other technological innovations, have the ability to save lives and reduce impaired driving.

> In fiscal year 2021, the Committee directed NHTSA to contract with the Volpe National Transportation Systems Center to update the 2007 Review of Technology to Prevent Alcohol-Impaired Crashes and looks forward to receiving that report. The Committee directs NHTSA to emphasize research on driver monitoring and to identify promising technologies that will reduce or eliminate impaired and distracted driving."[417]

July 29, 2021

Hyundai Mobis applied for a patent for a driver monitoring and breath-based system to determine alcohol impairment.[418]

August 5, 2021

Hyundai Mobis applied for two patents for a driver monitoring and breath-based system to determine alcohol impairment.[419, 420]

Tech Crunch published an article that stated:
"According to DADSS, the current timeline for bringing the breath-based approach to vehicles is by 2024, and the touch-based approach by 2025."[421]

August 10, 2021

The Senate passed the Infrastructure Investment and Jobs Act (IIJA) (H.R. 3684), sending the legislation back to the House for approval. Section 24220 of the legislation included the "Advanced Impaired Driving Technology" rulemaking codified as the Honoring Abbas Family Legacy to Terminate (HALT) Drunk Driving Act.[422]

On the passage, Sen. Luján (D-NM) stated:

> "Too many families across America have felt the pain of losing a loved one from drunk and impaired driving crashes. After years of advocacy from survivors and victims' families, the Senate took action to help end drunk and impaired driving with the inclusion of these measures in the bipartisan infrastructure legislation. As a victim and survivor of a drunk driving crash, I know how important this legislation is for those like me who live to tell the story and the thousands every year who can't. I'll continue fighting to get this signed into law."[423]

August 13, 2021

Panasonic applied for a patent for a driver monitoring system to determine alcohol impairment.[424]

September 9, 2021

Toyota applied for a patent for home-based breath-based to determine alcohol impairment.[425]

September 22, 2021

Honda applied for a patent for a driver monitoring, touch- and breath-based system to determine alcohol impairment.[426]

October 12, 2021

Mercedes Benz applied for a patent in Germany for a driver monitoring system to determine alcohol impairment.[427]

November 3, 2021

Bosch applied for a patent in Germany for a driver monitoring system to determine alcohol impairment.[428]

November 5, 2021

The House of Representatives agreed to Senate changes in the IIJA. Section 24220 of the legislation included the "Advanced Impaired Driving Technology" rulemaking codified as the Honoring Abbas Family Legacy to Terminate (HALT) Drunk Driving Act.[429]

November 9, 2021

An article published in the *Washington Post* noted that the DADSS program hopes to have a vehicle ready by 2024.[430]

November 15, 2021

President Joe Biden signed the IIJA into law (Public Law 117-58), codifying the HALT Act.[431] The new law requires all new cars – beginning in 2026 – to be equipped with smart technology that passively, seamlessly, and unobtrusively detects and stops impaired driving.

At the bill signing, Senate Majority Leader Schumer (D-NY) said "today's legislation will also make driving safer in America. It will require new cars to install drunk driving prevention technology."

Senator Sinema (I-Arizona) stated "We have a significant update in transportation policy. From strengthening public transit in midsized communities to new technologies preventing impaired driving…"[432]

The law doubled funding for the DADSS program for FY2022 – from $26 to $45 million.[433]

November 16, 2021

Hyundai and Kia applied for a patent for a breath-based system.[434]

December 8, 2021

Virginia Department of Motor Vehicles (DMV), the Automotive Coalition for Traffic Safety (ACTS) and Schneider announced a collaboration to make Schneider the first truckload carrier to conduct a trial deployment of DADSS.[435]

December 9, 2021

CorrActions applied for a patent for a driver monitoring system to determine alcohol impairment.[436]

December 16, 2021

The Senate Commerce committee discussed DADSS and the HALT Act implementation during a nomination hearing for Dr. Steve Cliff as NHTSA Administrator.[437]

> **Sen. Lujan (D-NM):** Dr. Cliff, I would like a clear timeline. Yes or no, is NHTSA prepared to implement the Federal Motor Vehicle Safety Standard established by the HALT Act within the three to 5
> years required in Section 24220 of the IIJA?
>
> **Dr. Cliff:** Thank you for that question, Senator Lujan, and thank you for your leadership on this really important issue. Absolutely, yes.

Sen. Lujan: This can't afford to wait, and I want to work with you to make sure Congress gets you the resources you need to implement this legislation within this deadline.

Sen. Peters (D-MI): Well, thank you, Mr. Chairman, and thank you, Senator Lujan, for your leadership on that legislation which I was proud to co-sponsor with you, and I know the Abbas family. As you know, the Abbas family is a wonderful, amazing family in Michigan and the tragic death of members of that family to a drunk driver on a night-time drive back from Florida with the entire family with a drunk driver on the wrong side of the highway crashed into them and killed the entire family, three small children, a mother and a father, was a horrific thing. I still vividly remember the funeral where the community turned out. It's clearly one of the saddest funerals I've ever been to to see a beautiful young family die so tragically on that highway. So this legislation must get enacted. We've passed it. It's critically important that, Dr. Cliff, you focus on that that we get it done. There are so many other families like the Abbas family that suffer similar tragedies and thousands of people every day. So I hope you prioritize that. I will be working with Senator Lujan and many others who will be making sure that you do that, but I hope I have your commitment to make that a priority.

Dr. Cliff: Thank you, Senator. You have my commitment.

Below is a written response to a question from Sen. Capito (R-WV) to Dr. Steve Cliff:

Question 2 [Sen. Capito]. Thank you for taking to the time to meet with me before your nomination hearing. I wanted to follow up on an issue we discussed on our call. As you know, as a part of the Infrastructure Investment and Jobs Act (IIJA), we were able to include the RIDE Act--of which I am a cosponsor. As part of this provision, NHTSA is required to conduct a rulemaking on a new safety standard requiring advanced drunk driving prevention technology in new vehicles. Reducing and preventing drunk driving fatalities is a priority for me and look forward to working with you on this issue. If confirmed, will you work with me on this issue as NHTSA moves forward on implementing the RIDE Act?

Answer [Dr. Cliff]: I agree that reducing and preventing drunk driving fatalities is critically important and I will ensure that it remains a top priority for NHTSA. If confirmed, I look forward to working with you on these issues.

Below is a written response to a question from Sen. Rick Scott (R-FL) to Dr. Steve Cliff:

Question [Sen. Scott]: The recently signed Infrastructure Investment and Jobs Act (P.L. 117-58) included a provision (Sec. 24220) based on my RIDE Act (S. 1331), that will require new passenger vehicles to be equipped with technology that can passively monitor or detect driver alcohol impairment and stop the vehicle if impairment is detected. How will oversee the enforcement of this provision? How else do you plan to reduce drunk and impaired driving in the United States?

Answer [Dr. Cliff]: NHTSA expects the widespread use of technology designed to detect driver impairment to be effective in reducing alcohol-impaired driving related crashes, injuries and fatalities. As part of rulemaking activities, NHTSA will develop compliance test procedures for such technology to ensure it works as intended. As the technology develops, NHTSA will continue to pursue several efforts to address impaired driving. These efforts include leveraging existing technology such as ignition interlocks, using education campaigns as part of high visibility efforts, and coordinating with traffic safety professionals and law enforcement to reduce impaired

driving and save lives. Through our formula grant programs, NHTSA will ensure that States have the financial and technical resources necessary to reduce impaired driving.

December 31, 2021

An *NPR* story on the IIJA noted the Insurance Industry Institute for Highway Safety's contention that advanced impaired driving prevention technology could save more lives than airbags.[438]

2022

January 22, 2022

General Motors applied for a patent for a driver monitoring system to detect alcohol impairment.[439]

January 26, 2022

The current and former Presidents of Mothers Against Drunk Driving sent a letter of support to Secretary Pete Buttigieg requesting the implementation of HALT Act provisions. The letter referenced a statement from the DADSS program that their system could meet the congressionally mandated timeline of the law.[440]

February 25, 2022

ZF Friedrichshafen applied for a patent for a breath-based system.[441]

March 29, 2022

ZF Friedrichshafen applied for a breath-based system and a driver monitoring system to determine alcohol and other drug impairment.[442]

April 14, 2022

Micron applied for a patent for a driver monitoring system to determine impairment.[443]

April 28, 2022

Six hundred seventy victim and victim survivors of impaired driving sent a signed letter to Secretary of Transportation Pete Buttigieg in support of implementing HALT Act provisions.[444]

May 20, 2022

On May 20, 2022, ACTS stated DADSS would add $200 to the cost of a vehicle once it is widely deployed. Additionally, Dr. Bud Zaouk, of KEA Technology, stated they are on track to get the technology ready within two years (around 2024).[445]

Pictured on the right is an image of the passive breath sensor from the above on the steering wheel.

May 22, 2022

ZF Friedrichshafen applied for a patent for a combination breath-based and driver monitoring system focused on determining drug-impaired cannabis impairment.[446]

June 8, 2022

The House Transportation and Infrastructure Subcommittee on Highways and Transit Committee held a hearing titled "Addressing the Roadway Safety Crises: Building Safer Roads for All." Seeing Machines, a tier 2 auto supplier, submitted information on driver monitoring systems and detecting impairment:

> "As mentioned earlier, DMS [Driver Monitoring Systems] systems are increasing rapidly in use. Current DMS technology can detect distracted and drowsy driving now, so doesn't it make sense to expand usage to all vehicles? In addition, there exists many commonalities between distracted, drowsy, and impaired driving. According to NHTSA, a driver with a .05 BAC limit or higher will show signs of reduced ability to track moving objects and reduced visual search. Driver Monitoring Systems are able to detect changes in eye movement and head pose and we believe that our technology can be adapted to detect these proven symptoms of alcohol impairment."[447]

In response to the 2020 NHTSA RFI on impaired driving prevention technologies, Seeing Machines submitted comments to the docket that stated:

> "Seeing Machines believes that camera-based driver monitoring systems (DMS) will become the primary vehicle technology to detect driver intoxication" and "the use of DMS for alcohol intoxication is a current area of research and development. The link between ocular metrics and intoxication is very robust."[448]

June 14, 2022

A specialized group of more than a dozen auto safety technical experts announced their formation of a new Technical Working Group (TWG) to assist with the implementation of advanced impaired driving prevention technology as mandated by Congress in the IIJA.[449]

The TWG is an independent body comprised of experts with extensive knowledge of vehicle safety technologies, the Federal Motor Vehicle Safety Standards (FMVSS) regulatory process, and public health initiatives. Members include:

- Nat Beuse, Vice President of Safety, Aurora; MADD Board Member
- Kadija Ferryman, PhD, Assistant Professor, Johns Hopkins Bloomberg School of Public Health
- Shannon Frattaroli, PhD, Director, Johns Hopkins Center for Injury Research and Policy
- Kelly Funkhouser, Program Manager, Vehicle Technology, Consumer Reports
- Shaun Kildare, PhD, Director of Research, Advocates for Highway and Auto Safety
- Anders Lie, PhD, retired, former Board Member, European New Car Assessment Program (Euro NCAP); former Traffic Safety Specialist, Swedish Transport Administration
- Stephanie Manning, Chief Government Affairs Officer, MADD
- Jeffrey Michael, EdD, Distinguished Scholar, Johns Hopkins Center for Injury Research and Policy
- Stephen Oesch, retired, former Senior Vice President, Insurance Institute for Highway Safety
- Roger Saul, PhD, retired, former Director, Vehicle Research and Test Center, National Highway Traffic Safety Administration (NHTSA)
- Ken Snyder, Executive Director, Shingo Institute, Utah State Huntsman School of Business; MADD Volunteer and Victim of Impaired Driving

- Don Tracy, retired, former Vice President, DENSO North America
- David Zuby, Executive Vice President and Chief Research Officer, Insurance Institute for Highway Safety

In response to the formation of the Technical Working Group, Sen. Luján and Rep. Dingell stated:

> **Sen. Luján:** With the passage of the RIDE/HALT Act in the Bipartisan Infrastructure Law, the United States is one step closer to putting an end to drunk and impaired driving. As the survivor of a drunk driving crash in which I was hit head-on, I am proud to lead on this initiative that will save thousands of lives each year and prevent families from receiving that painful call of losing a loved one. Now, Congress must ensure that the federal government is fully aligned to implement this law. The Technical Working Group announced today will provide essential support to ensure this bill becomes a reality.
>
> **Rep. Dingell:** We have the technology to prevent drunk driving – which is the single largest cause of traffic fatalities in our country – and it is past time we use it and save lives. When Congress passed my legislation requiring car manufacturers to install drunk driving prevention technology as standard equipment in new vehicles, we sent a clear message that we need to end this trauma now. As NHTSA begins the rulemaking process, the Technical Working Group will ensure this technology is implemented quickly and effectively.

June 17, 2022

Smart Eye stated that it is researching and testing a driver monitoring system to detect alcohol impairment.[450] Smart Eye along with the Swedish National Road and Transport Research Institute (VTI) tested at least 30 participants by increasing their BAC and testing their reactions on a racetrack.[451]

June 22, 2022

Denso applied for a patent for a driver monitoring system to determine alcohol impairment.[452]

June 23, 2022

As part of the cabin monitoring system, Hyundai Mobis announced a passive alcohol detection technology stating:

> "It will also be possible to detect if the driver is intoxicated and block the driver from driving. Hyundai Mobis' breathalyzer technology is a non-contact type that can measure just by exhaling a little. It uses optical sensor technology to detect the alcohol content in the driver's breath to determine the blood alcohol level. This technology is much more accurate and convenient than electrochemical sensors that require mouth-to-mouth blowing."[453, 454]

July 5, 2022

FY 2023 House Transportation and Housing and Urban Development, and Related Agencies Appropriations report language:

> "Drunk and impaired driving detection. -- Drunk driving is the number one cause of traffic fatalities, costing the United States $194,000,000,000 annually and accounting for roughly one-quarter to one-third of motor vehicle fatalities each year. To address the scourge of drunk driving, the Committee has continually supported the Driver Alcohol Detection System for Safety (DADSS) research under this

heading. The DADSS system specifically aims to detect the presence of a certain level of alcohol in a driver. NHSTA and staff of the DADSS program estimate they will complete their work by the end of fiscal year 2025. The Committee understands that a version of the DADSS technology is currently being tested which can determine the presence or absence of alcohol in a driver but cannot yet reliably quantify the exact amount of alcohol. This version is effective for limited deployment in fleets administering a zero-tolerance policy for its drivers. The Committee believes continued funding of the DADSS research is critical for completing development of DADSS technology set at the legal limit (e.g., currently 0.08 BAC for all states but Utah) that can be widely deployed in vehicles operated by consumers thereby avoiding approximately 7,000 or more drunk driving accident deaths annually. Therefore, the Committee continues to strongly support this promising and vital program and includes $10,000,000 for advanced research, development, and robust testing in fiscal year 2023.

The Committee is also encouraged by the development of camera-based driver monitoring systems. These developing, probability-based systems aim to detect a variety of behaviors that are not conducive to safe driving such as distraction, drowsiness, or impairment. The Committee believes that these technologies, in combination with other technological innovations, have the ability to save lives and reduce impaired driving.

House Report 117-99 directed NHTSA to contract with the Volpe National Transportation Systems Center to update the 2007 Review of Technology to Prevent Alcohol-Impaired Crashes and looks forward to receiving that report. The Committee directs NHTSA to emphasize research on driver monitoring and to identify promising technologies that will reduce or eliminate impaired and distracted driving."[455]

July 26, 2022

Hyundai Mobis applied for a patent for a driver monitoring and breath-based system to determine alcohol impairment.[456]

August 30, 2022

Toyoda Gosei applied for a patent for gas-based and driver monitoring system to determine alcohol impairment. [457] The system would utilize a gas sensor to determine alcohol impairment next to the skin of a driver.

September 22, 2022

As a result of a crash investigation, NTSB called on automakers to equip all new vehicles with technology to detect and stop alcohol impaired drivers.[458]

October 26, 2022

NHTSA met with the Automotive Safety Council (ASC). The meeting included various topics, including potential vehicle impairment technologies. ASC members attending included members from Tier 1 suppliers including: Qualcomm, Magna, Continental, ZF and Aptive.[459]

Denso also met with NHTSA where the subject of the meeting "included Denso's work on driver impairment technologies."[460]

Additionally, Toyota filed a patent for a driver monitoring system to determine alcohol impairment.[461]

November 2, 2022

Hyundai and Kia applied for a patent for a breath-based system.[462]

November 9, 2022

A team of NHTSA officials met with Honda, where "the subject of the meeting included Honda's work on driver impairment technologies."[463]

November 15, 2022

MADD released a statement on the anniversary of the signing of the IIJA. MADD highlighted an Ipsos poll that showed 9 out of 10 Americans support technology that is integrated into a car's electronics to prevent drunk driving. The survey found:

- 91% of respondents said the technology is a good or very good idea.
- 78% of respondents said they are much more or somewhat more likely to support the technology if it comes at no extra cost to consumers.
- 82% of respondents support or somewhat support the Congressional mandate for drunk driving prevention technology in all new cars.
- 58% of respondents said they were more likely to support passive drunk driving prevention technology in all new cars if the NTSB endorsed it.[464]

NHTSA met with Volvo and discussed potential vehicle impairment technologies.[465]

December 5, 2022

CorrActions, a company developing a driver monitoring system to determine alcohol impairment, met with NHTSA regarding CorrActions work on driver impairment technologies."[466]

December 6, 2022

Dr. Jeffrey Michael and Stephanie Manning, who are the Co-Chairs of the TWG on Advanced Impaired Driving Prevention Technology, met with NHTSA to discuss advanced impaired driving technology.[467]

December 7, 2022

ZF Friedrichshafen applied for a patent in Germany for a breath-based system.[468]

2023

February 7, 2023

Daimler Truck, a subsidiary of Mercedes Benz, applied for a patent for a driver monitoring system to determine alcohol impairment.[469]

February 17, 2023

ZF Friedrichshafen applied for a patent for a breath-based system.[470] Additionally, ZF Friedrichshafen applied for a patent for a breath-based and driver monitoring system to determine alcohol and drug impairment.[471]

March 8, 2023

Asahi Kasei Microdevices applied for a patent for a breath-based system.[472]

March 9, 2023

Gentex applied for a patent for a driver monitoring system to determine alcohol impairment.[473]

March 10, 2023

Honda applied for a patent for a driver monitoring system to detect alcohol impairment.[474]

March 15, 2023

Gentex applied for a patent for a driver monitoring system to determine alcohol impairment [475]

March 23, 2023

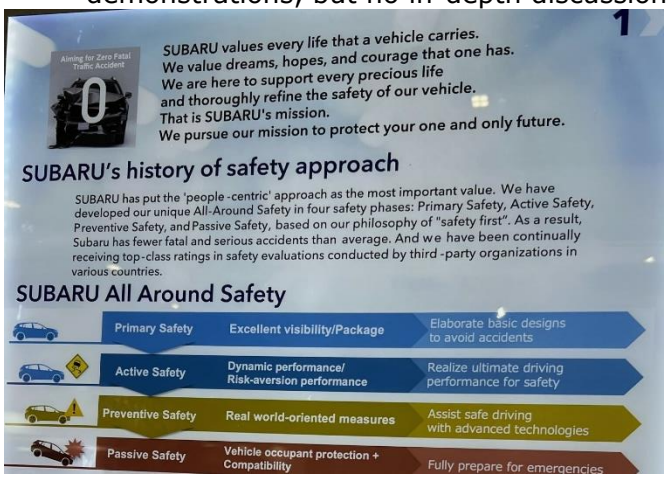
Toyoda Gosei filed a patent for a combination gas sensor and driver monitoring system to determine alcohol impairment.[476]

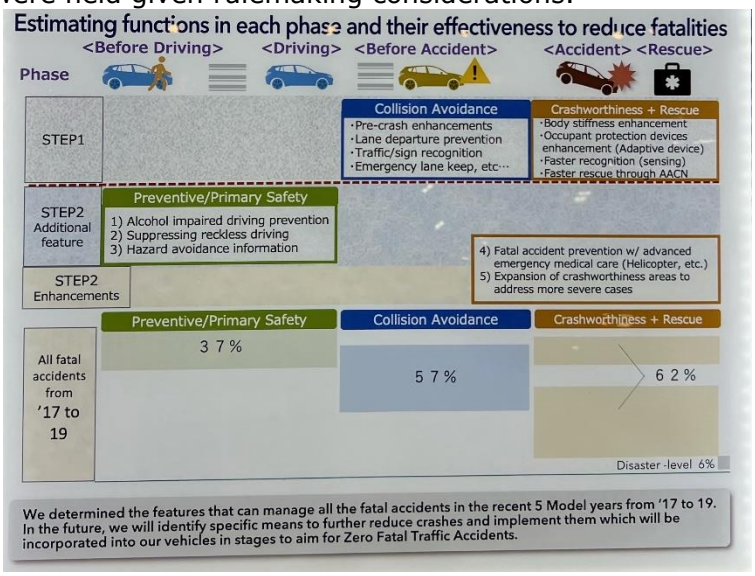
March 29, 2023

NHTSA met with ZF Friedrichshafen to discuss a prototype that had been developed to help prevent drunk driving deaths on driver impairment technologies."[477]

April 3-6, 2023

The ESV Conference was held in Yokohama, Japan.[478] At the conference, NHTSA met with: Honda, Subaru, Mazda, Toyota, and Nissan and provided high-level information briefings on their technologies' various capabilities. "Companies' presentations included technology demonstrations, but no in-depth discussions were held given rulemaking considerations."[479]





At ESV, Subaru's exhibit suggested the company is developing preventive/primary safety technology that would prevent alcohol impaired driving, suppress reckless driving, and provide hazard avoidance information. (Pictured above)

April 7, 2023

In 2023, Subaru applied for two patents for a driver monitoring system to determine alcohol impairment.[480, 481]

April 13, 2023

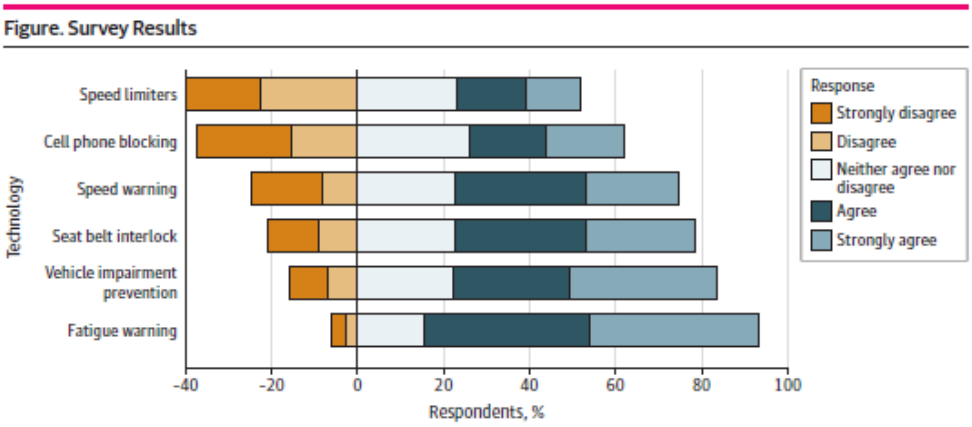
Subaru applied for a patent for a breath-based and driver monitoring system.[482]

April 18, 2023

The TWG on Advanced Impaired Driving Prevention Technology released recommendations for DOT to prevent impaired driving as required by the IIJA's Section 24220.[483]

April 20, 2023

Journal of the American Medical Association (JAMA) Network Open published a report that found strong public support for equipping all new cars with impaired driving prevention technology, as mandated in the IIJA. Nearly two-thirds of respondents, or 64.9 percent, either agreed or strongly agreed that vehicle impairment prevention technology should be available on all new vehicles. Nearly the same percentage of respondents (63.4 percent) said they support the mandate for the technology that is included in the Infrastructure Law.[484] Survey results featured in graphic above.



April 21, 2023

Senator Ben Ray Luján (D-NM) and Rep. Debbie Dingell (D-MI) issued a press release highlighting the Technical Working Group on Advanced Impaired Driving Prevention Technology (TWG) recommendations and the JAMA study:

> **Sen. Luján**: "After being hit head-on by a drunk driver many years ago, I was lucky to survive – but thousands of families each year are devastated by drunk and impaired driving crashes. I know how important it is to put an end to this crisis, and I know that there is much more we can right now toward achieving this goal. This JAMA survey makes it clear that a majority of Americans support these efforts to put an end to drunk and impaired driving. Now, with the guidance announced by the Technical Working Group, it's critical that we make progress toward implementing the HALT Act and saving lives."
>
> **Rep. Dingell**: "No community, and no family, should have to experience the devastation of losing a loved one to drunk driving. The Journal of the American Medical Association (JAMA) survey shows that the public agrees that we need to prevent these unnecessary tragedies by making impairment prevention technology standard in new vehicles – this technology will save lives. I am glad we are taking concrete steps toward making our roads safer, and welcome the recommendations made by the Technical Working Group and the Insurance Institute for Highway Safety (IIHS) to ensure that the HALT Act is implemented effectively, equitably, and efficiently."[485]

April 24, 2023

Volvo announced an investment of up to $6 million for CorrActions.[486] CorrActions is a company developing technology to determine alcohol and drug-impairment by monitoring the driver vehicle movements.[487, 488]

April 28, 2023

Hyundai Mobis applied for a patent for a driver monitoring system to determine alcohol impairment. [489]

June 22, 2023

Motor Trend highlighted interior monitoring sensors and reported Bosch is optimistic that these sensors can reliably detect an impaired driver. [490] At CES in January 2024, Bosch continued to discuss the development of this technology.[491]

June 23, 2023

NHTSA met with Continental where participants discussed information related to alcohol sensing technology.[492]

July 17, 2023

CorrActions met with NHTSA to discuss its work on driver impairment detection technologies.[493]

July 24, 2023

FY 2024 House Transportation and Housing and Urban Development, and Related Agencies Appropriations report language:

> **"Alcohol-impaired driving**. – Section 24220 of the IIJA requires the Secretary to issue a final rule relating to drunk and impaired driving prevention technology within three years of enactment. The Committee expects the NHTSA to meet the requirements of section 24220 and directs the NHTSA to provide a briefing on the status of these requirements within 90 days of enactment of this Act."[494]

August 3, 2023

NHTSA formed a consortium with University of Michigan and tier 1 and 2 automotive industry suppliers, Omni Sciences, and Protomatic. The consortium discussed emerging camera-based impairment sensing technology.[495]

August 23, 2023

NHTSA met with researchers from the University of Michigan, ST Microelectronics, ams-OSRAM, Denso and Protomatic to discuss the potential application of physiological monitoring cameras and algorithms to impairment detection.

The meeting included demonstrations of advanced camera sensors with a variety of depth sensing technologies.[496]

September 28, 2023

NHTSA met with Magna to discuss active safety technologies, thermal system for automatic emergency braking (AEB), pedestrian automatic emergency braking (PAEB), and Magna in-cabin technology for distracted and impairment driving using both driver monitoring systems and breath alcohol content (BrAC) state estimation tools."[497]

September 29, 2023

The Connecticut Department of Transportation joined Maryland and Virginia as part of the DADSS "Driven to Protect Initiative." As part of the agreement "The CTDOT Highway Safety Office also has a vehicle with the DADSS technology. Additionally, four of the CTDOT pickup trucks will have this technology installed in the future. Having these six vehicles is helping to generate real-world operational data that will improve the alcohol sensors. The vehicles will also be at schools, community events, fairs, sporting events, and more around the state, giving Connecticut residents and students a first-hand look at how the sensors work."[498]

October 17, 2023

A coalition of 43 organizations sent a letter to Secretary Buttigieg urging the successful and timely completion of the federal rulemaking process for Section 24220 of the IIJA (Public Law 117-58).[499]

November 6, 2023

NHTSA met with DYM Sense regarding its touch-based sensor.[500]

November 7, 2023

Representative Thomas Massie (R-KY) attempted to pass an amendment to prohibit funding for the HALT Act (Section 24220 of the IIJA).

MADD advocates and bipartisan leadership in the House of Representatives were able to defeat the amendment 229-201.[501] Leading up to the vote, Reps. Mike Lawler (R-NY) and Debbie Dingell (D-MI) sent a "Dear Colleague" to Members of Congress urging them to reject the amendment.

MADD met with Members of Congress and activated its grassroots advocates to thwart the amendment. The image on the right is from MADD that was posted on social media channels in advocacy leading up to the defeat of the amendment.

Below are transcripts of the floor debate on the amendment.[502]

> **Rep. Debbie Wasserman Schultz (D-FL):** Mr. Chair, I rise in opposition to this amendment. Let me be clear. The act that the gentleman is trying to defund does not require auto manufacturers to install kill switches. It does not do that. Passive drunk driving technology is a vital tool in safeguarding our loved ones and other innocent people on our roads. This new technology offers a lifeline of hope to not only save lives but to prevent the lifelong emotional toll and gargantuan costs these accidents inflict on families....
>
> You don't have a right to engage in potentially fatal behavior that we know poses a major health threat to public safety. Passive drunk driving technology is pro-police. This anti-drunk driving technology lightens the load on police officers, allowing them to focus on more pressing safety concerns. The importance of this technology goes far beyond statistics. It is about saving lives, preventing heartbreak, and making our roads safer. It is a passionate call to action to prevent alcohol-impaired driving from shattering the lives of those we hold dear. This amendment, I understand, was dubbed the kill switch amendment, and it does not require a kill switch. It simply requires passive technology to help us prevent drunk driving. In the name of the 406 people who were killed by a drunk driver in my own State of Florida last year alone, I urge my colleagues to vote ``no'' on this amendment. Let's take steps to reduce deaths due to drunk driving, not increase them.
>
> **Rep. Jan Schakowsky (D-IL):** "This technology has the potential of saving thousands of lives, and I don't see that you are agreeing that we should be saving those lives. I would say we should all vote against the drunk driver protection act."

Rep. Debbie Dingell (D-MI): Mr. Chair, I rise in strong opposition to this amendment. This amendment seeks to prohibit funding for the implementation of a bill known as the Honoring the Abbas Family Legacy to Terminate (HALT) Drunk Driving Act. I wrote it. I am the sponsor.

The HALT Drunk Driving Act honors the Abbas family from Michigan who were tragically killed in a car accident by a drunk driver. It requires NHTSA to do a rulemaking to create rules for impaired driving prevention technology in new vehicles to stop these tragedies from continuing to occur.

Thirty-seven alcohol-impaired driving deaths happen every day, equivalent to a death every 39 minutes. Studies show that the HALT Act would save over 10,000 lives annually. Our constituents agree. We need to stop drunk driving by making impairment prevention technology standard in new vehicles. If the technology exists to prevent drunk driving, why wouldn't we consider it?

Let me close by saying this amendment and the sponsor mischaracterized what the HALT Act is. It does not mandate kill switches or allow data collection that invades vehicle occupants' privacy. I protect data privacy in vehicles probably more than the sponsor of this does. That is ridiculous. It doesn't monitor how you drive. This amendment is an insult to every American who has been hurt or lost loved ones to drunk driving, including the Abbas family. Let's honor the memory of those affected by drunk driving.

December 12, 2023

NHTSA announced the pending release of an Advance Notice of Proposed Rulemaking for Advanced Impaired Driving Technology.

NHTSA stated:

> "This ANPRM will help gather information about the state of technology to detect impaired driving, about how to deploy technology safely and effectively, and will provide other information to further the agency's work as the research and technology advances to the level to develop a standard to prevent driver impairment."[503]

Quotes related to the announcement:

U.S. Department of Transportation Deputy Secretary Polly Trottenberg: The Advance Notice of Proposed Rulemaking we are announcing today is the first step toward a new safety standard requiring alcohol-impaired-driving prevention technology in new passenger vehicles. I want to applaud the NHTSA team, elected officials and advocates who helped get us to today and will continue to help lay the groundwork on this issue.[504]

Rep. Dingell (D-MI): Drunk and impaired driving has brought so much pain to families across the country, including the Abbas family, whose lives the HALT Act honors and remembers. At their funeral, the classmates of the Abbas children looked at me and said, 'We have the technology to stop this, why haven't you done something?' Today, we can tell everyone who has lost family, friends, and loved ones that we are making progress to keep drunk drivers off the road. The Advance Notice of Proposed Rulemaking announced today by NHTSA is an important step toward making this commonsense safety equipment standard in all vehicles, and when it is finalized, will save thousands of lives every year. Not one more family should have to

suffer the loss of a loved one due to a drunk driver, and I will keep fighting until we get this done.[505]

Sen Luján (D-NM): This advance notice is a key step to eliminating impaired driving, which will save thousands of lives every year. Driver safety technology is more sophisticated today than ever before, and it's time for NHTSA and automakers to invest in impaired driving prevention technology to get this done. I look forward to continuing to work with the Biden administration, advocates, industry partners, and my colleagues in the House and Senate to enact a final rule by the statutory deadline next year.[506]

Following NHTSA's announcement, Alliance for Automotive Innovation, a trade group that represents automakers, stated "Every single day automakers are working to make vehicles safer and smarter and to help address avoidable tragedies caused by behavior like drunk driving."[507]

The Washington Post noted the "Automotive Coalition for Traffic Safety stated "Robert Strassburger, chief executive of the Automotive Coalition for Traffic Safety, said the group has tested an initial version of its technology and aims to have a device that would comply with the law by the end of 2025."[508]

December 13, 2023

General Motors CEO Mary Barra discussed alcohol-impairment detection technology in response to the December 12 NHTSA ANPRM announcement:

"We've been working with regulators on that…We have technology to do that…I think that's technology that's coming that I think's going to be good for everyone," she told The Economic Club's David Rubenstein.[509, 510]

2024

January 5, 2024

NHTSA officially opened the 60-day ANPRM comment period on Advanced Impaired Driving Technology. The comment period closes March 5.

January 11, 2024

Valeo demonstrated its advanced impaired driving prevention technology at the Consumer Electronics Show (CES) in Las Vegas. Valeo's Safe Insight system combines driver monitoring and alcohol detection.[511]

Detailed company overview of passive advanced impaired driving prevention

Original Equipment Manufacturers

BMW

Combination of driver monitoring, breath, or touch systems to determine alcohol impairment

1. "Method for operating a motor vehicle, particularly one that can be operated autonomously, and test device for a motor vehicle," BMW. DE102018132223A1. (Filed 2018/Pending 2020)

    Driver monitoring system and breath-based system description highlight

    In addition, traffic safety for operating a motor vehicle can be further increased if the detection of whether a blocking criterion is present includes a test of the ability to drive, a blocking criterion being present if

    a. A breathing air sensor of the sensor unit detects when the user has reached or exceeded a limit value of an allowable alcohol level stored in the storage medium,

    b. A visual sensor means of the sensor unit detects a critical body movement, critical eye activity, eyelid frequency and or viewing direction stored in the storage means;

    c. A haptic sensor means of the sensor unit comprises reaching or exceeding a limit value of a pulse frequency of the user stored in the storage means.[512]

2. "Method for recognizing a state of at least one occupant of a vehicle and vehicle," BMW. DE102019132635A1 (Filed 2019/Pending 2021)

    Driver monitoring system description highlight

    In one embodiment, a connection, in particular the evaluation unit, to vehicle-specific components, such as an interior camera and / or seat sensors, is provided. In this way, a number of occupants and / or a spatial distribution of several occupants within the vehicle can thus be reliably identified. The occupant-selective recognition of the states of several occupants is thus further optimized.

    Breath-based sensor description highlight

    If the evaluation unit detects, for example, that one of the occupants is intoxicated, it is decisive whether this person is sitting in the driver's seat or in the front passenger seat, for example. For example, while the control unit would block the engine from starting in the first case, it would not do so in the second case because the person in the front passenger seat does not actively participate in the traffic.[513]

Ford

Touch or breath-based system

3. "Systems and methods to securely limit drivability of a vehicle by impaired users," Ford. US11161409B1. (Filed 2020/Approved 2021).

    Breath-based sensor description highlight

    The National Highway Traffic Safety Association (NHTSA) has proposed an inhibited driver sensor, developed by NHTSA, for incorporation into an automobile. This sensor would determine if the driver is impaired, e.g., inebriated, separate from any other vehicle systems and may send a message to the vehicle if the driver is impaired. The vehicle would then receive this message and prevent the driver from operating the vehicle in an impaired state. For example, this would introduce a single-source command, originating from outside the vehicle's electrical system, which would disable the vehicle. This introduces a potential threat to the vehicle from outside sources.

    Therefore, there exists a need for a robust method of verifying that the signal regarding an impaired driver sensor is genuine and a robust method of deactivating the vehicle in order to prevent false deactivation. It is with

respect to these and other considerations that the disclosure made herein is presented.

In an example implementation, information about whether a driver of the vehicle is impaired may be entered into distributed ledger 201 by a first device of system 100, e.g., alcohol interlock sensor 206. The information provided by alcohol interlock sensor 206 may be validated by information entered into ledger 201 by one or more other devices of system 100, e.g., exterior sensor 202 and/or interior sensor 204. Information subsequently entered into ledger 201 via, e.g., user device 210 and/or fleet manager device 212, may result in the previous information submitted by exterior sensor 202, interior sensor 204, and/or alcohol interlock sensor 206 to be modified, deleted, or further validated.[514]

4. "Method for analyzing the breath of vehicle occupants," Ford. DE102018200003A1. (Filed 2018/Pending 2019)

Breath-based sensor description highlight

Abstract. A method is provided for analyzing the breath of vehicle occupants, which comprises determining a time profile of a concentration of a respiratory gas in the vehicle interior and evaluating the time profile of the concentration of the respiratory gas in the vehicle interior.

According to further embodiments, the respiratory gas or gases may be selected from a group comprising carbon dioxide, acetone, isoprene, acetaldehyde, acetonitrile, ammonia, dimethyl sulfide, ethane, ethanol, ethylene, hydrogen, malondialdehyde, methane, propionaldehyde, nitric oxide, trimethylamine and pentane. For example, the degradation of blood alcohol increases the ratio of acetaldehyde to ethanol in the exhaled air.[515]

5. "Motors depending on the driving ability," Ford. DE602006009482D1. (Filed 2006/Approved 2009.

Touch-based sensor description highlight

The sensing means 2 may be arranged for sensing of alcohol related parameters, e.g. arranged to determine from any sensed alcohol related parameters of the body part 3 of the driver employed for the touching action a blood-alcohol content of the driver, and to compare the determined blood-alcohol content of the driver with the predetermined threshold value.

The sensing means 2 may further be arranged for sensing drug related parameters, e.g. arranged for sensing any drug related parameters based on the detection of one or more chemicals present at the body part 3 of the driver employed for the touching action. The system may further be arranged to determine from any sensed drug related parameters of the body part 3 of the driver employed for the touching action a blood-chemical content of the driver, and to compare the determined blood-chemical content of the driver with the predetermined threshold value.[516]

Driver monitoring system to determine alcohol impairment.

6. "Autonomous occupant attention-based control," Ford. US10289113B2. (Filed 2016/Approved 2019).

Driver monitoring system description highlight

Alertness Factor (AL)

One example of an operational factor is an operator alertness factor. As mentioned above, various sensor data collectors 110 may gather data 115 about a vehicle 101 operator. This data 115 may be used to determine the operator alertness factor. ***For example, image recognition techniques such as are known could be used to determine, e.g., based on a person's eyes, facial expressions, etc., whether the person is awake, a sleep, sober, drunk, etc***. Likewise, microphone data collectors 110 could provide data 115 that could be analyzed using known techniques to determine, based on a person's voice, whether the person was under the influence of drugs or alcohol. To take another example, steering wheel sensors 110 could be used to determine whether a person's hands were on or near a steering wheel, as could pedal and/or acceleration sensors 110. Collected data 115 from one or more of the foregoing, or from other data collectors 110, could be used to determine an operator alertness factor, e.g., a level of alertness normalized to a scale of between zero and one, where zero indicates the operator has zero alertness, e.g., is unconscious, and a one indicates that the operator is fully alert and able to assume control of the vehicle 101. [517]

General Motors

Driver monitoring system to determine alcohol impairment

7. "Method and system for mitigating the effects of an impaired driver," General Motors. US9290174B1 (Filed 2014/Approved 2016)

    Driver monitoring system description highlight

    Beginning with step 102, the method determines whether the driver of the host vehicle is impaired, and may do so in any number of different ways. An impaired driver may be a sleepy or drowsy driver, an injured or debilitated driver, or an intoxicated driver, for example. ***Step 102 may employ any known method or technique for detecting an impaired driver, including techniques that rely on driver readings from driver sensors 18 to capture and evaluate images of the driver's face in order to look for slackening facial muscles, to evaluate the frequency, duration and/or pattern of eye closure, to examine the orientation or movement of the driver's head or body, or to monitor the direction or pattern of the driver's gaze, to cite a few possibilities.*** Movement of the driver may also be monitored by sensors located in the driver's seat to detect driver position, as well as sensors in the steering wheel to monitor the driver's hand position. In other examples, driver impairment is determined not by directly monitoring the face or body of the driver, but by evaluating the behavior or performance of the driver and looking for signs of impairment such as lane departure, inconsistent vehicle speed, erratic driving, etc***.***[518]

8. "Motor vehicle with cognitive response test system for preemptively detecting potential driver impairment," General Motors. US11807090B2 (Filed 2020/Approved 2023)

    Driver monitoring system description highlight

    A test system for detecting impairment aboard a motor vehicle includes an electronic control unit (ECU) and sensors in communication therewith. ***The sensors are positioned within a vehicle interior, and include at least a touch screen and a microphone, and possibly an eye-tracking camera. In response to receiving a start request indicative of a requested start event of the motor vehicle, the ECU executes instructions to***

initiate a cognitive response test via the sensors. The ECU determines a test score of a driver during the test while the motor vehicle remains off, compares the test score to baseline scores to determine a passing or failing test result, and executes a control action aboard the motor vehicle in response to the passing or failing test result. The ECU may disable or immobilize the motor vehicle in response to the failing test result.[519]

9. "Driver state display," General Motors. US11840145B2 (Filed 2022/Approved 2023)
    Driver monitoring system description highlight
        The ***data processor 12 uses information gathered by the driver monitoring system 20 to determine if the driver of the vehicle is distracted, drowsy, intoxicated, experiencing biomedical or other fitness distress, etc. The data processor 12 may communicate with vehicle systems which take action to get the driver's attention by issuing audio alerts, lighting up a visual indicator on the dashboard or vibrating the seat.*** If the data processor determines that the driver is distracted while the vehicle's external sensors determine it is about to have a collision, the vehicle systems could automatically apply the brakes, using information from interior and exterior sensor fusion.[520]

Combination of driver monitoring, breath, or touch systems to determine alcohol impairment

10. "Vehicle immobilizer methods and apparatus based on driver impairment," General Motors. US8196694B2 (Filed 2009/Approved 2012)
    Breath-based sensor description highlight
        For example, ***the system 100 may require a breath sample when the vehicle operator is present in the driver's seat, and attempts to start the engine/motor 102 of the vehicle***
    Driver monitoring system description highlight
        In alternate embodiments, ***the system 100 may require the driver to position his or her eyes in alignment with or proximity to an optical sensor that may sense eye nystagmus or blink rate***.
    Touch-based sensor description highlight
        In still other alternate embodiments, ***the system 100 may require the driver to touch a sensor to allow for a non-invasive blood evaluation***.[521]

11. "System and method to restrict vehicle operations in response to driver impairment," General Motors. US10471969B1 (Filed/Approved 2019)
    Description of system highlight
        The ***impairment sensor 29 is configured to detect an impairment level of a vehicle occupant (e.g., the vehicle operator) and provide impairment information to the electronic processing device 38. The impairment sensor 29 may include one or more of a breathalyzer, an infrared sensor, a near infrared tissue spectrometry sensor, a distance spectrometry sensor, an electrochemical sensor, an eye scanner, a laser sensor, a camera, a microphone, a motion detector, a driving performance sensor, an ocular movement sensor, and a behavioral sensor, etc***[522]

12. "Drive-cycle sampling and monitoring for impairment detection system," General Motors. US10507844B2 (Filed 2017/Approved 2019).

Breath-based sensor description highlight

While the example of the impairment measurement device 198 including a BAC measurement device will be discussed, the impairment measurement device 198 may include other suitable types of impairment measurement devices and may not be breath-based. For example, the impairment measurement device 198 may measure a concentration of one or more other types of chemicals in blood, such as marijuana (e.g., THC), amphetamines, etc… ***An advantage of incorporating passive measurement devices may be that the measurements can be recorded during operation of the vehicle with no distraction to the driver. For example, the driver's breath may be monitored passively by using a suction device to collect a breath sample as the driver exhales during routine operation of the vehicle.***

Driver monitoring system description highlight

Other types of impairment measurement devices may be vision-based, such as based on capillary action of a driver's skin in response to the impairment measurement device 198 applying a predetermined type of light (e.g., infrared or laser) to the driver's skin. Still other types of impairment measurement devices may monitor brain activity using an electroencephalogram (EEG). Impairment may be detected, for example, based on an operator's brain waves constituting a pattern associated with intoxication and/or impairment. Measurements provided by another type of impairment measurement device may be used in place of, or in addition to, BAC[523]

13. "Systems and methods for overriding vehicle limitation system" General Motors. US10442433B2 (Filed 2017/Approved 2019)

Breath-based sensor description highlight

The chemical measurement device 198 may measure a BAC each time a driver starts the engine 102 (e.g., each time the ignition state 178 transitions to crank from OFF or accessory). Alternatively, the chemical measurement device 198 may measure a BAC each time the ignition state 178 transitions to accessory

Driver monitoring system description highlight

Other types of chemical measurement devices may be vision based, such as based on capillary action of a driver's skin in response to the chemical measurement device 198 applying a predetermined type of light (e.g., infrared or laser) to the driver's skin. Measurements provided by another type of chemical measurement device may be used in place of BAC…

The limitation control module 196 generates commands to allow, allow to a limited extent, or prevent vehicle movement based on the measurements from the chemical measurement device 198. For example, ***the limitation control module 196 may prevent vehicle movement (e.g., prevent shifting of the transmission 110 out of park) when the chemical measurement device 198 measures a BAC of greater than a predetermined value*** (e.g., 0.08, 0.02, 0.00, or another suitable value). For example, the limitation control module 196 may command the TCM 114 to maintain the transmission 110 in park and to ignore the range selector input 174 from the range selector when the chemical measurement device 198 measures a BAC of greater than the predetermined value. The limitation control module 196, however, allows the engine 102 to be started despite the

BAC being greater than the predetermined value, for example, to allow an HVAC system of the vehicle to be used to warm and/or cool the passenger compartment of the vehicle.[524]

Honda

Touch or breath-based system

14. "System and method for capturing and decontaminating photoplethysmopgraphy (PPG) signals in a vehicle," Honda. US10153796B2. (Filed 2013/Approved 2018).

Touch-based system description highlight

In one embodiment, the optical sensors 202 can emit the plurality of light sources at the plurality of frequencies in order to non invasively measure the driver's and/or occupant's blood alcohol levels***. For example, the source circuitry 204 of the optical sensors 202 can emit light into the driver's skin. The optical sensors 202 can measure a tissue alcohol concentration based on the amount of light that is reflected back by the skin to the detector circuitry 206. Additionally, the optical sensors 202 can noninvasively monitor a condition of the driver 118 through the determination of biological signals, such as body-trunk plethysmograph and respiration that are detected from the driver's back from one or more optical sensors 202 included within sensor assemblies 120 disposed at the seat back 134 of the vehicle seat*** 122. In particular, one or more filtered signals can be evaluated to determine the driver's PPG signals that fall between normal and intoxicated states in order to determine driver intoxication. [525]

Driver monitoring system to determine alcohol impairment:

15. "Biological state guidance device, biological state guidance method, and storage medium," Honda. US20230356740A1. (Filed/Pending 2023).

Driver monitoring system description highlight

In the example of ***FIG. 2 , in the case of "A," for example, the target biological state is set as the "alerted state" because of easy intoxication or the like.*** In the case of "B" as an infant, the target biological state is set as the "relaxed state." In the case of "C," the target biological state is set as the "normal state." In the case of "D," the target biological state has not been set.[526]

Combination of driver monitoring, breath, or touch systems to determine alcohol impairment

16. "Vehicle control system," Honda. US9073431B2 (Filed 2014/Approved 2015).

Touch-based sensor description highlight

Each of ***the touch type alcohol sensors 11C detects the alcohol density in the sweat secreted from surfaces of the palm or the fingers of the driver, or in the subcutaneous tissues of the driver as the alcohol intake level***, and outputs the signal indicating the detection result of the alcohol density to the controller 14.

Breath-based sensor description highlight

Each of ***the breathalyzer type alcohol sensors 11A and 11B detects an alcohol density in an exhalation of a driver of the vehicle 1 as an alcohol intake level of the driver, and outputs a signal indicating a detection result of the alcohol density to the controller*** 14.

Driver monitoring system description highlight

The vehicle state sensor 12 includes a wheel speed sensor that detects the rotational speed (wheel speed) of a drive wheel of the vehicle 1; an acceleration sensor that detects the acceleration acting on a vehicle 1; a gyro sensor that detects the posture or the direction of progress of the vehicle 1; and a yaw rate sensor that detects the yaw rate (rotational angular speed around a vertical axis of the center of gravity of the vehicle) of the vehicle 1.[527]

17. "System and method for responding to driver state," Honda. US11383721B2 (Filed 2013/Approved 2022)

Touch-based sensor description highlight

In another embodiment, the ECU 106 can determine blood alcohol content (BAC) (e.g., blood alcohol levels) of the driver from information received by the blood alcohol content sensors 310. For example, ***an optical sensor can emit light towards the driver's skin and measure a tissue alcohol concentration based on the amount of light that is reflected back by the skin***. ***The BAC can be analyzed to determine if the BAC coincides with a particular physiological driver state. For example, high BAC can coincide with an impaired/distracted driver state (e.g., an intoxicated driver).***

Driver monitoring system description highlight

In step 4408, in some embodiments, ***the response system 188 can determine whether the driver state is true based on the combined driver state. For example, whether or not the driver is vigilant, drowsy, inattentive, distracted, intoxicated, among others.*** If the driver state is not true (i.e., NO), the response system 188 can proceed back to step 4402 to receive additional monitoring information. If, however, the driver state is true (i.e., YES), the response system 188 can proceed to step 4410.[528]

18. "Management device, management method, and storage medium," Honda. US20210291875A1. (Filed/Pending 2021).

Driver monitoring system description highlight

When the vehicle interior monitoring device 240 includes an infrared camera and it can be detected whether a user is in a drunken state using a vehicle interior image which is expressed by thermography, the vehicle 200 may not include the exhalation detector 244 and the alcohol detector 246.

Breath-based sensor description highlight

[0050] The exhalation detector 244 detects alcohol included in exhaled air of a user in the vehicle 200 and detects whether the user is drunken. For example, the ***exhalation detector 244 detects an amount of alcohol included in a unit amount of (for example, 1 [l]) exhaled air of the user and determines whether the amount of alcohol is equal to or greater than a first threshold value*** (for example, about 0.5 [mg]/[l] to 1 [mg]/[l]) The exhalation detector 244 determines that the user in the vehicle 200 is in a drunken state when it is determined that the amount of alcohol is equal to or greater than the first threshold value, and determines that the user in the vehicle 200 is not in the drunken state when it is determined that the amount of alcohol is less than the first threshold value.

[0051] The exhalation detector 244 determines whether the amount of alcohol is greater than a second threshold value (for example, about 1 [mg]/[l]). When it is determined that the amount of alcohol is greater than

the second threshold value, the exhalation detector 244 determines that the user in the vehicle 200 is in a state (condition) in which an immediate countermeasure is necessary such as a drunken state or a comatose state.
[0052] The alcohol detector 246 detects an amount of alcohol included in blood of a user in terms of a blood alcohol content by coming into contact with a part of the user in the vehicle 200 in which a skin is exposed, and determines whether the user is in the drunken state. The alcohol detector 246 determines, for example, when the alcohol content of the user is equal to or greater than a third threshold value (for example, about 1 [mg]/[ml] to 2 [mg]/[ml]). The alcohol detector 246 determines that the user in the vehicle 200 is in the drunken state when it is determined that the alcohol content is equal to or greater than the third threshold value, and determines that the user in the vehicle 200 is not in the drunken state when it is determined that the alcohol content is less than the third threshold value.
[0053] The alcohol detector 246 determines whether the blood alcohol content is greater than a fourth threshold value (for example, about 2 [mg]/[ml]). When it is determined that the alcohol content is greater than the fourth threshold value, the alcohol detector 246 determines that the user in the vehicle 200 is in a state (condition) in which an immediate countermeasure is necessary such as a drunken state or a comatose state.
[0054] The exhalation detector 244 and the alcohol detector 246 are examples of a "detector configured to detect the condition of a user." The vehicle 200 may include at least one of the exhalation detector 244 and the alcohol detector 246. When the vehicle interior monitoring device 240 includes an infrared camera and it can be detected whether a user is in a drunken state using a vehicle interior image which is expressed by thermography, the vehicle 200 may not include the exhalation detector 244 and the alcohol detector 246. [529]

19. "Control device and control method," Honda. US20220011768A1. (Filed 2021/Pending 2022)

Description of driver monitoring, breath and touch based system highlight

In step S601, the control device 2 acquires information of the driver of the vehicle 1. The obtained information includes, for example, a state of the driver (including being awake, being drunk, sleeping, and/or being stunned), whether or not the driver has a driver's license, and/or carrying no driver's license. ***The state of the driver is detected based on, for example, an image of the driver captured by a vehicle compartment camera, biological information of the driver measured by a biological sensor (pulse, body temperature, alcohol component contained in sweat, and the like), and/or an alcohol concentration in the vehicle compartment detected using an alcohol odor sensor***. [530]

Hyundai, Kia

Touch or breath-based system

20. "Apparatus and method for detecting alcohol content of vehicle occupant's breath," Hyundai, Kia. US11698365B2. (Filed 2020/Approved 2023)

Breath-based sensor description highlight

To this end, the inlet 110 may be provided on a position that is capable of easily absorbing the driver's exhalation, e.g., one side of a steering wheel and a position that is capable of easily absorbing the passenger's exhalation, e.g., one side of a dashboard of the passenger's seat.

The valve 120 may include a driver valve which is controlled to open or close to allow the driver's exhalation to flow into the sensor 130 and a passenger valve which is controlled to open or close to allow the passenger's exhalation to flow into the sensor 130. Here, the driver valve and the passenger valve may each include a solenoid valve controlled by a controller 160. The valve 120 may be provided at a position where a snorkel (driver's exhalation passage), to which the inlet 110 absorbing the driver's exhalation is connected, and a snorkel (passenger's exhalation passage), to which the inlet 110 absorbing the passenger's exhalation is connected, intersect each other. The sensor 130 may detect an alcohol component in at least one of the driver's exhalation or the passenger's exhalation. In this case, the sensor 130 may include an alcohol sensor. Here, the alcohol component may include an alcohol component having an alcohol concentration above a threshold determined to be a drinking state, but is not limited thereto, and may also include an alcohol component having an alcohol concentration below the threshold.[531]

21. "Device and method for preventing driving under influence," Hyundai, Kia. US11458839B2. (Filed 2020/Approved 2022)

Breath-based sensor description highlight

The first measuring device 310 may be disposed in the vehicle to detect the alcohol present in the indoor air. The first measuring device 310 may include a simplified alcohol sensor 311 that detects a presence or an absence of an alcohol component in the indoor air of the vehicle. The simplified alcohol sensor 311 is for detecting only a presence or an absence of the alcohol component in the driver's seat, but requires a level of detection performance configured for detecting a presence or an absence of a trace amount of alcohol component. The simplified alcohol sensor 311 may be implemented as a low-performance and low-cost sensor compared to a blood alcohol level measuring sensor applied to the second measuring device 320.

The second measuring device 320 may measure the level of the alcohol (e.g., the concentration of the alcohol) contained in the breath (the exhalation) of the driver. The second measuring device 320 may include the blood alcohol level measuring sensor having a performance configured for precisely detecting the alcohol with a resolution of 0.01% blood alcohol concentration. In the present connection, the resolution of 0.01% blood alcohol concentration may be converted to a resolution of 0.05 mg alcohol concentration in 1 liter of air. As the blood alcohol level measuring sensor, a fuel cell sensor, a semiconductor sensor, and/or a spectrophotometer sensor may be used. The second measuring device 320 may be manufactured on-board with the first measuring device 310. [532]

22. "Device and method for controlling alcohol interlock," Hyundai, Kia. US11077857B2 (Filed 2020/Approved 2021)

Breath-based sensor description highlight

When there is no fellow passenger, the controller 130 may determine that the exhalation input to the blood alcohol concentration measuring device is input by the driver, and may determine the blood alcohol concentration to determine whether the driver is drunk. In addition, even when there is the fellow passenger, when the fellow passenger does not intrude into the driver region and the breath of the fellow passenger has not changed, the controller 130 may determine that the exhalation of the fellow passenger is not input, thereby determining that the exhalation input to the blood alcohol concentration measuring device is input by the driver.
The controller 130 determines whether the driver is drunk. When determining that the driver is drunk, the controller 130 may control the vehicle so as not to be started. In addition, when determining that the driver is not drunk, the controller 130 may control the vehicle to be started.[533]

23. "Alcohol Sensing System and Method for Controlling the Same," Hyundai, Kia. US20230173917A1. (Filed 2022/Pending 2023)

Breath-based sensor description highlight

Before operating in the alcohol sensing mode in which the driver's condition (drunk-driving condition) is sensed, the alcohol sensing system 10 according to an exemplary embodiment of the present disclosure may operate in the moisture removal mode in which the moisture and other foreign substances in the air duct 20 are removed. For example, when a flow rate at which the driver's breath is drawn into the sensor module 30 through the air duct 20 is relatively insufficient or when the moisture collected in the passage of the air duct 20 is higher than or equal to a threshold, the controller 34 may rotate the fan 33 in the second direction and operate the heater 36 for a predetermined time, and accordingly the moisture in the air may be evaporated by heat generated by the heater 36, and the other foreign substances may be discharged to the outside through the first opening 21 of the air duct 20 (the moisture removal mode). [534]

24. "Interlock control system linked to digital key and interlock control method for the same," Hyundai, Kia. US20220355801A1 (Filed 2021/Pending 2022)

Breath-based sensor description highlight

[0090] In addition, in the alcohol measuring step (S200), the alcohol measuring sensor mounted at an upper portion of a steering wheel of the vehicle, a front portion of a cluster, or on an overhead console may receive exhalation from the driver and measure the blood alcohol concentration.
[0091] In this case, an alcohol measuring position controlling step (S510) may be further included to automatically adjust the driver seat such that the driver is positioned at an alcohol measuring position at which the driver conveniently exhales to the alcohol measuring sensor 200 based on the personal information of the driver getting in the vehicle before the alcohol measuring step (S200).
[0092] In addition, the alcohol interlock controlling step (S300) may include a decomposition time period calculating procedure (S310) of calculating a decomposition time period predicted as being required to decompose blood alcohol, based on the personal information of the driver, which is extracted by the IMS controller by authenticating the digital key, when the blood alcohol concentration of the driver, which is transmitted from the alcohol measuring sensor, exceeds a preset reference value, and an ignition restricting procedure (S320) of restricting the ignition using the digital key for the decomposition time period calculated by the decomposition time period calculating procedure (S310).

[0093] In this case, in the decomposition time period calculating procedure (S310), the decomposition time period predicted as being required to decompose the blood alcohol of the driver may be calculated based on the blood alcohol concentration of the driver and the personal information of the driver, and may be provided.[535]

Combination of driver monitoring, breath, or touch systems to determine alcohol impairment

25. "Apparatus and method for controlling alcohol interlock of vehicle," Hyundai, Kia. US11801845B2 (Filed 2020/Approved 2023)

Driver monitoring system description highlight

According to an exemplary embodiment of the present disclosure, when a predetermined time has elapsed, the controller 140 may determine that the condition for reconfirming the occupant seated in the driver's seat is satisfied, ***and when a situation that is similar to the drunken state is determined based on a driver state acquired through the camera 110***, the controller 140 may determine that the condition for reconfirming the occupant seated in the driver's seat is satisfied

Breath-based sensor description highlight

The alcohol sensor 124 may acquire an alcohol content based on an exhalation of the occupant seated in the driver's seat. The controller 140 may determine a drunken state of the occupant seated in the driver's seat based on the alcohol content sensed by the alcohol sensor 124.[536]

26. "Apparatus and method for controlling alcohol interlock," Hyundai, Kia. US11305649B2. (Filed 2020/Approved 2022)

Driver monitoring system description highlight

In addition, the camera 110 may be configured to obtain the face image of the passenger and an exhalation image of the passenger as a thermal image. The exhalation image of the passenger may include an image of air emitted from a mouth of the passenger. In general, air emitted from a mouth may be distinguished from air in an atmosphere due to a temperature difference. The camera 110 may include an infrared camera having an infrared sensor and a thermal imaging camera having a thermal sensor to obtain the image of the air emitted from the mouth.

Breath-based sensor description highlight

In addition, the sensor 120 may be configured to detect blood alcohol concentration included in exhalation of the passenger. The sensor 120 may include an alcohol sensor. The alcohol sensor may be disposed at a position capable of detecting exhalation of the driver, that is, around a steering wheel or a cluster.

Further, in response to determining that the condition for detecting the components of the exhalation of the passenger is satisfied (Y), the controller 140 may be configured to determine whether the exhalation component of the passenger is the exhalation of the driver (S140). The process in S140 will be described in more detail with reference to FIG. 4. In response to determining in S140 that the exhalation of the passenger is the exhalation of the driver (Y), the controller 140 may be configured to detect the alcohol concentration in the exhalation of the passenger determined as the exhalation of the driver (S160). In S160, the controller 140 may be configured to detect the alcohol concentration only for the exhalation of the passenger at the

driver's seat. On the other hand, in response to determining in S140 that the exhalation of the passenger is not the exhalation of the driver (N), the controller 140 may be configured to output a message requesting a retry of the exhalation operation through the display 130 to measure the exhalation of the passenger (S150).[537]

27. "Device and method for controlling vehicle," Hyundai, Kia. US20220169152A1. (Filed 2020/Pending 2022)

Driver monitoring system description highlight

On the other hand, when the carbon dioxide concentration in the exhalation of the driver does not exceed the reference value, the controller 150 may set the seat location such that the distance from the alcohol sensor to the driver (the driver face) becomes smaller than the predetermined distance. According to an embodiment, the controller 150 may set the seat location at which the distance from the alcohol sensor to the driver (the driver face) obtained by the camera becomes smaller than the predetermined distance, and control the sliding operation of the seat (in the front and rear directions) or control the angle of the seat.

Breath-based sensor description highlight

When the exhalation of the driver is introduced, the controller 150 may start measuring the alcohol in the exhalation of the driver. In addition, the controller 150 may also measure the carbon dioxide concentration in the exhalation of the driver. [538]

Mercedes Benz

Driver monitoring system to determine alcohol impairment

28. "Method for evaluating the driving ability of a driver of a motor vehicle," Daimler Truck AG. DE102023102946A1. (Filed/Pending 2023)

Driver monitoring system description highlight

Equally advantageous is an embodiment of the invention in which a reaction of the driver's pupils to the light of oncoming vehicles is observed to evaluate the ability to drive while driving. In other words, the reaction of the pupils to the light of oncoming vehicles is taken into account while driving in such a way that a separate light source is not necessary, which could also lead to the driver being blinded, for example. A**ccording to general knowledge, the pupils contract less quickly under the influence of alcohol or drugs than when not under the influence of alcohol, which means that the reaction of the pupils indicates a lack of driving ability. In this case, for example, not only a close-up, but a camera recording or a video sequence is carried out.** The contraction of the pupils is now observed in the video sequence recorded by the optical detection device and, if necessary, compared with the reference data of the same driver and/or observed and evaluated as a function of predetermined data.[539]

29. "Method for determining an inability to drive a driver of a vehicle," Mercedes Benz Group AG. DE102021005093A1 (Filed/Pending 2021)

Driver monitoring system description highlight

Abstract: The invention relates to a method for determining the inability to drive a driver (3) of a vehicle (1), image signals of the driver (3) being continuously recorded by means of a driver camera (4). According to the invention, a probability is determined based on captured image signals as to

whether a bottle (2) that the driver (3) is holding is a bottle (2) with an alcoholic beverage (P5) and whether the driver (3) drinks from the bottle (2), - if it is determined on the basis of the captured image signals that the driver (3) drinks from the bottle (2), a probability of a reduction in a level (P6) of the alcoholic beverage (P5) in the bottle (2) is determined, - a probability of a change in a reaction time (P1) of the driver (3) in relation to a driving task is recorded, - a probability of a change in a reaction time (P2) of a pupil's Driver (3) is detected and a probability of a change in speaking behavior (P3) of the driver (3) based on voice operations is detected, the determined probabilities being entered in a network diagram (N) rden and an area (A1, A2) delimited by the probabilities is calculated and a measure of the inability to drive is determined based on the area (A1, A2), a vehicle-side reaction being triggered depending on the measure of the inability to drive.[540]

Nissan

Combination of driver monitoring, breath, or touch systems to determine alcohol impairment

30. Nissan makes public announcement about the development of a driver monitoring, touch and breath--based system to determine alcohol impairment in 2007. [541, 542]

Driver monitoring system description highlight

Facial Recognition System

A camera is mounted on the instrument cluster facing the driver to monitor the driver's face. The system is calibrated to monitor the driver's state of consciousness through the blinking of the eyes. When the system detects signs of drowsiness, a voice and message alert is triggered via the navigation system. Additionally, a seat-belt mechanism is activated which tightens around the driver to gain his or her immediate attention.

Driving Behavior

By constantly monitoring the operational behavior of the vehicle (e.g. sensing if the vehicle is veering out of its driving lane), the system can identify signs of inattentiveness or distraction in the driver. When the system detects such behavior, voice and message alerts are issued via the navigation system. The seat-belt alert mechanism is also activated, tightening around the driver to gain immediate attention.

Touch-based sensor description highlight

A hi-sensitivity alcohol odor sensor is built into the transmission shift knob, which is able to detect the presence of alcohol in the perspiration of the driver's palm as he or she attempts to start driving. When the alcohol-level detected is above the pre-determined threshold, the system automatically locks the transmission, immobilizing the car. A "drunk driving" voice alert is also issued via the car navigation system.

Breath-based sensor description highlight

Additional alcohol odor sensors are also incorporated into the driver's and passenger seats to detect the presence of alcohol in the air inside the vehicle cabin. When alcohol is detected, the system issues both a voice alert and a message alert on the navigation system monitor.

Subaru

Driver monitoring system to determine alcohol impairment.

31. "Driving assistance apparatus," Subaru. US20230339495A1. (Filed/Pending 2023)

Driver monitoring system description highlight

The driving incapable state may indicate, for example, deterioration of the physical condition to an extent that a consciousness level decreases, ***or an intoxicated state resulting from drinking***, drug, etc.
(a) Fixing of the visual field of the occupant P (e.g., three seconds or more)
(b) When it is determined that eyes of the occupant P are closed, i.e., the occupant P is recognized as being unconscious, based on the image captured by the driver monitoring camera 401
(c) When the driving assistance control unit 200 determines predetermined zigzag traveling
(d) When fluctuation of the inter-vehicle distance between the own vehicle and the preceding vehicle is equal to or greater than a predetermined poor-physical-condition determination threshold
(e) When an amount of rearward or downward movement of the center of gravity of the occupant P detected by the seat surface pressure sensor 402 is equal to or greater than a predetermined poor-physical-condition determination threshold. [543]

32. "Emotion determination device," Subaru. US20230339474A1. (Filed/Pending 2023).

Driver monitoring system description highlight

The driving incapable state may indicate, for example, deterioration of the physical condition to an extent that a consciousness level decreases, or ***an intoxicated state resulting from drinking, drug, etc.***
(a) Fixing of the visual field of the occupant P (e.g., three seconds or more)
(b) When it is determined that eyes of the occupant P are closed, i.e., the occupant P is recognized as being unconscious, based on the image captured by the driver monitoring camera 401
(c) When the driving assistance control unit 200 determines predetermined zigzag traveling
(d) When fluctuation of the inter-vehicle distance between the own vehicle and the preceding vehicle is equal to or greater than a predetermined poor-physical-condition determination threshold
(e) When an amount of rearward or downward movement of the center of gravity of the occupant P detected by the seat surface pressure sensor 402 is equal to or greater than a predetermined poor-physical-condition determination threshold

Combination of driver monitoring, breath, or touch systems to determine alcohol impairment

33. "Driving skill estimation device," Subaru. US20230351777A1. (Filed/pending 2023)

Driver monitoring system description highlight

The occupant state determination unit 400 may determine the quality of the driving skill of the occupant, e.g., the driver. [0161] At this occasion, the occupant state determination unit 400 may determine whether or not the driver is in an unsuitable state for driving. Non-limiting examples of the unsuitable state for driving may include being in a poor physical condition, having unsuitable emotions for driving, and having taken alcohol.

Breath-based sensor description highlight

Moreover, the occupant state determination unit 400 may include other sensors than these sensors. [0093] For example, a sensor may be provided that acquires, for example, various kinds of biometric data, i.e., so-called vital signs, and an alcohol concentration in exhaled air. [544]

Toyota

Touch or breath-based system

34. "Information processing device, information processing system, information processing method, and program," Toyota. US20220101458A1. (Filed 2021/Pending 2022).

Breath-based sensor description highlight

> The concentration of the alcohol in the exhaled breath may be directly or indirectly acquired. For example, in a case where the exhaled breath of the user does not directly contact the sensor, the concentration of the alcohol contained in the exhaled breath may be calculated based on the concentration of the alcohol in the air around the sensor. By using the concentration of the alcohol in the exhaled breath, the estimation can be made how much alcohol the user drinks after returning home.
> [0040] Further, the controller may be configured to, in a case where the alcohol is detected from the exhaled breath of the user, estimate that an amount of the alcoholic beverage corresponding to the acquired concentration of the alcohol is consumed by the user after returning home. [545]

Driver monitoring system to determine alcohol impairment

35. "Readiness and identification by gaze and/or gesture pattern detection," Toyota. US11144052B2. (Filed 2018/Approved 2021)

Driver monitoring system description highlight.

> ***the present systems and methods may be utilized to determine whether the driver is intoxicated, drowsy, or otherwise incapacitated and unable to receive control of the vehicle***. Systems and methods of the present disclosure may include an imaging device 110 configured to face a driver 130 and capture gaze and gesture inputs from the driver 130. Gaze and gesture systems may include infrared illumination sources 120 to generate rich reflections off an eye or other features of the driver for capture by the imaging device 110. The combination of infrared illumination sources 120 and imaging devices 110 may enable detailed eye-tracking systems capable of determining eye movement, pupil dilation, gaze direction, or the like.[546]

36. "Attention ability test device, attention ability test method, and vehicle," Toyota. US20230136521A1 (Filed 2022/Pending 2023).

Driver monitoring system description highlight.

> The attention ability test device 10 is a device for testing the visual attention ability of an examinee. The attention ability test device 10 in this example is mounted in a vehicle 100, and tests the attention ability of a driver, who is an examinee. Note here that a person's attention ability largely varies, depending on their condition on the day, such as the amount of alcohol consumed, sleeping hours, the extent of nervousness, the presence/absence of disease, or the like, in addition to their inherent characteristics. In other words, one's attention ability varies every day. ***The attention ability test device 10 in this example is used to test the attention ability of a driver, which varies every day, to determine the presence/absence of abnormality on the driver, in particular, whether or not they have been drinking.***
>
> FIG. 14 illustrates a distribution of the evaluation values CR, PR obtained in the above-described experiments, wherein the abscissa represents the center evaluation values CR, and the ordinate represents the periphery evaluation

values PR. In FIG. 14, a black circle represents an evaluation value obtained with a non-drinker examinee, while a cross mark represents an evaluation value obtained with a drinker examinee. In the case illustrated in FIG. 14, most of the center evaluation values CR of non-drinker examinees are lower than the value Ca, and those of drinker examines are higher than the value Ca. Further, most of the periphery evaluation values PR of non-drinkers are lower than the value Pa, and most of those of drinkers are higher than the value Pa. Thus, with the results of experiments illustrated in FIG. 14 obtained, setting the value Ca to the center threshold CRth and the value Pa to the periphery threshold PRth enables determination, in a test, as to the presence/absence of drinking, that is, whether the driver has drunk alcohol prior to the test.[547]

Combination of driver monitoring, breath, or touch systems to determine alcohol impairment

37. Toyota makes public announcement about a driver monitoring and touch-based system to determine alcohol impairment in 2007.

Driver monitoring system description highlight.

The system could also kick in if the sensors detect abnormal steering, or if a special camera shows that the driver's pupils are not in focus. The car is then slowed to a halt, the report said.

The world's No. 2 automaker hopes to fit cars with the system by the end of 2009, according to the report.

Touch-based sensor description highlight.

Cars fitted with the detection system will not start if sweat sensors in the driving wheel detect high levels of alcohol in the driver's bloodstream, according to a report carried by the mass-circulation daily, Asahi Shimbun [548, 549]

38. "Vehicle occupant information acquisition device and vehicle control system," Toyota. US20170028987A1 (Filed 2016/Approved 2017)

Driver monitoring system description highlight.

The cameras 18 are disposed at the ceiling of a vehicle cabin interior or the like, from where facial expressions and the like of the occupants sitting on the seats can be imaged. Each camera 18 captures images of an occupant. In the present exemplary embodiment, the captured images obtained by the imaging are used for determining states of physical condition and the like from facial coloration, expressions and the like of the occupants. The captured images may also be used for facial recognition and the like in order to identify the occupants in the vehicle.

Breath-based sensor description highlight.

Each alcohol sensor 16 is disposed at a position at which the breath of an occupant can be easily detected such as, for example, a headrest or the like. By detecting alcohol, the alcohol sensor 16 determines whether or not an occupant sitting on a seat is under the influence of alcohol.[550]

39. "Impairment evaluation system," Toyota. US10166992B2. (Filed 2015/Approved 2019)

Driver monitoring system description highlight.

In another example of a challenge 14, the system 10 may analyze the gaze of the driver to determine if the driver is fit for operating the motor vehicle 12. The system 10 includes a camera. The camera may be mounted on the sun visor above the steering wheel. The camera is configured to detect the eyes

of the driver so as to perform the horizontal gaze nystagmus test. The system 10 may issue instructions to the driver to perform the horizontal gaze nystagmus test.

Voice-based sensor description highlight.

The system 10 may include a speech recognition unit. The speech recognition unit may include a microphone and an executable program configured to analyze the user's voice to detect a slur, or the user's response time. The speech recognition unit may be further configured to record and store a phrase spoken by the driver so as to generate a stored phrase. The stored phrase serves as a benchmark for the user's speech pattern when sober. In the event the impairment event unit 24 detects an impairment event 16, the challenge unit 28 requires the driver to repeat the stored phrase. The speech recognition unit compares the repeated phrase with the stored phrase. The challenge unit 28 renders the motor vehicle 12 inoperable when the repeated phrase deviates from the stored phrase a predetermined amount. For instance, the speech recognition unit may compare the length of time taken to repeat the phrase with the duration of the stored phrase, the presence of a lisp in the repeated phrase that was not present in the stored phrase, or the delay in repeating the stored phrase to determine that the response is unacceptable. [551]

40. "Vehicle systems and methods for detecting and mitigating an incapacitated driver," Toyota. US20190202464A1. (Filed 2018/Approved 2020)

Driver monitoring system description highlight.

the driver detection sensors 132 are located throughout the passenger cabin 201 and may generate one or more output signals indicative of the position of the particular driving apparatus as manipulated by the driver. More specifically, the output signals may indicate that the driver is incapacitated based on the driver's particular style or approach for manipulating a particular driving apparatus. For example, the output signal may indicate that the driver 250 is manipulating the steering wheel 232 improperly and in such a manner to indicate he or she is likely incapacitated. More specifically, the driver may move the steering wheel 232 such that the vehicle 100 may swerve or weave on the road when the driver is intoxicated by alcohol. In another example, a turn radius, speed, and the like of the steering wheel 232 may be indicative of alcohol intoxication as the driver manipulates the vehicle 100 through a turn (e.g., such as through an intersection). Although alcohol intoxication, drowsiness, and drug intoxication are described, it should be appreciated that the disclosure is not limited to determining only these specific types of driver incapacitation based on the driver detection sensors 132.

In another example, when the driver 250 is intoxicated by alcohol or has ingested stimulants such as amphetamine, then the camera may detect the driver's pupils have a delayed or lack of reaction to light or are dilated. In still another example, the eye monitoring sensors 142 may detect that the driver's pupils are extremely constricted (which may be referred to as pinpoint pupils) and/or the eyes of the driver are rolling back, which may be indicative of opioid use. Although drowsiness, alcohol intoxication, stimulant intoxication, and opioid intoxication are described, it should be appreciated that the disclosure is not limited to determining only these specific types of driver incapacitation based on the conditions of the driver's eyes.

Breath-based sensor description highlight.

In still another embodiment, the body signal may indicate that the driver is intoxicated by alcohol based on the blood alcohol level monitored by a breathalyzer or similar device to measure blood alcohol levels.[552]

Volvo

Driver monitoring system to determine alcohol impairment

41. Volvo made a public announcement about the development of a driver monitoring system to determine alcohol impairment in March 2019. [553, 554, 555, 556]

Driver monitoring system description highlight.

"Volvo Cars believes intoxication and distraction should be addressed by installing in-car cameras and other sensors that monitor the driver and allow the car to intervene if a clearly intoxicated or distracted driver does not respond to warning signals and is risking an accident involving serious injury or death."[557]

In Volvo's 2021 Annual and Sustainability Report, Volvo notes "if a clearly distracted (or intoxicated) driver does not respond to warning signals and risks a serious, potentially lethal accident, the car could intervene as a last resort by actively slowing down and stopping the car."[558]

In September 2022, Volvo announced the EX90 will have technology to prevent impaired driving.[559]

42. "Method and system for perceptual suitability test of a driver," Volvo. WO2005098777A1 (Filed 2004/Approved 2005)

Driver monitoring system description highlight.

It is another object of the invention to provide a method and system to automatically test the influence of drugs and/or alcohol and/or medical conditions or crises, such as stroke, epilepsy, multiple sclerosis, uncontrolled diabetes, etc. and other such states on perceptual impairment of a driver or any other person involved in the operations of the above mentioned equipments and / or devices

A basic idea is to assess the perceptual suitability of an operator to perform a task, such as driving. Perceptual ability is influenced by alcohol, drugs, and medical conditions, but also by other factors such as age and experience. Thus, a subject of the invention is to test for the perceptual effects of alcohol, drugs, etc., not for the presence of alcohol, drugs, etc. per se. This is particularly important because e.g. a particular concentration of a drug can have quite different effects. The effects of any drug depends on a number of additional factors such as dose, user tolerance, metabolism how the drug was administered, the drug's purity, the user's expectations, coexisting illness, fatigue, and the presence of other drugs or substances.[560]

Tier 1 Suppliers

Magna

Combination of driver monitoring, breath, or touch systems to determine alcohol impairment

43. Magna is working on a system that the company demonstrated in January 2024 at the Consumer Electronics Show (CES) in Las Vegas and at an auto technology showcase in September 2023 in Washington, D.C. [561] Magna is using a breath-based originally developed by Senseair.

Driver monitoring and breath-based system description highlight

> Magna's Impaired Driving Prevention Technology combines our Driver Monitoring System technology with a non-dispersive infrared ethanol sensor developed by our industry partner into a single safety system. The combined system supports a robust determination of a driver's fitness to perform the driving task, including an assessment of their breath alcohol concentration, with the goal of reversing impaired driving trends.[562]
>
> The new safety technology determines if drivers are "fit to drive" in a fast, reliable and affordable way. The integrated solution combines key elements of the interior sensing system, which utilizes camera technology to detect driver distraction, drowsiness and intoxication through pupillary signals, with infrared sensor technology developed by Senseair, a leader in air and gas sensing. Cockpit-embedded sensors, placed in proximity to the driver, measure and quantify the alcohol and carbon dioxide levels in diluted exhalations from the driver. The technology is intended to passively detect an intoxicated driver with a blood alcohol concentration at or above the legal limit of 0.08 percent in all states except Utah, where the legal limit is 0.05 percent.[563]
>
> Magna is taking a belt-and-suspenders approach, whereby during the time it takes a driver to enter, sit down, belt up, and start the vehicle (maybe 10-15 seconds) normal breathing directs enough air toward the steering wheel for a little snorkel with a fan to collect a sample and scan for both CO2 and any alcohol. In the meantime, a camera is verifying that the breath is coming from the driver, and not a potentially sober passenger blowing toward the steering column. The system also notes the background levels of air (and possibly alcohol if, for example, someone spilled hand sanitizer or vodka in the carpet) for comparison. If alcohol is detected at levels nearing the 0.08 g/dl level, the system then prompts the driver to look directly at the driver monitoring camera, which then looks for nystagmus.[564]

Driver monitoring system to determine alcohol impairment

44. "Vehicular driver monitoring system with heart rate measurement," Magna. US11433906B2 (Filed 2020/Approved 2022).

Driver monitoring system description highlight

> The driver (and/or passenger) monitoring system (comprising the camera(s) and a controller or control unit having a processor for processing image data captured by the camera(s)) can also operate as a remote Photoplethysmography (rPPG) system to monitor human's heart rate, and optionally other vital signs. The system, responsive to detection of a change of the driver's heartbeat, may determine if the driver's capability of driving the vehicle is impaired, such as due to the driver having a health issue, the driver being tired or drowsy, the driver being stressed, or the driver being drunk or under drug influence of the like. The system may generate an

alert or warning (such as to the driver or to a passenger in the vehicle or to a remote system or control remote from the vehicle) if the system determines a health issue or the like with the driver.[565]

Bosch

Driver monitoring system to determine alcohol impairment

45. In 2023, Bosch announced the development of a driver monitoring system to determine alcohol impairment.[566, 567]

Driver monitoring system description highlight

> Motor Trend highlights interior monitoring sensors and reports Bosch is optimistic that these sensors can reliably detect an impaired driver. [568]
>
> Bosch uses infrared and RGB cameras to take precise measurements of a driver's eye openings (droopy eyelids could mean impairment/drowsiness), mouth position (more yawning could indicate drowsiness) and more. Even reduced saccade velocity (the speed at which someone alters the direction of their gaze) can be an indicator of drunk driving. [569]
>
> Bosch is currently focusing efforts on eye-motion detection, but in collaboration with the University of Berne and Center for Digital Health Interventions (CDHI) at ETH Zurich and the University of St. Gallen, the Bosch IoT Lab is researching other possible methods by which drunk driving might be detected from today's real-time vehicle sensor data streams available on the Controller Area Network (CAN bus). [570]

46. "Method and apparatus for detecting tampering with a breathalyser test for a vehicle and monitoring system for a vehicle." Bosch. DE102021212388A1. (Filed 2021/Pending 2023).

Driver monitoring system description highlight

> **Abstract:** To ***detect tampering with an alcohol test, a camera signal (125) is read in by a vehicle camera (110) of a vehicle (100), the camera signal (125) containing movement information or gesture information from a driver (130) of the vehicle (100) and recording time information about a Recording time of the movement information or gesture information represents.*** Furthermore, a sensor signal (140) is read in by an alcohol sensor (145), the sensor signal (140) representing the execution of the alcohol test and execution time information about the execution time of the execution. In a generation step, a manipulation signal (150) is generated, which represents a detected manipulation of the alcohol test if the movement information deviates from defined target movement information (155) and/or the gesture information deviates from defined target gesture information (160).[571]

47. "Method and device for controlling the speed of a vehicle," Bosch. DE102020215926A1. (Filed 2020/Pending 2022).

Driver monitoring system description highlight

> Conspicuous movement patterns can be recognized from the evaluation of the evaluated movement variables, which, for example, in the case of temporally fluctuating lateral accelerations or temporally fluctuating longitudinal accelerations of the road user driving ahead. These can be evaluated with regard to the fluctuation frequency and/or with regard to the deviation of the peak values and compared with

stored threshold values. The threshold values can be defined as speed-dependent threshold values, for example, which allow more deviations at high speeds than at low speeds without recognizing a conspicuous movement pattern. ***These evaluations indicate a drunk driver or a distracted or tired driver, for example if the road user ahead is driving very one-sidedly in the lane or the direction indicator is activated unnecessarily for a long time.***

The status of the direction indicators of the vehicle driving ahead can be evaluated as further data on the movement variables, the evaluation of which can be useful. If the direction indicator is activated in one of the directions for a longer period of time without the road user in front turning or changing lanes, or the direction indicator is activated without the possibility of turning or changing lanes, this can also indicate a distracted driver or an incapacitated driver let drivers close.[572]

48. "Method and device for determining a reaction time of a vehicle driver," Bosch. US20160046295A1. (Filed 2015/Approved 2018).
Driver monitoring system description highlight
In addition, computing device 5 is set up to detect a region of view 10 or field of view, or an angular region of view 10, of the vehicle driver 2. For this purpose, various optical or visual stimuli 7 are distributed along windshield 8 in order in this way to determine the boundaries of region of view 10 of driver 2. In FIG. 1, a so-called tunnel vision situation is shown, ***which is distinguished by a small angle a and which permits the inference that driver 2 is under the influence of alcohol or is tired.***[573]

Hyundai Mobis

Touch or breath-based system

49. As part of the cabin monitoring system, Hyundai Mobis also announced on June 23, 2022 passive alcohol detection technology
Breath-based sensor description highlight
"it will also be possible to detect if the driver is intoxicated and block the driver from driving. Hyundai Mobis' breathalyzer technology is a non-contact type that can measure just by exhaling a little. It uses optical sensor technology to detect the alcohol content in the driver's breath to determine the blood alcohol level. This technology is much more accurate and convenient than electrochemical sensors that require mouth-to-mouth blowing."[574, 575]

Driver monitoring system to determine alcohol impairment

50. "Method and device for responding to emergency situation," Hyundai Mobis. US20230365161A1. (Filed 2023/Pending 2023).
Driver monitoring system description highlight
For example, the processor 2500 may determine whether the driver is conscious based on the DSM camera information and the steering wheel sensor information. In addition, the processor 2500 may determine whether the driver is in a drowsy or drunk state. The processor 2500 may stop the vehicle on the shoulder in response to the driver's state abnormality. The processor 2500 may control the vehicle to move to the shoulder when there is the driver's state abnormality.[576]

Combination of driver monitoring, breath, or touch systems to determine alcohol impairment

51. "System and method for determining driver's inebriation," Hyundai Mobis. US20220340144A1. (Filed 2021/Pending 2022)

Driver monitoring system description highlight

Breathing test for determining whether the driver is inebriated, through the internal camera 40 attached to the inside of the vehicle, is usually performed through the driver's mouth. Therefore, an optimal position of the driver's seat 20 is obtained by comparing the position of the driver's mouth and the position of the breathalyzer 10. The controller 30 may measure the driver's weight and height to adjust the height of the driver's seat 20 and front and rear distances with the sun visor, the cluster, the steering wheel, etc., and may measure a distance with the breathalyzer 10 in a diagonal direction, whereby it is possible to output the movement request signal for the driver's seat 20 to move the seat to a convenient position for the driver where breathing test is easily performed.

Breath-based sensor description highlight

Specifically, the breathalyzer 10 is to determine whether the driver is inebriated, through the driver's exhalation, and may be provided at various points in front of the driver. The controller 30 of the disclosure controls such a breathalyzer 10 and the driver's seat 20 together. The controller 30 outputs a movement request signal for the driver's seat 20 when determination of driver's inebriation is required by the breathalyzer 10, for example, immediately before the engine of the vehicle is started. That is, before determining a driver's inebriation, in order to increase the accuracy of the measurement, the controller 30 moves the seat 20 first. Next, the controller 30 controls the breathalyzer 10 to start determination of driver's inebriation when the movement of the driver's seat 20 is completed. That is, the controller 30 controls the breathalyzer 10 to start determination of driver's inebriation only when the movement of the seat 20 to the appropriate position is completed.[577]

52. "Drunk driving prevention system and method therefor," Hyundai Mobis. US20230041464A1. (Filed 2021/Pending 2023)

Driver monitoring system description highlight

As shown in FIG. 6 , the drunk driving prevention system according to a preferred embodiment of the present disclosure may include a camera 300 for photographing an image including a face of a driver seated on the driver's seat, a breath test device 100 for detecting alcohol contained in the driver's breath, and a control module 200 for identifying the driver on the basis of the image photographed by the camera 300 and detecting the driver's inebriation from the alcohol concentration detected by the breath test device 100, thereby operating an ignition interlock device 630 of the vehicle.

Breath-based sensor description highlight

According to a preferred embodiment of the present disclosure, the breath test device 100 may take in the driver's breath to detect the amount of respiration and the alcohol concentration contained in the driver's breath. To this end, the breath test device 100 may include a suction unit 110 for sucking the driver's breath and a sensor unit 120 having an alcohol sensor for detecting alcohol contained in the driver's breath.

The suction unit 110 may be installed near the driver's seat at a location where the breath exhaled by the driver may be easily taken in, and preferably, may be installed near a cluster, a steering wheel, or a center fascia.

In particular, a fan driven by a motor may be installed in the suction unit 110 of the breath test device 100 so as to increase or reduce the amount of air intake by controlling the rotation speed of the fan. The fan may be installed in an inlet of the suction unit 110, and the operation of the motor for driving the fan may be

controlled by a control unit of the breath test device 100 itself or a sensor control unit 240 in the control module 200.
In addition, the sensor unit 120 is configured to detect the amount of respiration through the suction unit 110 and detect an alcohol content contained in the intake air. In this regard, the sensor unit may include a carbon dioxide sensor for measuring the amount of respiration and an ethanol sensor to detect the alcohol concentration in the driver's breath. In addition, an optical sensor capable of detecting the alcohol content from the breath in an optical manner may be applied to the breath test device.

53. "Drunk driving prevention system with bypass mode and drunk driving prevention method using the system," Hyundai Mobis. US20230040522A1. (Filed 2021/Pending 2023)

Driver monitoring system description highlight

according to a preferred embodiment of the present disclosure, the drunk driving prevention system having a bypass mode may include a camera 300 capturing images including the face of a driver seated in a driver's seat, a sensor module 100 measuring the alcohol content in the exhaled breath of the driver, and a control module 200 checking the identity of the driver based on the images captured by the camera 300 and checking the intoxication state of the driver based on the alcohol content measured by the sensor module 100 to activate an engine start block device 630 of the vehicle.

Breath-based sensor description highlight

According to a preferred embodiment of the present disclosure, the sensor module 100 may include an inhaling unit 110 pulling exhaled breath of a driver and a sensor unit 120 provided with an alcohol content measurement sensor measuring the alcohol content in the exhaled breath of the driver. The inhaling unit 110 may be installed at a position where the breath exhaled by the driver may be easily pulled, and may preferably be installed in the vicinity of the cluster, steering wheel, or center fascia. In particular, the inhaling unit 110 of the sensor module 100 is provided with a fan driven by a motor, and the air intake may be increased or decreased by controlling the rotation speed of the fan. The fan is installed in the inlet portion of the inhaling unit 110, and the motor for driving the fan may be controlled by a control unit of the sensor module 100 or a sensor control unit 240 of the control module 200.

54. "System and method for preventing drunk driving of vehicle," Hyundai Mobis. US20230044733A1. (Filed 2022/Pending 2023)

Driver monitoring system description highlight

In order to prevent the passenger from taking the breathalyzer test instead of the driver and to prevent drunk driving of the driver, the driver status monitoring unit 50 may identify that the current driver is gripping the steering wheel and continuously looking ahead. The driver status monitoring unit 50 may identify the forward gaze of the current driver through the camera sensor 43 provided in the vehicle or may identify the grip on the steering wheel through a pressure sensor provided on the steering wheel, and may identify the grip on the steering wheel and continuous forward gaze through various sensors.

Breath-based sensor description highlight

The breathalyzer 21 may measure the blood alcohol level through the driver's breath, and the sobriety determination unit 20 may determine that the current driver is inebriated when the measured blood alcohol level is greater than or equal to a reference value.

The breathalyzer 21 may measure the blood alcohol level by suctioning the breath, and the sobriety determination unit 20 may determine that driving is possible when the measured blood alcohol level is less than the reference value and that driving is impossible when the measured blood alcohol level is greater than or equal to the reference value by comparing the measured blood alcohol level with the reference value.[578]

55. "System for preventing drunk driving and method for controlling the same," Hyundai Mobis. US20230044709A1. (Filed 2021/Pending 2023)

Driver monitoring system description highlight

According to the preferred embodiment of the present disclosure, a method of controlling an image capture notice of the drunk driving prevention system includes starting a breath-checking, providing a first image capture notice by a notice device before image capture by the camera, and capturing an image by the camera to determine, by the control module, whether the breath-checking is complete based on the images captured by the camera and the alcohol content measured by the sensor module.

Breath-based sensor description highlight

The determination unit may obtain the information on the alcohol content in the exhaled breath of the driver and measured by the sensor module 100 and compare the measured alcohol content with the reference alcohol content to check the intoxication state of the driver.

When the comparison result shows that the measured alcohol content of the driver exceeds the reference alcohol content, the determination unit 220 determines that the driver may not drive due to intoxication, and the vehicle control unit 250 of the control module 200 may activate the engine start block device 630. In this regard, the engine start block device 630 refers to a device that disables the vehicle by blocking the engine start and may be a device that cuts off the engine start power. On the other hand, when it is verified that the measured alcohol content of the driver does not exceed the reference alcohol content or the driver is free of alcohol, the determination unit 220 may determine that the driver may drive and allow the engine start following the engine start-on input of the driver. [579]

Valeo

Combination of driver monitoring, breath, or touch systems to determine alcohol impairment

56. Valeo demonstrated their advanced impaired driving prevention tech in January 2024 at the Consumer Electronics Show (CES) in Las Vegas. Valeo's Safe Insight system combines driver monitoring and alcohol detection.[580]

57. "Method and apparatus for in-vehicle impairment detection with driver verification," Valeo. (Filed 2018/Approved 2021)

Driver monitoring system description highlight

Image sensor 130 senses image data used for validating that the driver is the person who actually touched the biosensor 120 and for whom impairment has been determined. The image sensor 130 is preferably a 3D time of flight (TOF) camera that can differentiate the hand of the vehicle driver 405 versus the hand of passengers in vehicle 100. This is to avoid people from fooling the impairment detection system 110 by using the passenger's hand or other objects that may permit an impaired driver to fool the system.

Touch-based sensor description highlight

Biosensor 120 is preferably located to permit contact with a predetermined region of the driver's skin which improves accuracy of the sensed property. As noted in the Background section above, touch based systems incorporated into the start button or steering wheel may lead to false negatives. The present inventors have recognized that this may be due to the number and/or density of blood vessels and capillaries in the body part touching the sensor during the test. For example, the inventors recognized that human fingers and thumbs typically used to press the start button of a vehicle have fewer blood vessels and capillaries than the fatty ball of flesh at the base of the thumb and palm (called the thenar). Depending on normal, moderate and severely restricted blood flow in hands, the thenar region may ultimately produce a slightly higher response under a wider range of conditions. Thus, the inventors determined that a more suitable location for the sensor 120 is a surface which the thenar or palm of the hand touches in the normal course of driving, such as the driver hand rest or palm rest. Alternative locations of the biosensor 120, such as on the push-to start button or steering wheel, may be used in conjunction with the driver verification feature of the disclosed embodiments.[581]

Denso

Touch or breath-based system

58. "Alcohol detection system and method for vehicle," Denso. US8201437B2. (Filed 2009/Approved 2012).
    Breath-based sensor description highlight
    The alcohol detection device 100 is configured as shown in FIGS. 2A and 2B. The alcohol detection device 100 has a breath inlet 19 a and a display unit 14. The breath inlet 19 a is provided at a front upper part of a casing 19 for taking in breath air blown by a driver (user of a vehicle) to be tested. The display unit 14 is provided as an indicator at a lower part of the breath inlet 10 a for displaying measured concentration of alcohol contained in the breath supplied through the breath inlet 19 a. The breath inlet 10 a is tubular and extends from the front surface of the casing 19. The alcohol detection device 100 also has an exhaust fan 15F, which is provided at a lower part on a rear surface of the casing 19 for forcibly exhausting the breath air subjected to the measurement of alcohol concentration. [582]
59. "Engine starting controller," Denso. US8469134B2. (Filed 2009/Approved 2013).
    Touch-based sensor description highlight
    Abstract: When a driver of a vehicle brings his/her detection part close to a case, a sensor detects a pulse of the driver at the detection part with an optical method, and takes an image of the detection part. An individual certification means determines whether the driver of the vehicle is an authorized person or not based on the image of the detection part taken by the sensor. An alcohol concentration determiner calculates an index value of a blood alcohol concentration of the driver based on the pulse detected at the detection part by the sensor, and determines whether the index value exceeds a criterial value of a drinking assessment. When it is determined that the driver of the vehicle is an authorized person and the index value does not exceed the criterial value of the drinking assessment, a permission means permits the driver to start an engine of the vehicle. [583]

Driver monitoring system to determine alcohol impairment

60. "Vehicle driving system," Denso. US20220289249A1. (Filed 2022/Pending 2022).
    Driver monitoring system description highlight
    The ***drunkenness level indicates an extent of drunkenness of the driver and an extent of adverse effect of drugs. The drunkenness level is determined,***

for example, by observing the movements of the eyes of the driver with a driver monitoring unit 36 of the HMD 30. If the drunkenness level is acceptable, it is determined that the adverse effect of the alcohol and drugs is small. Note that, the drunkenness level may be determined by an alcohol sensor or the like.

The control prohibition unit 17D prohibits the driving control unit 17B from performing acceleration/deceleration control and steering control of the vehicle 10 if it is determined that the driver is not suited to driving. In S290 of the driving setting procedure described below, the control prohibition unit 17D forcibly causes the vehicle 10 to stop irrespective of the driver's intention.[584]

61. "Wakefulness maintaining apparatus and method of maintaining wakefulness," Denso. US7982618B2. (Filed 2007/Approved 2011).
Driver monitoring system description highlight

The image processing ECU 4 controls the camera 2 and the LED 3. The image processing ECU 4 receives an image data from the camera 2, and temporarily stores the image date in a memory (not shown). Furthermore, the image processing ECU 4 reads the image date and performs an image recognition process to the image data. Then, the image processing unit ECU 4 generates processing date for determining a condition of the driver and an event such as an action and an appearance of the driver, and stores the processing date in another memory (not shown).
The ***control device 5 includes a condition determining part 51, an event determining part 52, a timer part 53, and a memory part 54. The condition determining part 51 determines the condition of the driver, for example, drowsiness, looking off, and drunkenness,*** based on the processing data provided from the image processing ECU 4.[585]

62. "Driver management apparatus and travel management system," Denso. US8164463B2. (Filed 2008/Approved 2012).
Driver monitoring system description highlight

(7) In the foregoing embodiment, the state of the driver are estimated from an image of his/her face. The state of the driver may be estimated from the image of the posture of the driver, or from the electrocardiogram of the driver, the blood pressure of the driver, the pulse waves of the driver, the breathing of the driver, the characteristic operation or characteristic manner of the driver. With respect to the image of the face of the driver, the state of the driver is estimated from the blink in the foregoing embodiment, but the state of the driver may be estimated based on a facial expression of the driver or based on the manner, in which the driver moves the hand to the face. With respect to the image of the posture of the driver, the state of the driver may be estimated from the manner in which the driver sits.
(8) At S140 of the driver state estimation processing of the foregoing embodiment, the reporting condition on which the results of estimations of the state of the driver determine that the center 30 should be informed of the sensing information is that the driver be sleepy. ***More specifically, the reporting condition is that the sleepiness level D be higher than the threshold Th. The reporting condition may be that the driver be driving carelessly, drunk or tired***…[586]

63. "Data storage device of vehicle," Denso. US20200043254A1. (Filed 2019/Pending 2020).
Driver monitoring system description highlight

The in-vehicle ECU 60 is collection of a plurality of ECUs other than the ECUs 20, 30, 40, 50, 70, and controls various in-vehicle devices 61. The in-vehicle ECU 60

receives an output signal of an occupant monitor sensor 62. The occupant monitor sensor 62 detects the state of an occupant in the vehicle interior and transmits information about the detected state of the occupant to the in-vehicle ECU 60. The information detected by the occupant monitor sensor 61 includes***, for example, information indicating whether the driver is intoxicated and information indicating whether the driver is unconscious***.[587]

64. "Evacuation driving assistance system," Denso. US10829124B2. (Filed 2016/Approved 2020).

Driver monitoring system description highlight

At step S4, using the driver monitor 21, the categorization unit 15 acquires a state of the driver after provision of stimulation to the driver. Based on an acquisition result, the categorization unit 15 determines which one of the plurality of categories the driver falls into.

The plurality of categories include a drowsiness state, an illegal state, and a critical illness state. The drowsiness state is a state such that upon arousal from catnap, the driver can return to the normal-driving enabled state. ***If the result of monitoring by the driver monitor 21 after provision of stimulation to the driver by the stimulator 23 indicates a sigh of the driver regaining consciousness and no feature corresponding to consumption of alcohol or drugs (for example, a high alcohol concentration in the exhalation, a behavior or look specific to the intoxicated state, or the like***), the categorization unit 15 determines that the driver is in the drowsiness state.[588]

ZF Friedrichshafen

Touch or breath-based system

65. "Vehicle control element for measuring concentrations of substances in exhaled air and/or in body odor of vehicle occupants," ZF Friedrichshafen. US20230266299A1. (Filed/Pending 2023).

Breath-based sensor description highlight

The detection of these substances with the invention is used to determine the state of a vehicle occupant, in particular a vehicle operator, with regard to illness and driving incapacity. If certain substances exceed a respective predefined threshold value, in particular when starting travel, a vehicle immobilizer is activated according to one aspect of the invention, e.g. an alcolock or breath alcohol ignition interlock device, which blocks the vehicle's ignition if the vehicle operator's breath alcohol exceeds a specific value. [589]

66. "Vehicle device and vehicle," ZF Friedrichshafen. DE102022201988A1. (Filed 2022/Pending 2023).

Breath-based sensor description highlight

According to the invention, it was recognized that it is problematic in laser spectroscopy that many of the relevant absorption ranges/wavelength ranges are not substance-specific. It was recognized that, for example, in the case of breath alcohol detection, the range around 3.4 micrometers in wavelength is a possible absorption band for detecting ethanol.

The vehicle device according to the invention can be used to increase the substance selectivity when measuring the breath of vehicle occupants, for example by means of infrared laser spectroscopy using a corresponding laser sensor module.[590]

67. "Computer-implemented method and apparatus for associating an odor substance of a gas under investigation with an electrical signal," ZF Friedrichshafen. (Filed 2022/Pending 2023).

Breath-based sensor description highlight

> The processor 150 is configured to determine who is operating the vehicle and require a breath sample 210 from the operator. The breath sample 210 can be obtained using a mouthpiece provided for this, with which the submitted breath sample 210 is conducted to the first and second odor sensors 110, 130. Air can also be sampled from inside the vehicle and conducted to the odor sensors 110, 130. A portion of this air can also comprise a breath sample from the operator. The first odor sensor 110 is configured to obtain a first electrical breath sample signal on the basis of an interaction between one or more odor substances in the breath sample 210 and the first odor sensor 110. At least one safety odor group is also filtered out of the breath sample by the filter 120, which contains at least one safety odor substance classified as a substance indicating illness, psychotropic substances and/or drugs. A filtered breath sample 220 is obtained with the filter 120. The second odor sensor 130 is configured to obtain a second electrical breath sample signal on the basis of an interaction between one or more odor substances in the filtered breath sample 220 and the second odor sensor 130. The processor 150 determines a difference between the first and second breath sample signals. If the processor 150 determines that there is a difference in the breath sample signals, this difference is assigned to the safety odor group. This can be established if there is a difference in the breath sample signals, or a predetermined threshold value is exceeded.[591]

Combination of driver monitoring, breath, or touch systems to determine alcohol impairment

68. "Processing unit, system, and computer-implemented method for a vehicle interior for detecting and reacting to odors of a vehicle occupant," ZF Friedrichshafen. (Filed 2021/Pending 2023).

Breath-based sensor description highlight

> Drugs and/or illnesses have characteristic odors that can be detected in exhalations. Drugs that can be detected in exhalations comprise alcohol, cocaine, amphetamines, cigarette smoke, cannabis, tetrahydrocannabinol, morphine, and methadone. By way of example, the smell of ammonia is an indication of kidney failure. The smell of acetone indicates diabetes.
>
> If alcohol is detected in an exhalation, and identified as coming from the position of the vehicle driver, the second signal comprises an electric signal for a display, e.g. in the form of an infotainment system or heads-up display, or an acoustic device, e.g. speakers in the vehicle interior, to inform the vehicle occupants visually or acoustically that the driver is unfit due to alcohol content.

Driver monitoring system description highlight

> In another embodiment of the system, the second sensor detects individual appendages. The system is designed to identify the vehicle occupants on the basis of these appendages. By way of example, hands may be recorded by a camera. The system then distinguishes the hands of the driver from those of a passenger. This measure further prevents misuse. This is of particular advantage if the first sensor is an apparatus that measures alcohol content when a finger is placed on it by determining the blood alcohol concentration on the basis of reflections or other light interactions.[592]

69. "Gas analysis system that can be arranged in a vehicle interior and designed to determine substances in exhaled air and/or body odor from vehicle occupants," ZF Friedrichshafen. DE102022203044A1. (Filed 2022/Pending 2023).
Breath-based sensor description highlight
Abstract. Gas analysis system (10) which can be arranged in a vehicle interior and is designed to determine substances in exhaled air (20) and/or body odor of vehicle occupants, the gas analysis system (10) comprising a transmitting device; a receiving device; an evaluation device, designed to attenuate the intensity of the detected when the radiation emitted by the lighting module and the reflected and/or scattered radiation pass through the volume of exhaled air (20) and/or body odor lying between the transmitting device and the receiving device To determine radiation relative to the radiation emitted by the lighting module and/or absorption lines and/or emission lines that occur and at least alcohol, cannabinoids, ammonia and/or acetone based on the respective characteristic attenuations in intensity, absorption lines and/or emission lines in the exhaled air (20) and/or body odor.
Driver monitoring system description highlight
According to a further aspect, the gas analysis system includes an interface to a vehicle interior monitoring device. The evaluation device is designed to receive distance data from the transmitting device and/or the receiving device from the head of the vehicle occupant via the interface from the vehicle interior monitoring device and to use this distance data to determine the attenuation of the intensity of the detected radiation and/or the absorption lines and/or or the emission lines. This improves the robustness and accuracy of the gas analysis system. The vehicle interior monitoring device may include a 2D or 3D interior camera, a lidar, a radar or a time-of-flight sensor.[593]

70. "Gas analysis system for vehicles and arrangement of such systems," ZF Friedrichshafen. US20230266300A1. (Filed/Approved 2023). **In addition to alcohol, this system can detect for other drugs.**
Breath-based sensor description highlight
The gas analysis system can measure substances in body odors contained in the air conveyed through the measurement chamber, for example. Body odors comprise all detectable human scents emitted through the skin or other bodily orifices, e.g. breath odors. Substances in exhalations and/or body odors can be substances indicating the presence of alcohol, cocaine, amphetamines, cannabinoids, morphine, methadone, ammonia, acetone, or a combination thereof. These substances represent biomarkers that can indicate a normal biological or abnormal process in the body.
Driver monitoring system description highlight
The time intervals for activating and/or deactivating the system 10, e.g. the air suction process and analysis in the measurement chamber 10, can be regulated on an individual basis via a control unit, and further supplemented by other sensors, e.g. a 2D/3D camera, gas pedal sensor, vehicle start-stop sensor, and HMI system.[594]

71. "Method for analyzing a quantity of a gas present within a vehicle, use of analytical data and use of an analysis device as well as analysis device, analysis system and vehicle," ZF Friedrichshafen. DE102022204281A1. (Filed 2022/Pending 2023). **This patent is specifically focused on determining cannabis impairment.**
Breath-based sensor description highlight
The invention is based on the inventors' consideration that the purely respiratory gas-based detection of tetrahydrocannabinol (THC) is difficult because the low vapor

pressure means that the maximum THC concentration in the gas phase is extremely low; namely in the range of a few hundred ppt, parts-per-trillion. For comparison: The legal limit for breath alcohol is 130 ppm, parts per million, i.e. a factor of 10^6 higher. Although THC is the primary psychoactive ingredient in cannabis, an adequate detection limit is difficult to achieve. In order to achieve the low THC detection limit, the existing THC detectors mentioned above work with comparatively time-consuming sampling and enrichment processes, some of which are based on disposable components, and usually focus on the analysis of breathing gas condensate rather than on the gas phase itself.

Driver monitoring system description highlight

In particular, the driver's other driving condition can be determined by means of sensory detection of vehicle behavior and/or driver behavior. The sensory detection is preferably implemented by carrying out one or more detection steps selected from the group of detection steps consisting of:
- Detection of a vehicle lane deviation
- Detection of irregular or noticeable acceleration or deceleration of the vehicle
- Detection of irregular or conspicuous operation of the vehicle's main or auxiliary resources,
- Detection of a driver's body and/or head posture in the seat
- Detection of an irregular or abnormal eye parameter of the driver, such as pupil size and/or blinking
- Detection of an irregular or abnormal oral parameter of the driver,
- Detection of an irregular or abnormal humidity and/or temperature value based on the driver's body.[595]

Continental

Touch or breath-based system

72. "Method and device for checking the blood alcohol level of a driver of a vehicle," Continental. WO2011038803A1. (Filed 2010)

Touch-based sensor description highlight

For this purpose, the invention provides a method for controlling the blood alcohol level of a vehicle driver consisting of: to equip the driver of an accessory on which is mounted an electronic module comprising a microprocessor, means for measuring the BAC by near infrared spectrometry arranged to extend in contact with the skin of the conductor equipped with the said accessory, and means for transmitting and receiving signals.[596]

Driver monitoring system to determine alcohol impairment

73. "Method and apparatus for vehicle operator performance assessment and improvement," Continental. WO2002034571A2. (Filed 2001).

Driver monitoring system description highlight

At step 508, the vehicle operator is monitored to provided data to the fusion module 102 relating to the condition of the driver. The driver physical condition may include fatigue or intoxication or a psychological condition of the driver. Additionally, a distraction level of the driver may be monitored. At step 510, the driver's cognitive load is estimated. The driver's cognitive load may take into account driver preferences, past performance and habits. Then, at step 512, vehicle information is prioritized based upon the driver's cognitive load for communication to the driver.[597]

Combination of driver monitoring, breath, or touch systems to determine alcohol impairment

74. "Safety device for a vehicle," Continental. EP3279897B1. (Filed 2016/Approved 2019).
Breath-based and Driver monitoring system description highlight

> The determination of the safety level may also comprise determination of facial expression by means of the camera 20 and the control device 16 and/or exhaled alcohol vapors detection.[598]

Aptiv

Touch or breath-based system

75. "Chemical vapor sensor having an active and a passive measurement mode," Aptiv. (Filed 2005/Approved 2007/In 2018 now owned by Aptiv)
Breath-based sensor description highlight

> **Abstract.** A chemical vapor sensor is provided that measures a chemical species of interest with high sensitivity and chemical specificity. In an aspect, an ethanol vapor sensor is provided, sized for being inconspicuous and on-board a vehicle, having a passive measurement mode and an active breathalyzer mode, for detecting a motor vehicle driver that exceeds a legal limit of blood alcohol concentration (BAC), for use with vehicle safety systems. For the passive mode, a vapor concentrator is utilized to amplify a sampled vapor concentration to a detectible level for use with an infrared (IR) detector. In an aspect, ethanol vapor in a vehicle cabin is passively measured and if a predetermined ethanol level is measured, a countermeasure is invoked to improve safety.[599]

Driver monitoring system to determine alcohol impairment

76. Aptiv noted driver monitoring systems to determine alcohol impairment.
Driver monitoring system description highlight

> ***So, how does the camera know whether the driver is tired, stressed, distracted or impaired***? The interior sensing platform collects data points from the entire face and compares them to a baseline for that driver. Is the driver blinking more often than usual, or are the blinks lasting longer than usual? Is their head tilting at an odd angle? Are their eyes narrowing or closing? Has their facial expression changed? The system can follow the eyes of the driver to make sure the driver is focused on the road. In addition, the platform can spot when a driver has "spaced out" and is staring straight ahead but not really paying attention. Advanced systems will also be able to understand what might be distracting the driver and get their attention back on the road.
>
> Systems can build on basic drowsiness and distraction recognition with additional capabilities. They can detect voices and accurately identify drivers with cameras and biometrics such as fingerprints. ***They can determine whether the driver is intoxicated,*** stressed, lost in thought, or even trying to spoof the autonomous driving system by holding up a picture.[600]
>
> Driver-monitoring systems that can detect drowsiness or inattention are just the beginning. As these systems evolve, they will become part of a broad interior sensing platform that provides personalization, advanced safety, infotainment and even connectivity with smart home systems. The DMS can identify the driver and enable personalization to automatically adjust the seat, temperature, side mirror, etc., to the driver's preferences. ***The systems will be able to identify whether the driver is impaired*** or is having a medical emergency.[601]

Gentex

Touch or breath-based system

77. "Systems and methods for ride share monitoring," Gentex. US11074465B2. (Filed 2019/Approved 2021).
    Breath-based sensor description highlight
    > Additionally, the chemical detection device 70 may be configured to detect and identify a variety of chemicals that may generally be considered dangerous which may or may not cause a significant odor. Examples of such chemicals or sources of such chemicals may be allergens including, but not limited to, peanuts, soy, perfumes, smog, etc. Additional examples of chemical or sources of such chemicals may include, but are not limited to, explosives, gun powder, accelerants, carbon dioxide, carbon monoxide, volatile organic compounds (VOCs), ***drugs (e.g. methamphetamine, alcohol***), smog, smoke, exhaust, etc.[602]

Driver monitoring system to determine alcohol impairment

78. "Driver intoxication test system and method," Gentex. US20230286379A1. (Filed/Pending 2023).
    Driver monitoring system description highlight
    > **Abstract.** A driver intoxication test system is provided for a vehicle including: a quick intoxication pre-test subsystem for quickly determining whether there is reason to suspect the driver may be intoxicated; an intoxication validation test subsystem for determining whether the driver is intoxicated; and a controller is configured to determine whether the quick intoxication pre-test subsystem has detected a reason to suspect the driver may be intoxicated. When a reason to suspect the driver may be intoxicated has been detected, an intoxication validation test is conducted and it is determined whether the driver has passed the intoxication validation test. When a reason to suspect the driver may be intoxicated has not been detected, the controller does not instruct the intoxication validation test subsystem to conduct an intoxication validation test. [603]

79. "Systems and methods for eye gaze based alertness measurement," Gentex. US20230294706A1. (Filed/Pending 2023)
    Driver monitoring system description highlight
    > The delay between the controller 28 recognizing an event (and determining a target direction 62) and the looking direction of the eye 20 of the driver 11 being directed toward the event may be compared to a database of delay data corresponding to similar events. In this way, the delay may be correlated with an accurate alertness measurement. For example, the database may be employed to determine an average response time of the driver 11 seeing a deer (e.g., the deer 48 a of FIG. 4A) within 3 meters of the vehicle. The actual response time of the driver 11 may be compared to the average response time to determine how alert the driver 11 is. It is generally contemplated that the gaze direction 34 may be less detectable when the eyes 20 are closed. The duration of eye closure may further be incorporated with the alertness detection process to identify a particular state of the driver 11. The state may be at least one of an inebriated state, a drunken state, an intoxicated state, a drowsy state, an asleep state, or any state associated with inattentiveness and/or eye closure duration or level of closure.[604]

80. "Radar-based monitoring in a vehicle," Gentex. US20210209386A1. (Filed/Pending 2021).
    Driver monitoring system description highlight

In step 160, radar-based occupant monitoring system 10 may determine whether a driver of vehicle 44 is impaired. In step 170, in response to a determination that the driver of vehicle 44 is impaired, radar-based occupant monitoring system 10 may communicate with a vehicle system capable of causing vehicle 44 to pull off a road into a safe location. The safe location may be a shoulder of a road, a parking lot, and the like.[605]

LG Innotek

Touch or breath-based system

81. "Vehicle Safe Starting Device," LG Innotek. US20180037113A1. (Filed 2016/Approved 2019).
    Touch-based sensor description highlight
    The present invention relates to a vehicle safe starting device which controls the starting of a vehicle according to a driver's state. One embodiment analyzes blood alcohol concentration by projecting infrared rays into the driver's skin and receiving a reflected signal, and thereafter controls so that the vehicle is not stared if the blood alcohol concentration is larger than a reference value. Since a general breathalyzer using a driver's exhalation is not used, but infrared rays and a method of skin contact touch using a finger, etc. are used, it is possible to accurately measure the blood alcohol level without giving a driver inconvenience, and it is possible to preempt vehicle accidents by blocking driving in an inappropriate state.

    A touch part physically contacting skin of a man; an optical sensor part projecting an electromagnetic wave of a predetermined frequency region to the skin of a man contacted by the touch part and receiving a reflective signal of the projected electromagnetic wave; and an analysis part analyzing the reflective signal and outputting a start control signal as a result of the analysis."[606]

Panasonic

Touch or breath-based system

82. "Alcohol detection system," Panasonic. US7911350B2. (Filed 2008/Approved 2011).
    Touch-based sensor description highlight
    Abstract. A drunk driving detection system to be incorporated in a vehicle includes a steering wheel, a film, a pair of contact detection electrodes, an alcohol sensor, and a control circuit. The steering wheel is provided with an opening in a portion to be grasped by a driver. The film is liquid-impermeable and air-permeable, and covers the first opening. The contact detection electrodes are provided on the film. The alcohol sensor is provided in a space in communication with the opening. The control circuit is connected to the contact detection electrodes and the alcohol sensor, and measures the resistance between the contact detection electrodes. When the resistance is within a predetermined range, the control circuit determines that the driver is in contact with the film and detects an alcohol drinking condition of the driver based on the output from the alcohol sensor.[607]

Driver monitoring system to determine alcohol impairment

83. "Method for estimating physical condition, physical condition estimation apparatus, and non-transitory computer-readable recording medium," Panasonic. US11883210B2. (Filed 2021/Approved 2024).
    Driver monitoring system description highlight

In the fifth example, a case will be described in which the level of intoxication of a person is estimated as the person's physical condition.

[0117] In the present example, for example, the physical condition estimation apparatus 10 measures the blood flow volumes of the person's forehead and the portions under the person's eyes as the blood flow volumes of the at least two body parts. The physical condition estimation apparatus 10 then estimates the level of intoxication of the person as the person's physical condition on the basis of the measured blood flow volumes of the person's forehead and the portions under the person's eyes Since the blood flow volume of the portions under a person's eyes becomes high relative to the blood flow volume of the person's forehead when the person is intoxicated and the blood flow volume of the portions under the person's eyes becomes low relative to the blood flow volume of the person's forehead when the person is sick due to intoxication, the level of intoxication of the person can be estimated.

[0118] If the physical condition estimation apparatus 10 in the present example is installed in a vehicle and estimates that the level of intoxication of the person is equal to or higher than a certain value, that is, if the person is intoxicated, the physical condition estimation apparatus 10 may control an engine of the vehicle such that the engine does not start (device control). As a result, an intoxicated person is prevented from driving the vehicle.

[0119] If the physical condition estimation apparatus 10 in the present example estimates that the level of the intoxication of the person is equal to or higher than the certain value, that is, if the person has drunk too much, the physical condition estimation apparatus 10 may notify the person of the result of the estimation or display the level of intoxication of the person to the person .As a resist, the person can understand the level of intoxication thereof and it becomes possible to prevent the person from drinking too much again.

[0120] The method for estimating the level of intoxication of a person as the person's physical condition is not limited to the one based on the blood flow volumes of at least two body parts. The level of intoxication of person may be estimated on the basis of the person's facial expression, heartrate, blood pressure, blood flow, or exhaled air, instead, Since, when a person gets intoxicated, the person's line of sight becomes unstable, the person's circulation of the blood improves and the person's heartrate increases, the person's face turns red, the person becomes relaxed and the person's blood pressure decreases, and the alcohol concentration of the person's exhaled air increases, the level of intoxication of the person can be estimated. One, some, or all of these pieces at information may be used to estimate the lever of intoxication of a person.[608]

Sony

Driver monitoring system to determine alcohol impairment

84. "Vehicle control apparatus and vehicle control method," Sony. US20190329791A1. (Filed 2018/Pending 2019).

Driver monitoring system description highlight

The present technology relates to a vehicle control apparatus and a vehicle control method that allow safer automated driving. The vehicle control apparatus includes a driver monitoring section and a penalty application section. The driver monitoring section detects a driving intervention level indicating an extent to which the driver intervenes in driving of a vehicle.

In step S45, the driver's condition detection section 142 determines whether or not a dangerous situation is present. Here, the dangerous situation refers, for example, to

a **situation in which the driver is unable to resume the requested driving intervention level at once or drive properly, for example, because the driver is unconscious, fast asleep, or drunk.** Then, in the case where it is determined that a dangerous situation is not present, the process proceeds to step S46.[609]

85. "Vehicle control device, vehicle control method, and program," Sony. US20210221339A1. (Filed/Pending 2021).

Driver monitoring system description highlight

The driver monitoring unit 42 monitors a driver to determine whether the driver loses a normal judgment ability or physical movement ability. For example, the driver monitoring unit 42 detects a direction of a face and opening degrees of eyelids from the imaged image of the driver. In a case where a period in which the driver does not face forward or a period in which the eyelids are closed than a predetermined opening degree has exceeded a threshold, the driver monitoring unit 42 determines whether the normal judgment ability or physical movement ability has been lost. **Furthermore, the driver monitoring unit 42 judges ingestion of drugs or alcohol on the basis of expressions and behaviors of the driver and may determine whether the normal judgment ability or physical movement ability has been lost from the determination result**. The driver monitoring unit 42 outputs the determination result to the electronic control unit 60.[610]

Combination of driver monitoring, breath, or touch systems to determine alcohol impairment

86. "Automatic driving control device and automatic driving control method, and program," Sony. US11718329B2 (Filed 2021/Approved 2023)

Breath-based sensor description highlight

In a case where an alcohol detection sensor is connected to the monitor unit 21, the monitor unit 21 detects the alcohol intake level of the driver on the basis of the alcohol concentration detected from the breath of the driver, and provides the alcohol intake level to the determination processing unit 26 as the driver status. Therefore, when switching to the automatic driving mode, the determination processing unit 26 can determine whether the driver has a sufficient level of driving ability to recover back to the manual driving or not on the basis of the alcohol intake level of the driver. Further, when switching to the automatic driving mode, the determination processing unit 26 uses the determination result based on the alcohol intake level of the driver, and observes the elapse of the transition of the consciousness degree of the driver…

Driver monitoring system description highlight

In step S132, the driver status determination unit 153 obtains the driver status from various kinds of data monitored by the driver monitor device 127, and provides the driver status to the automatic driving controller 154. For example, the driver status determination unit 153 obtains, as the driver status, biometric information about the driver such as the stability of the line of sight, the alcohol intake degree, the pulsation, a face recognition fatigue degree measurement result, an odor measurement result, a response evaluation of the driver according to the human machine interface, and the like.[611]

Toyoda Gosei

Combination of driver monitoring, breath, or touch systems to determine alcohol impairment

87. "Alcohol level detection device," Toyoda Gosei. US20230067020A1. (Filed 2022/Pending 2023). The system uses a gas sensor to determine alcohol impairment next to the skin of a driver and also a driver monitoring system to determine impairment.
Driver monitoring system and gas-based sensor description highlight
Abstract. An alcohol level detection device capable of detecting an alcohol level of a driver, includes a thermal camera mounted near a driver seat and to detect a body temperature of the driver, a contact electrocardiogram sensor disposed on a steering wheel steered by the driver and to detect an electrocardiogram waveform and a heart rate of the driver, a non-contact gas detection sensor disposed on a grip of the steering wheel and to detect an alcohol component contained in a gas discharged from a skin of the driver without contact with the skin, and a determination circuit which determine the alcohol level of the driver based on a measurement value of the body temperature detected by the thermal camera, measurement values of the electrocardiogram waveform and the heart rate detected by the contact electrocardiogram sensor, and a value of the alcohol component detected by the gas detection sensor. [612]
88. "Intoxication detection device," Toyoda Gosei. US20230304991A1. (Filed/Pending 2023). The system uses a gas sensor to determine alcohol impairment next to the skin of a driver and also a driver monitoring system to determine impairment.
Driver monitoring system and gas-based sensor description highlight
Abstract. An intoxication detection device includes: a gas detection sensor; a gas storage recess which is recessed to accommodate the gas detection sensor therein; and an exhaust fan formed adjacent to the gas storage recess. The intoxication detection device is configured to detect an alcohol component contained in a discharge gas discharged from a skin of the driver without contacting the skin in response to a hand of the driver being brought close to the gas detection sensor. The exhaust fan is operated for a predetermined period of time while a state of the hand blocking the gas storage recess is detected, and during the operation, the exhaust fan is configured to exhaust air or the discharge gas stored in the gas storage recess. The gas detection sensor is set so as to measure the discharge gas stored in the gas storage recess after the exhaust fan stops operating.[613]

Tier 2 Suppliers/Other

Driver Alcohol Detection System for Safety (DADSS)

The Driver Alcohol Detection System for Safety (DADSS), is a public-private partnership between NHTSA and the Automotive Coalition for Traffic Safety (ACTS) that began in 2008. [614]

Touch or breath-based system

89. ACTS estimates their breath or touch based technology will cost auto manufacturers $150-$200 per vehicle to add their technology, and reports it has tested an initial version, aiming to have a device that would comply with the law by the end of 2025.[615, 616]

90. "Sensor system for passive in-vehicle breath alcohol estimation," Automotive Coalition for Traffic Safety. US11104227B2. (Filed 2016/Approved 2021)
Breath-based sensor description highlight
Abstract Methods and apparatus allow for passive determination of a driver's Breath Alcohol Concentration (BrAC). Alcohol concentrations can be determined from exhaled breath, however inconvenience to a driver is often a barrier for incorporation

of BrAC sensors into vehicles. The methods and apparatus allow for passive determination of a driver's BrAC, while detecting and accounting for a wide range of environmental conditions that may reduce the accuracy of a passive BrAC reading. [617]

91. "Breath test system," Automotive Coalition for Traffic Safety. US11391724B2. (Filed 2013/Approved 2022)
Breath-based sensor description highlight
FIG. 1 is a schematic drawing (not to scale) of one embodiment of the system 1 according to the invention. The system 1 may be built into a separate physical enclosure, or being part of inventories, e.g. in a vehicle cabin. A test person 12 is shown positioned in the vicinity of an inlet area 4 of the sensor unit 5, equipped with a sensor element 8 generating a signal corresponding to the ethyl alcohol concentration of the air flowing through the inlet area 4. Means for active transport of air through the sensor unit 5 is provided by a fan or pump 9, preferably including means for controlling the volume flow. The inlet area 4 constitutes one or several openings, into which air can be freely flowing, or driven by the fan 9. Preferably, a particle filter 11 e.g. made from porous material is included in the inlet area 4. This prevents particles and aerosols from contaminating the sensor unit 5 while not impeding the air flow to any significant degree. When the person 12 is directing expiratory air towards the inlet area 4 from a distance not exceeding 50 cm, the air flowing through the sensor unit 5 will consist of a mixture of ambient and expiratory air from the person 12. [618]
92. "Highly accurate breath test system," Automotive Coalition for Traffic Safety. US10151744B2. (Filed 2013/Approved 2018)
Breath-based sensor description highlight
FIG. 1 shows a schematic drawing (not to scale) of one embodiment of the system 1 according to the invention. It comprises a sensor unit 5 including a compartment C which forms a passage for breath air that is to be analyzed, a source 6 of IR light, i.e. an IR emitter, and a first sensor 8 capable of detecting a volatile substance, e.g. ethanol, a second sensor 7 capable of detecting e.g. CO2, and suitably a fan or a pump 9, driven by a motor. The system suitably also comprises a presence detector 2 for detecting that a test person is in the vicinity of the system, and also preferably an audiovisual unit 3 comprising a display unit 3 b and a loudspeaker 3 a. The system also comprises an analyzer 10, which preferably includes a general purpose digital microcontroller with capacity to execute signal algorithms, and means 14 for bidirectional control of current drive pulses to the motor driving the fan or pump. [619]

93. "System for non-invasive measurement of an analyte in a vehicle driver," Automotive Coalition for Traffic Safety. US10099554B2. (Filed 2016/Approved 2018).
Touch-based sensor description highlight
Abstract. A system for non-invasively measuring an analyte in a vehicle driver and controlling a vehicle based on a measurement of the analyte. At least one solid-state light source is configured to emit different wavelengths of light. A sample device is configured to introduce the light emitted by the at least one solid-state light source into tissue of the vehicle driver. One or more optical detectors are configured to detect a portion of the light that is not absorbed by the tissue of the vehicle driver. A controller is configured to calculate a measurement of the analyte in the tissue of the vehicle driver based on the light detected by the one or more optical detectors, determine whether the measurement of the analyte in the tissue of the vehicle driver exceeds a pre-determined value, and provide a signal to a device configured to control the vehicle. [620]

Combination of driver monitoring, breath, or touch systems to determine alcohol impairment

94. "System and method for controlling operation of a vehicle using an alcohol detection apparatus," Automotive Coalition for Traffic Safety. US20200101982A1. (Filed 2019/Approved 2021).

Driver monitoring system description highlight

As shown in the diagram, the system 5 contains one or more cameras 80 to record activity while the operator is attempting to start the car and thereafter. It can be appreciated by those skilled in the art that the controller 25 can run a facial recognition algorithm to determine if the person giving the voice command to start the car is sitting in the driver's seat and is the operator of the vehicle. Thus, the system 5 is able to determine if someone other than the driver is attempting to give the voice command and the breath sample. If the system 5 determines that someone other than the person sitting in the driver's seat is attempting to start the car, the prompt "vehicle disabled" is given.

Breath-based sensor description highlight

Note that breath alcohol sensor unit 40 is configured so that it can work in "sniffer mode", drawing the driver's breath into the breath analyzer 75. To this end, breath alcohol sensor unit 40 comprises the fan 60 which is provided to draw the driver's breath into the breath alcohol sensor unit. Note that fan 60 is preferably turned on before or when the driver starts speaking so that breath alcohol sensor unit 40 is able to capture as much breath as possible, whereby to provide a more accurate BRAC measurement (and hence provide a more accurate blood alcohol concentration reading). To this end, system 5 can be configured to turn on fan 60 when the driver's door is opened, or when the driver sits in the driver's seat, or when the driver begins to speak, etc.

Touch-based sensor description highlight

In one form of the invention, the system 5 utilizes the touch alcohol sensor unit 90 in addition to the one or more breath alcohol sensor unit 40. This can be helpful where breath alcohol sensor unit 40 yields inconclusive results, or where it is desired to confirm the results of breath alcohol sensor unit 40. The touch alcohol sensor unit 90 uses one or more lasers that are able to penetrate the skin of the operator's finger. The touch alcohol sensor unit 90 detects the returning light and able to sense the blood alcohol content using an infrared or near-infrared light. However, other spectroscopy methods using different regions of the electromagnetic spectrum could be used as well. [621]

95. "System and method for disabling a vehicle," Automotive Coalition for Traffic Safety. US20120228047A1. (Filed 2012/Approved 2013).

Driver monitoring system description highlight

The system includes an image capturing system and a blood alcohol detection and monitoring system. As shown in FIG. 6, the image capturing system is mounted to capture an image of the driver 20. A rear facing camera 80 is positioned proximate to location of the blood alcohol detection sensor 50. The system includes both a camera and signal processing electronics 90. The signal processing electronics 90 typically includes a microprocessor or controller contained in a module. The system is configured to determine whether the hand presented at the alcohol sensing detector 50, is in fact connected to the person in the driver seat.

Touch-based sensor description highlight

As shown in FIG. 2, a blood alcohol detection system is provided. The blood alcohol detecting system includes a finger sensor 50 for sensing the finger of the vehicle driver. The results of the interaction between the finger sensor and the driver's finger are analyzed by a controller to determine the blood alcohol concentration of

the driver. The sensor and alcohol detecting system may employ any of a number of known technologies.[622]

Senseair/Asahi Kasei Microdevices

Touch or breath-based system

96. At CES in 2022, Asahi Kasei Microdevices featured the passive breath-based system to determine alcohol impairment. [623, 624, 625, 626,627, 628] At CES in 2024, Asahi Kasei Microdevices and Senseair again featured this system.[629]

Breath-based sensor description highlight

Our touch-fee alcohol sensors, which do not require a mouthpiece, are likewise crucial for driver safety.[630]

The system draws the driver's exhaled breath into a sensor device, which measures both of concentrations of alcohol and carbon dioxide. The known quantity of carbon dioxide in human breath serves as an indicator of the degree of dilution of the alcohol concentration of the exhaled air. The Senseair alcohol sensor utilize NDIR technology, similar to evidential grade equipment used by the Police, for quick and accurate concentration calculation.[631]

97. "Preventive and persuasive actions against drunk driving," Senseair. US8370027B2. (Filed 2007/Approved 2013).

Breath-based sensor description highlight

Abstract. A vehicle safety system is provided that includes an alcohol concentration determining arrangement. A control unit is adapted to receive and analyze data from the alcohol concentration determining arrangement and output a blocking signal or a dissuasion signal under certain conditions. A blocking arrangement is adapted to prevent driving of the vehicle by the vehicle occupant upon receipt of a blocking signal. An output device is adapted to receive the dissuasion signal and to present a warning to the vehicle occupant to dissuade the occupant from driving the vehicle. The control unit is operable to categorize the concentration of alcohol in the occupant's blood into one of three categories: a low concentration category, in which the blocking signal will not be generated, a high concentration category, in which the blocking signal will be generated, and an intermediate category, in which the dissuasion signal will be generated.[632]

98. "Multi-channel gas sensor," Senseair. US11499914B2. (Filed 2020/Approved 2022).

Breath-based sensor description highlight

In embodiments, the multi-channel gas sensor may comprise a computational unit that is arranged with a correlation algorithm to calculate the diffusion factor needed for estimating the breath alcohol concentration and blood alcohol level.[633]

99. "Combined vehicle mounted breath analyzing and hvac system and method," Senseair. US20220242416A1. (Filed 2020/Pending 2022).

Breath-based sensor description highlight

Abstract. The present invention relates to a breath analyzing system and method. In particular the invention relates to a breath analyzing system combined with a heat, ventilation and air conditioning system (HVAC-system) of the vehicle, wherein the settings of the HVAC system are controlled to optimize the performance of the breath analyzing system. In particular the HVAC system may be set to a closed

position facilitating a concentration build up of breath gases in the compartment. Alternatively the HVAC system may shift between open and closed positions.[634]

100. "Method and system for determination and classification of intoxicating substance in a breath sample facilitated by a user interaction scheme," Senseair. US20230286466A1. (Filed 2021/Pending 2023).

Breath-based sensor description highlight

Abstract. The present invention relates to a breath analyzing system and method. In particular the invention relates to a breath analyzing system and method arranged to provide tracer-aided determination and classification of the presence of a breath intoxicating substance facilitated by a user interaction scheme. If a determination may not be performed within a first compliant mode of operation an interactive mode is initiated wherein the user is stepwise instructed to perform actions that facilitate the classification. An action compliance value, representing how well the user follows issued actions/instructions, is determined and used to select actions.[635]

101. "Method and system for tracer-aided determination and classification of intoxicating substance in breath sample," Senseair. US20230051132A1. (Filed 2021/Pending 2023).

Breath-based sensor description highlight

Abstract. The present invention relates to a breath analyzing system and method. In particular the invention relates to a breath analyzing system and method arranged to provide tracer-aided classification of the presence of a breath intoxicating substance above a limit concentration and providing status to a user about the progression of the classification. The method/system detects a peak in the tracer signal and defines an evaluation period corresponding to the duration of the peak. Measurements classification of the concentration of the intoxicating substance is used for the evaluation period, and if required to achieve a result, for a plurality of evaluation periods.[636]

102. "Multi wavelength breath analyzing system and method," Senseair. US20220244241A1. (Filed 2020/Pending 2023).

Breath-based sensor description highlight

Abstract. The present invention relates to a breath analyzing apparatus and method. In particular the invention relates to a breath analyzing apparatus operating in the 3.3-3.6 μm wavelength range and arranged to provide absorption information in at least two different wavelength bands in the wavelength range. The absorption information from the wavelength bands are compared with tabulated data of preselected substances to identify an unidentified substance.[637]

103. "Gas sensor system," Asahi Kasei Microdevices. US20230324290A1. (Filed 2023/Pending 2023)

Breath-based sensor description highlight

The air intake port 11 and the air discharge port 12 are connected to the gas sensor 10. When alcohol concentration measurement is to be performed in the present embodiment, air including exhaled air of a driver is introduced into the cell of the gas sensor 10 from the air intake port 11. Moreover, after alcohol concentration measurement or the like has been performed, air inside the cell of the gas sensor 10 is discharged from the air discharge port 12. [638]

CorrActions

Driver monitoring system to determine alcohol impairment

104. In 2023, CorrActions announced technology to determine alcohol and drug-impairment via a driver monitoring system.[639]

Driver monitoring system description highlight

> CorrActions provides a software-only, motion based, driver monitoring product. CorrActions uses unconscious, uncontrollable, muscular submovements to monitor brain activity. By tracking these movements from sources like steering wheels or smartphones, CorrActions can detect a wide range of cognitive states. For example, fatigue, inattention, anxiety, alcohol/ drugs, etc. [640]

105. "System and method for monitoring individual's daily activity," Corractions. US20230414129A1. (Filed 2021/Pending 2023)

Driver monitoring system description highlight

> The present invention provides a novel technique for quantification of individual's operational state (e.g., low motivation, cognitive load, intoxication, mental fatigue, drowsiness, stress, inattention, vertigo, motion sickness) according to cognitive error detection by said individual in his/her activity. This is implemented in the invention using a sensing system in signal/data communication with a control system. The sensing system may be of any known suitable type including one or more sensors capable of monitoring movement intention or movement of at least a portion of the individual's body and providing corresponding motion pattern data. The control system analyses the motion pattern data to identify a motion profile indicative of the individual's cognitive operational state according to individual's error detection, prior, during or after to actual occurrence of the error.[641]

Smart Eye

Driver monitoring system to determine alcohol impairment

106. In 2022, Smart Eye stated that it is researching and testing a driver monitoring system to detect alcohol impairment.[642]

Driver monitoring system description highlight

> In an on-going study called Fit 2 Drive, Smart Eye and the Swedish National Road and Transport Research Institute (VTI) have so far been able to collect data from more than 30 participants while gradually increasing their blood alcohol concentration. At the same time, the participants drove a car equipped with multiple sensors on an enclosed race track. This is the first collection of data to offer visual information from the driver, giving valuable insight into how different people behave at different levels of intoxication.
>
> In Sweden, driving while intoxicated is illegal even in very controlled situations on an enclosed test track. In order to conduct the study, Smart Eye and VTI had to get special permission from the Swedish government. But despite the complicated processes of collecting data from drunk drivers, these types of studies are absolutely necessary for future research on driver impairment.[643]

DYM Sense

Touch or breath-based system

107. DYM Sense is a touch-based system to determine alcohol impairment.[644]

Touch-based sensor description highlight

A special sensor detects a high level of alcohol in the driver's blood, and prevents the vehicle from starting.[645]

108. "Devices, systems and methods for non-invasive measurement of blood alcohol level," DYM Sense. US20210100498A1. (Filed 2020/Pending 2021).

Touch-based sensor description highlight

Abstract. A system for determining a blood alcohol level of a subject may include a single light-emitting diode (LED) or, in some embodiments, two LEDs that may be operated in a pulsed mode and may illuminate a target location on a subject (e.g., a portion of a distal phalanx of a finger) with multiple illuminated light pulses. The system may include a photosensor that may sense multiple light pulses received from (e.g., reflected from, or transmitted through) the target location and generate multiple output signals. The system may include a controller that may determine a blood alcohol level of the subject based on the multiple output signals. Utilization of a single LED/two LEDs and operation thereof in a pulsed mode may prevent (or significantly reduce) heating of the LED(s) and/or the photosensor, thus eliminating a need in cooling units.[646]

Micron

Driver monitoring system to determine alcohol impairment

109. "Impaired driver assistance," Micron. US11753047B2. (Filed 2020/Approved 2023)

Driver monitoring system description highlight

For example, based on the current level of mental capacity of a driver evaluated via an artificial intelligence (AI), a vehicle can selectively give control to or take control from the driver. For instance, the vehicle can enable an autonomous driving mode, disable driving of the vehicle, order a rideshare for the driver, or determine a destination from an inference made based on a pattern of trips made using the vehicle, the current location, and the current time. ***These are some of the many actions the vehicle can take based on the mental capacity or determined impairment of a driver or a potential driver.***

In some embodiments, the received data received from the camera(s) and/or the sensor(s) (e.g., see cameras 118 a to 118 b and sensors 114 a to 114 b) can include information on a gait of a driver approaching the vehicle 102 before driving the vehicle, information of a posture of the driver while approaching the vehicle or while in the vehicle, or information on facial characteristics of the driver, or any combination thereof. ***The received data can also include information on blood alcohol content of the driver, a body temperature of the driver, or speech of the driver, or any combination thereof***. [647]

110. "Black box operations controlled by driver mental state evaluation," Micron. US20210245765A1. (Filed 2020/Approved 2022).

Driver monitoring system description highlight

Alternatively, or in conjunction with the foregoing, a user's mental state can be determined using specialized hardware. As one example, a vehicle can be equipped with a breathalyzer device. A user may be required to use this device prior to using a vehicle. The output of such a device may comprise a blood alcohol content (BAC) level value. In some embodiments, this BAC value may be used to set the mental state. In other embodiments, this value may be used as a factor in determining the user's mental state (e.g., combined with operational parameters).

In some embodiments, the output of block 102 comprises a continuous value. In this scenario, the value can comprise a value between 0 and 1, inclusive, where zero represents a fully alert mental state and 1 indicates a fully impaired mental state. In this scenario, a value between 0.00 and 0.25 may indicate a normal/alert state, a value between 0.25 and 0.50 may indicate a drowsy state, a value between 0.50 and 0.75 may indicate a tired state and a value between 0.75 and 1.00 may indicate an impaired state.[648]

111. "Determining driver capability," Micron. US20230329612A1. (Filed 2022/Pending 2023)

Driver monitoring system description highlight

In some examples, the AI model 225 can be updated and/or replaced periodically or in response to new data being available to train the AI model 225. For example, the AI model 105 can be updated with new clinical data and/or data associated with the driver including data indicative of a driver's baseline and/or data indicative of a driver just prior to an impairment event, during an impairment event, and/or just after an impairment event.

At block 444, the method 440 can include inputting the data into an AI model. The AI model can be trained with clinical data and/or data from people who suffer from the same re-occurring and intermittent health condition as the driver. The AI model can also be trained with data associated with the driver. The data associated with the driver can enable the AI model to establish normal characteristics of the driver, characteristics of the driver just prior to an impairment event, characteristics of the driver during an impairment event, and/or characteristics of the driver just after an impairment event.[649]

112. "Driver screening," Micron. US11091166B1. (Filed 2020/Approved 2021)

Driver monitoring system description highlight

In some embodiments, a taxicab or a vehicle of a ridesharing service can take pictures or record a video of a driver inside the taxicab or vehicle and generate a risk score of the driver. ***The risk score can relate to whether or not the driver is too tired, intoxicated, or unstable to drive. The score can even relate to an intoxication level or tiredness level of the driver as well as the mental state or stability of the driver.*** The score can also relate to physical or cognitive impairment of the driver, criminal history of the driver and riding history of the driver. The customer, via a mobile device, can be presented the risk score when booking a ride. Also, the rider can be alerted or prompted to refuse the driver when the risk score is above a threshold. This can occur when the customer is using the mobile device to book a ride. To put it another way, in booking a taxi or ridesharing, a vehicle can take pictures of the driver and evaluate the performance readiness level of the driver (e.g., whether the driver is tired, slow in response, intoxicated, the current performance level relative to peak performance level, driving style, etc.).[650]

[1] "Fast Act Reauthorization: Transportation and Safety Issues," U.S. Senate. June 19, 2019. https://www.govinfo.gov/content/pkg/CHRG-116shrg52608/html/CHRG-116shrg52608.htm

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