



UNITED STATES
DEPARTMENT OF TRANSPORTATION

V2V Safety Research Program

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1939 WORLDS FAIR :“FUTURAMA”



Agenda

- The Motor Vehicle Safety Challenge

- V2V technology explained

- USDOT and its partners accomplishments thus far

- V2V research moving forward



Motor Vehicle Safety Challenge

- 32,367 highway deaths in 2011
- 5.3 million crashes in 2011
- Leading cause of death for ages 4, 11-27

- Vehicle-to-vehicle communications technology can address a large majority of these crashes. Key types of crashes address by V2V include:

- *Rear-end and head-on collisions*
- *Lane change related (blind spot warning)*
- *Intersection related*
- *Turning across path (left hand turns)*



Connected Vehicle Technology – 5.9 GHz DSRC

■ What is it?

- Wi-Fi radio adapted for vehicle environment

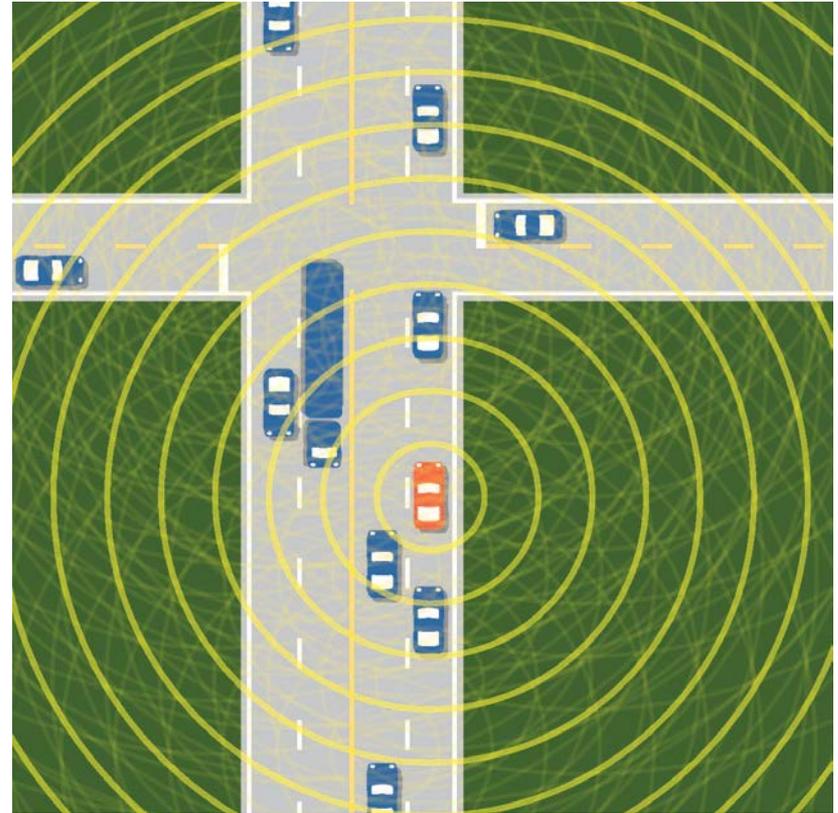
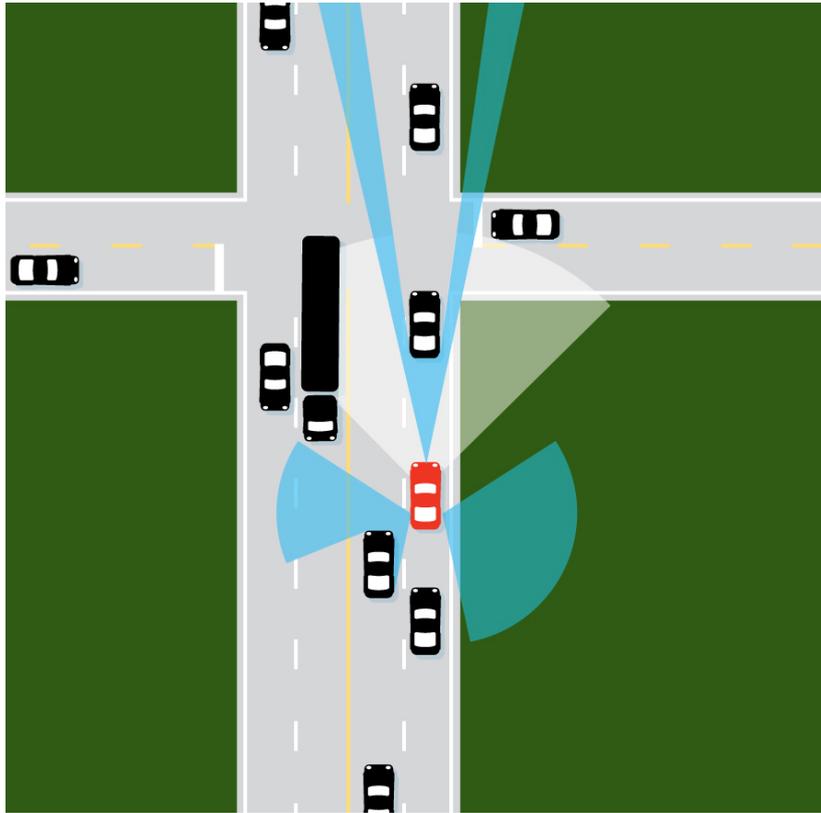
■ How does it work?

- A “Basic Safety Message” (BSM) is transmitted from each equipped vehicle 10 times per second.
- BSM includes information about the “other” vehicles’ location, speed and heading.
- Each vehicle “listens” for these message from other vehicles, computes trajectories, and identifies potential crash situations
- Warning are issued to the driver if a crash is determined to be “imminent”.
- Cautionary warnings can also be issued to prevent an imminent crash situation from developing in the first place.



Benefits of V2V communications....

Uses a single sensor (radio) to detect threats from all directions



Compared to non-cooperative detection systems (e.g., radar, camera), V2V offers potentially lower cost for more comprehensive situational awareness

Benefits of V2V communications...continued

- DSRC signals go beyond “line of sight” systems to allow earlier warnings in challenging crash situations.
- BSM messages provide better information about driver intent (by transmitting path histories, turn signal, brake and throttle status for example) which can enhance path predictions and thus target warnings more precisely.
- V2V technology can also be leveraged to:
 - enhance automated vehicle operations; and,
 - provide a technology platform for a variety of high value mobility and environmental applications

V2V “special” requirements

- **A security solution is needed to ensure trusted communications between vehicles and to maintain appropriate privacy**
 - **Public key Infrastructure (PKI)**
 - **Security Credential Management System (SCMS)**
 - **Communications Data Delivery System (CDDS)**
- **Requires “two (or more) to tango”**
 - **Safety benefits critically linked to market penetration**
 - **To speed deployment, USDOT and its partners are developing :**
 - **Vehicle Awareness Devices (VADs)**
 - **Aftermarket Safety Devices (ASDs)**
 - **Retrofit Safety Devices (RSDs)**

Connected Vehicle Safety Program Partners and Contractors

Vehicle Manufacturers

Logos of vehicle manufacturers: BMW, GM, VOLVO, HONDA, Mercedes-Benz, Ford, DAIMLER (Daimler Trucks North America), TOYOTA, NISSAN, CHRYSLER, Freightliner, HYUNDAI, KIA MOTORS.

USDOT

Logos of USDOT agencies: U.S. Department of Transportation Research and Innovative Technology Administration (NHTSA), U.S. Department of Transportation Federal Motor Carrier Safety Administration, U.S. Department of Transportation Federal Highway Administration, the VOLPE center, FTA.

Academia

Logos of academic institutions: UGPTI, UMTRI, GEORGE MASON UNIVERSITY, MONTANA STATE UNIVERSITY, Texas Transportation Institute, CVPC, THE UNIVERSITY OF IOWA, CALIFORNIA PATH.

Public Agencies

Logos of public agencies: MDOT (Michigan Department of Transportation), Oakland County Michigan, VDOT (Virginia Department of Transportation), MINNESOTA DOT, ADOT, OAK RIDGE National Laboratory, MCDOT (Metropolitan Council of Denver), NYSDOT.

Industry

Logos of industry companies: SiloSmashers, noblis, Booz | Allen | Hamilton, Telcordia, ECONOLITE, CAMBRIDGE SYSTEMATICS, SIEMENS, kapsch, Visteon, Delcan, DGE Inc., Westat, Autotalks, Savari, DENSO, SAIC, MERITOR WABCO, DELPHI, COGENIA, Mixon Hill, OmitAir, ARINC, ARADA SYSTEMS, MACROSYS, Battelle, ITRI, CISCO, CohdaWireless.

Associations/Standards Developers

Logos of associations and standards developers: ATRI (American Transportation Research Institute), ite, IEEE (Advancing Technology for Humanity), ITS AMERICA, APTA, SAE International, CVSA (Commercial Vehicle Safety Alliance).

What has DOT and its partners accomplished thus far?

Safety Benefits

- Developed and Demonstrated key safety applications
- Demonstrated high level of customer acceptance (Driver Clinics)
- Adapted the technology for multiple vehicle platforms (cars, trucks, buses)

Robustness

- Leveraged a “tried and true” security approach (PKI), adapted it for a mobile environment, and successfully demonstrated fundamental operations in a real world setting.
- Completed Model Deployment to demonstrate operations at (early) real world deployment levels—thus helping verify safety benefits and customer acceptance

Research moving forward

- **Development of test procedures**
 - **Applications**
 - **Communications**
- **Complete Heavy Vehicle Research**
- **Pedestrian crash prevention (V2P)**
- **Motorcycles crash prevention (V2M)**

More detailed discussions to follow...

Key Research areas:

- **Safety Applications Testing– John Harding, NHTSA**
- **Scalability – Mike Lukuc, NHTSA**
- **Initial Security models – Mike Lukuc, NHTSA**
- **DVI Principles –Chris Monk, NHTSA**
- **Heavy Vehicle Research —Alrik Svenson, NHTSA**

Model Deployment

- **Overview - John Harding, NHTSA**
- **Integrated Light Vehicle Project – Mike Lukuc, NHTSA**
- **Model Deployment Characteristics – Emily Nodine, RITA/Volpe**
- **Safety Impact Methodology – Mikio Yanagisawa, RITA/Volpe**
- **Transit Operations– Steve Mortensen, FTA**
- **Lessons learned – Kevin Gay, RITA/Volpe**

Contact Information

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