The Future of Transportation: Autonomous and Connected Vehicles

Tokyo Motor Show
November 26, 2013
We live in an increasingly connected world
Connectivity is changing how we think about transportation

- Bike Sharing
- Connected Vehicle technology
- Electronic tolling
- Multimodal Freight Management
- Bus Rapid Transit
Big data is driving the future of roadway safety

The future of transportation lies increasingly in the continued investment and use of real-time information to make our infrastructure smarter, including enabling vehicles to communicate with each other and with the world around them.

According to U.S. DOT, *nine out of 10 drivers* would like to have vehicle-to-vehicle safety features in their own vehicles and believe the technology would be useful in improving driver safety overall.
Connected vs. Automated Vehicles

Vehicle-to-Vehicle Communications using 5.9 GHz DSRC Vehicles and In-Vehicle Apps Connected to the Internet Autonomous and Semi-Autonomous Vehicles
Dedicated Short Range Communications (DSRC)
Short-to-medium range wireless communications protocol that permits very low latency data transfer critical in communications-based active safety applications
DSRC is the backbone of the connected vehicle program

• Basic Safety Message (BSM) sent 10 times per second (every 100 milliseconds)
• Message communicates vehicle position, trajectory and operational data
• Cars process information and warn driver as necessary
DSRC safety applications

Communications between Vehicle and Infrastructure

- Blind Merge Warning
- Curve Speed Warning
- Emergency Vehicle Signal Preemption
- Highway/Rail Collision Warning
- Intersection Collision Warning
- In–Vehicle Amber Alert
- In–Vehicle Signage
- Just–in–Time Repair Notification
- Left Turn Assistant
- Low Bridge Warning
- Low Parking Structure Warning
- Pedestrian Crossing Information at Intersection
- Road Condition Warning
- Safety Recall Notice
- SOS Services
- Stop Sign Movement Assistance
- Stop Sign Violation Warning
- Traffic Signal Violation Warning
- Work Zone Warning

Communications between Vehicles

- Approaching Emergency Vehicle Warning
- Blind Spot Warning
- Cooperative Adaptive Cruise Control
- Cooperative Collision Warning
- Cooperative Forward Collision Warning
- Cooperative Vehicle–Highway Automation System
- Emergency Electronic Brake Lights
- Highway Merge Assistant
- Lane Change Warning
- Post–Crash Warning
- Pre–Crash Sensing
- Vehicle–Based Road Condition Warning
- Vehicle–to–Vehicle Road Feature Notification
- Visibility Enhancer
- Wrong Way Driver Warning
What is the Safety Pilot?

• Model for a national deployment of the connected vehicle technology
• Designed to determine the effectiveness of the safety applications at reducing crashes
• Designed to determine how real-world drivers will respond to the safety applications
• 1-year deployment began Aug 21, 2012
• Extended to focus on vehicle-to-infrastructure and commercial vehicle applications
Largest connected vehicle pilot in the World

• More than 2,836 cars, commercial trucks, and transit vehicles
• A variety of different devices
  – Vehicle Awareness Devices
  – Aftermarket Safety Devices
  – Integrated Safety Systems
  – Retrofit Safety Devices
  – Roadside Equipment
• 73 lane-miles of roadway instrumented with 27 roadside-equipment installations
Schedule moving forward

- 2013: U.S. DOT decision on light duty vehicles
- 2014: U.S. DOT decision on heavy duty vehicles
- 2015: U.S. DOT guidance on infrastructure
Challenges remain

- Protecting the spectrum
- Developing and funding a security network
- Day one applications
- Role of the aftermarket
- Funding infrastructure
- Privacy
Significant Activity Related to Autonomous Vehicles

• OEMs rolling out product that include increasing level of automation
• OEMs and others testing fully automated vehicles
• Multiple state passing automated vehicle testing laws
• Test beds under development
Levels of vehicle automation

U.S. DOT in May 2013 defined vehicle automation using five levels:

**Level 0: No-Automation**: Driver is in complete control of the primary vehicle controls (braking, steering, throttle, and motive power) at all times.

**Level 1: Function-Specific Automation**: Automation involves one or more specific control functions (electronic stability control, pre-charged brakes, etc.)

**Level 2: Combined Function Automation**: Automation of at least two primary control functions designed to work in unison to relieve the driver of control of those functions.

**Level 3: Limited Self-Driving Automation**: Drivers can cede full control of all safety-critical functions under certain traffic or environmental conditions and rely heavily on the vehicle to monitor for changes that require a transition back to driver control.

**Level 4: Full Self-Driving Automation**: The vehicle is designed to perform all safety-critical driving functions and monitor roadway conditions for an entire trip. Such a design anticipates that the driver will provide destination or navigation input, but is not expected to be available for control at any time during the trip.
Barriers to deployment remain:

• Cost
• Liability
• Security
• Technical
• Societal
21st World Congress on Intelligent Transportation Systems

Cobo Center
September 7-11, 2014
Our Theme and Program

• The theme: *Reinventing Transportation in Our Connected World*

• Major program events: Policy Roundtable, High Level Plenaries, CTO Summit, Executive, Special and Technical Sessions, Opening and Closing Ceremonies, Special Awards
Our Exhibition

• Sales are underway and filling up fast
• More than 300,000 square feet of exhibit space
• Working TMC on exhibit floor
• Entrepreneurial Village
• Youth Connections
Our Technology Showcase

• Primary showcase will take place on Belle Isle, a 983 acre island
• Variety of additional demonstration venues including inside the Cobo Center
• More than 30 demonstrations already being considered
• Theme areas include: Electric Vehicles, Connected Vehicles, Autonomous Vehicles, Day in the Life, Goods Movement, TMC of the Future, Mileage Based User Fees
Cobo Center -- $270 Million Rebuilding
Come to the Motor City