Future Vehicle Safety: Connected, Cooperative, or Autonomous?

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Presentation Outline

- Connected Vehicle Program
- Connected Vehicle Development
- Other Smart Vehicle Efforts
- What Does the Future Hold?





Eliminate Crashes



- Top Down "Big Bang" Approach
- Bottom up "Evolutionary" Approach

Opportunity for Safer Driving

Greater situational awareness

Your vehicle can "see" nearby vehicles and knows roadway conditions you can't see

Reduce or even eliminate crashes thru:

Driver Advisories Driver Warnings Vehicle Control

IntelliDrive has the potential to address 82% of the vehicle crash scenarios involving unimpaired drivers



Work Zone Notification



Intersection Collision Avoidance





Benefits of Connected Vehicles

Safety Benefits

Increase Driver
 Situational Awareness

•Reduce or Eliminate Crashes

- •Driver Advisories
- •Driver Warnings
- Vehicle Safety Controls



Mobility Benefits

- V2I, I2V Interactivity (SPAT)
- Data-Rich Environment
 - Operations Efficiency
 - •Traffic, Transit, Parking
 - Weather
 - Performance Management

Environmental Benefits

- Reduce Emissions
- Save Fuel





Connected Vehicle Key Issues

- NHTSA Requirement for DSRC
- Earliest Deployment 2020 vehicle fleet (late 2019)
- Policy Issues
 - Governance, privacy, security, liability
- Availability of 5.9 GHz DSRC Licenses in Texas
- Migration of Commercial Vehicle Applications to 5.9 GHz DSRC
- Early Infrastructure Deployment



Connected Vehicle Development





Michigan Test Bed

- 50 roadside equipment units (RSEs)
- 9 equipped vehicles with on-board equipment units (OBE)
- 3rd Party Testing On-going



Safety Pilot Project



Safety Pilot

- More than 2,800 vehicles
 - Cars, commercial trucks, transit
 - Integrated Safety Systems, Vehicle Awareness Devices, and Aftermarket Safety Devices
- 73 lane-miles of roadway instrumented with 29 roadsideequipment installations
- 1 year of data collection



Photos Courtesy of E. Seymour, TTI

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FHWA Turner-Fairbanks Test Bed

- Signal, Phase, and Timing (SPaT)
- I2V applications
- Vehicle Warnings
- Eco-driving
- Emergency priority





- Arizona Emergency Vehicle Test Bed
- California SafeTrip21, VII California Test Bed, Vehicle Infrastructure Technology Affiliates Laboratory
- Florida ITS World Congress, Orlando
- Minnesota Automated Snow Plows, Stop Sign Warning Systems
- New York– Commercial Vehicles I-495

Connected Vehicles for State and Local DOTs

- AASHTO Deployment Guide
 - Enhance Safety
 - Reduce primary and secondary crashes
 - Enhance Mobility
 - More accurate traveler info, efficient use of capacity
 - Reduce Environmental Impacts
 - Facilitate Electronic Payment
 - Improve Agency Operational Performance
 - Reduce infrastructure, resources for system maintenance
 - Improve asset condition monitoring, performance measures
 - ITE Connected Vehicle Task Force



Autonomous Vehicles

Automated Highway Systems (AHS) Autonomous Control Unmanned Military Vehicles Degree of autonomy Autonomous Adaptive Cruise Cooperative Platooning Control Adaptive Cruise Control (CACC) Assist Intelligent Intersection Speed Adaption Movement Assist Information/Waming Autonomous Electronic Emergency **Cooperative Collision** Warning Systems Brake Light Warning System

Degree of cooperation

Key: Indicates DOT focus application for connected vehicles

Data source: KPMG - Self Driving Cars: The Next Generation

DARPA Challenge



- 2007 DARP Urban Challenge
- 11 teams, 6 completed course
- 60 mile course
- Traffic control, obstacles, other traffic





Photo: www.tartanracing.org/

Google Car

- A dozen on the road at any one time
- Logged over 300,000 miles
- No crashes while under computer control
- Still challenges with weather, temporary work zones, unique conditions



Photo: www.techhive.com





Autonomous Vehicle Legislative Approval

- Nevada approves autonomous vehicles in February 2012
- Nevada DMV approves Google's license application
- California <u>SB 1298</u> was approved by the State Assembly on Aug. 28 with a vote of 66-2



Photo: www.forbes.com

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– SPaT data

Real-time Traveler Information

Cooperative Systems

- Tolling and pricing applications
- Special use and managed lane systems
- Roadway and Pavement Marking
- Construction Work Zone Warning

What Does the Future Hold?

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Questions Still to be Answered

- Are Applications Available and are Benefits Validated?
- What is the Minimal Infrastructure Needed for Maximum Benefit? How Much, Where, What Type?
- Degree of Market Penetration Required for Effectiveness?
- Is Technology Stable, Reliable, Secure, and Interoperable?
- Are Policies/Governance/Funding Sufficient for Sustainability?
 - Acceptability by the Public?

Observations

- 2010-2019
 - Decade of Connectivity
 - Decade of Electrification



Photo: www.nissan-zeroemission.com

Vehicle Connectivity

ZDNet

Laptops

Virtualization Windows Data Centers Apple C

READ THIS: What Apple should copy from the Sa

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Topic: UberMobile

US Edition

Apple Battles With Android-Centric MirrorLink For Control Connected Car

Summary: There are two cross-vendor efforts to defragment the car computer space ar your automobile. With the outcome uncertain, developers remain in limbo.

By Eric Lai for UberMobile | August 27, 2012 -- 21:35 GMT (14:35 PDT)

Android often gets criticized for fragmentation. But the connected car market has it beat t mile, with literally dozens of competing telematics platforms, each with its own code and c developers to wrestle with.

At the Charged: Electric Vehicle Symposium Silicon Valley held last week on SAP's Palo Altc campus, I learned a few things which left me unoptimistic that things are changing anytim

The good news: carmakers are eager to garner more apps. You have Nissan, which is intr the 8th generation of its NissanConnect system that includes integration with Google loca and Pandora music. Or BMW, which is working with developers on 100 apps today for its c computing platform, according to Andreas Winckler, a senior advanced technology engine BMW Group's Silicon Valley office. And there's even this juicy rumor about Tesla Motors and the telematics system in its Model S Sedan that I heard from a source at a rival electric ca NEWS & EVENTS: NEWS RELEASES: 2012 NEWS RELEASE

Agero Vehicle Connectivity Innovation Featured in HondaLink EV for 2013 Honda Fit EV

Agero Extends Honda Relationship Beyond the Dashboard to Ensure Positive EV Customer Experience

DALLAS, August 27, 2012 --- Agero, a leader in vehicle connectivity innovation for global automobile manufacturers, announced today the successful launch of a new connected-vehicle program with American Honda Motor Co., Inc. of remote interface systems, specifically designed to enhance the electric vehicle (EV) ownership experience.

HondaLinkTM EV, recently launched along with the all-new 2013 Honda Fit EV, leverages Agero's technologies through multiple interfaces including a smart phone/tablet application and a personalized web portal designed to assist the owner with wirelessly managing vehicle charging, mapping their available driving range and setting their interior cabin temperature remotely. Additionally, Agero helps manage the customer relationship between Honda and Fit EV owners, with call center support and roadside assistance.

"The breadth of integration that the Agero technology provides is key to the seamless Honda Fit EV customer experience," said Charles Koch, Manager of the HondaLink program for American Honda. "From ongoing roadside assistance support to initiatives that help provide useful digital tools, Agero helps keep our network tightly integrated and extends our vision for new cloud-based customer support."

"We're facing a lot of potential unknowns in terms of customer acceptance of a new technology, so we need to provide multiple interfaces to ensure we're delivering a high level of knowledge and comfort to Fit EV owners," said Charlie Cavolina, president, Agero Connected Vehicle Services. "Likewise, it's a platform that also must quickly provide vehicle manufacturers with immediate feedback from owners so that next-generation systems can be quickly adapted."

Cavolina is optimistic the channels Agero provides to EV owners today will evolve into one of the key benefits of EV ownership – providing an instant link to information that educates vehicle owners regarding their vehicle's real-time performance as well as, in the near future, guiding them through the potential root-saving opportunities in using EV hetery storage to hatter manage their





• 2020-2029

Decade of Smart Vehicles
NHTSA Decision 2013
2019 Vehicle Fleet



Photo: www.sae.org/mags/aei/8727

Observations (cont.)

Implications of Smart Vehicles

 Lawrence Burns, former head of R&D at GM

- No crashes
- Lighter vehicles
- Changed infrastructure
- Related impacts
 - Emergency rooms
 - Insurance industry
 - Personal injury law

What is the Future in Texas?



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Questions & Contacts

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