Precise Positioning – Automated Driving & Safety Communications

GPS Technology Innovations & Networking Applications

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Industry Participation – T. Russell Shields

- Founding officer and director of the **Intelligent Transportation Society of America (ITS America)**
- Founder and current member of the **ITS World** Congress board of directors
- Chair of the first ITS World Congress in the U.S. in 1996
- First president of the **Automotive Multimedia Interface Collaboration (AMI-C)**
- Served two terms as chair of the Communications Committee of the **United States Transportation Research Board** (National Research Council)
- Past Convenor of **ISO/TC204/WG16**, the international working group that develops standards for V2V and V2I communications
- Co-Chair of the ITU-organized **Collaboration on ITS Communications Standards**
- Member and chair of many committees of the **Society of Automotive Engineers (SAE)**; named an **SAE Fellow** in 2007
- Recipient of the 1998 **SAE-Delco Electronics Intelligent Transportation Systems Award** for distinguished service to the ITS industry
- Inducted into the inaugural class of **ITS America's ITS Hall of Fame** in 2008
- Named the inaugural U.S. member of the **ITS World Congress Hall of Fame** in 2010
Vehicle-to-Vehicle (V2V) Communications – Current Efforts

V2V communications have been in development for more than a decade

- 5.9 GHz (700 MHz in Japan)
  - Proposed for V2V communications in the U.S., Europe, Japan, and many other locations
  - Can be used for a wide range of applications
    - Safety warnings (under testing in the Ann Arbor, Michigan Safety Pilot trial)
    - Collision avoidance (hope for the future)
    - Pedestrian-to-vehicle communications (possibly further in the future)

- U.S. NHTSA V2V Roadmap Status
  - Pending decision/final report for light vehicles, scheduled for Fourth Quarter 2013
  - Decision for heavy vehicles scheduled for 2014
Vehicle-to-Vehicle (V2V) Communications – Current Efforts

• University of Michigan Transportation Research Institute (UMTRI)/USDOT led Safety Pilot Model Deployment in Ann Arbor, Michigan
  ‣ First phase completed in August 2013
  ‣ See www.safetypilot.us

• International standards harmonization efforts by the U.S. DOT continue with the EU DG CONNECT (and starting to include DG MOVE) and the Japan MLIT
V2V Communications – Basic Requirements

V2V requirements for road transportation safety applications differ from those for land and water

- Each vehicle needs to send frequent updates of time, position, speed, and heading
  - Over 100 km per hour (27 meters per second) common

- A listening vehicle needs to determine if its path might intersect with another vehicle's path

- Transmitted V2V information for surface transportation need to be very accurate and reliable
  - Road vehicles often come very close to each other (a key difference)

- All vehicles should use a consistent data source for positioning and time
  - Mismatches could result in crashes
V2V Communications – Position Requirements

V2V for land transportation safety applications need completely reliable position information accurate to centimeters

• The automotive industry does not know how to get reliable, consistent, tamper-proof, highly accurate positioning
  ‣ For hundreds of millions of vehicles of different ages and levels of repair
  ‣ From dozens of vehicle manufacturers based in different countries

• How to help NHTSA with its V2V decision
  ‣ Identify the level of vehicle safety warnings that are reliable using current GNSS technology
  ‣ Provide clear information on the long-term evolution of possible future reliability of GNSS technology to understand if collision avoidance using vehicle safety communications will become practical
Automated driving is gaining commitments from vehicle manufacturers and suppliers

- Automated driving testing has been evolving over the past decade in many places
  - Demos in the U.S., Germany, Japan, Korea, China, etc.
  - Some U.S. states have passed laws affecting versions of automated driving
  - The UK has passed a law permitting the testing of driverless vehicles on public roads

- In early September 2013, Nissan CEO Carlos Ghosn announced Nissan’s intention to have automated driving in production vehicles in 2020

- Mercedes made a similar announcement at the 2013 Frankfort Motor Show two weeks later
Automated Driving – Key Issues

Automated driving is currently practical only on limited-access highways

• Vehicle manufacturers cannot afford mistakes
  ‣ Lives are at stake
  ‣ There could be potential damage to reputation and finances

• There is no good way to predict the behavior of pedestrians and bicyclists on the roadside
  ‣ Even though vehicle sensors will increasingly be used to detect pedestrians and reduce accidents
  ‣ Even though there will be pedestrian-to-vehicle communications in the future
Automated Driving – Next Steps

Progress will be step-by-step

- High-end vehicles already have some automated driving features
  - Brake assist
  - Stop-and-go adaptive cruise control (ACC) under 30 mph with ACC at higher speeds
  - Lane departure warning

- High-end vehicles will receive gradually improved and additional features

- Mass-market vehicles will receive mature technologies fairly quickly due to the reduced cost of cameras and IC chips
Automated Driving – Next Steps

- ACC will move to full automatic braking
- Lane departure warning will evolve into lane handling
- Expressway automated driving will
  - Rely on sensor probe data instead of GNSS and maps
  - Use broadcast information collected from authorities and probe data about road works and road hazards
  - Return to human control under complex conditions with advance notice from the system
  - Be unavailable under some bad weather conditions
- The approach will vary by vehicle manufacturer

Automated driving will initially occur on limited-access highways, possibly by 2020
Automated Driving – Challenges

• Collecting the detailed road information
  ‣ Each vehicle manufacturer is likely to drive all qualified roads for testing and collecting sensor information
  ‣ Driving both ways on all U.S. and Canadian limited-access highways is estimated to take about 2,000 hours

• Securing road construction and road hazard information reliably from authorities

• Gradual development of regulations and case law about automated driving
  ‣ Mitigate some of vehicle manufacturers’ concerns about liability
  ‣ Provide predictable, clear legal environment
Automated Driving – Evolution

- Over the following decades, automated driving will move step by step to additional roads.
- Precise, reliable vehicle positioning can help move forward the extension of automated driving beyond limited-access highways.
- Vehicle manufacturers will extend automated driving without relying on GNSS until there is assurance of complete reliability.
Thank You