PATH’s Truck Cooperative ACC System Development and Testing

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PATH Background

- Created by U.C. Berkeley Institute of Transportation Studies and Caltrans in 1986 to develop intelligent transportation systems (ITS) to apply information technology to improve road transport:
  - Congestion
  - Energy/environmental impacts
  - Safety
  - Economic impacts
- Major emphasis on driving automation systems since the start – over 600 person years of effort to date
- Automated highway system Demo ‘97 (many riders)
- Heavy truck and bus emphasis since 2000
  Potential early adopters of technology
Truck Cooperative ACC
Development and Testing Project

• FHWA Exploratory Advanced Research Program project, with Caltrans cost sharing, 2014-2017

• Developing and evaluating CACC system performance on 3 Class-8 trucks (SAE Level 1 automation, longitudinal control only)

• Goals:
  – Implement smooth, accurate cooperative vehicle following control
  – Measure achievable energy savings
  – Determine driver preferences among gaps
Equipment on Each Truck

- Dual DSRC Antennas
- Supplementary display
- Video camera (production)
- 5 Hz GPS
- ACC radar (Production)
- PC-104 computer
- Emergency disengage button by driver
How Does it Work?

• Starts with Volvo’s adaptive cruise control (ACC) using radar/video sensing of forward vehicle
• Adds 5.9 GHz DSRC radio for V2V communication
• Enables faster response to speed changes, with more stable vehicle following
  – Driver-selectable time gaps of 1.5, 1.2, 0.9 or 0.6 s
  – Discourages cut-ins
  – Saves energy, emissions
What are we doing?

- Here: carefully-controlled testing of energy consumption under different conditions:
  - Baseline individual tractor-trailer rig
  - Tractor-trailers at 4 reduced CACC gaps
  - Variations in speed, loading, and aerodynamic trailer improvements

- In California: assessing 24 truck drivers’ preferences among the 4 gap settings in public traffic:
  - Daytime and nighttime driving
  - Second and third truck positions

- Simulations: impacts based on market pen.
What more needs to be done?

• Definitive test results to show stakeholders realistic predictions of energy savings
  – Accounting for imperfections in real traffic (cut-ins)
  – Understanding how much drafting benefit is already gained from close manual following of trucks
• Efficient operational strategies for matching up with other trucks
• International standards on V2V messaging for CACC
• Change laws restricting close following
• Overcome perceptions of riskiness by general public
• Develop safety assurance methods for L4 or L5 automation without driver supervision