Partial Automation for Truck Platooning

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Background

- Funded under FHWA Exploratory Advanced Research Program solicitation, Spring 2013
- Use Cooperative Adaptive Cruise Control (CACC) with DSRC for V2V communication to enable closer vehicle following than Adaptive Cruise Control (ACC)

CACC vs. Truck Platooning

- CACC Represents SAE / NHTSA Level 1 Automation
  - Driver responsible for monitoring traffic
  - Driver responsible for active steering
- Platooning Generally Represents SAE Level 2+ Automation
  - Automated steering needed at short gaps because of forward visibility limitations
- CACC uses a ***Constant Time Gap*** (CTG) following strategy
- Platoons use a ***Constant Distance Gap*** (CDG) strategy

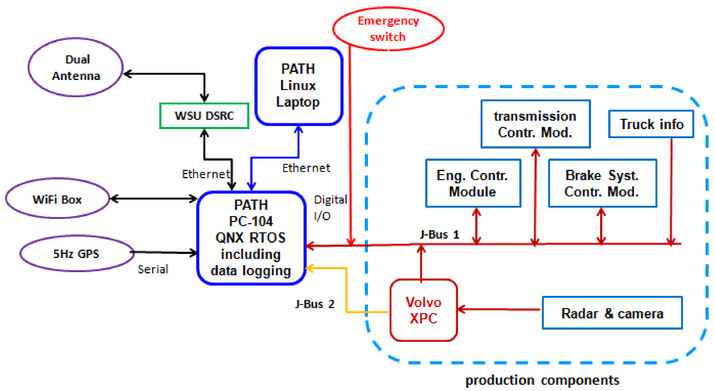
CACC Operation Concept

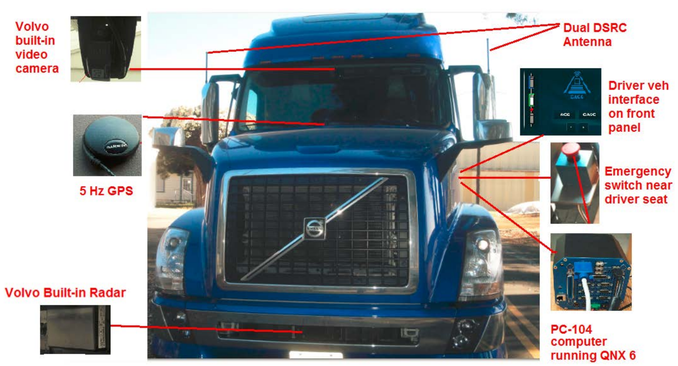
- Onboard sensors, communication and control
  - Forward looking radar
  - Video camera
  - J-1939 Bus information
  - 5.9 GHz DSRC V2V communication
  - 5 Hz GPS
  - Engine torque control
  - Engine retarder control
  - Service brake control
  - Driver-Vehicle-Interface

CACC Advantages

- CACC system has several advantages:
  - reduced aerodynamic drag, more energy and environment friendly
  - enhanced stability of vehicle following
  - damping out traffic disturbances
  - shorter than normal gaps discouraging other vehicle cut-ins
  - faster responses to hard braking
  - Much tighter and synchronized behavior than ACC
  - Not as tight in vehicle following as platooning

Control System and Hardware





Demo Ride Scenarios

- Truck 1: Adaptive Cruise Control, integrated with followers
- Truck 2: CACC
- GPS based localization: automatically determine vehicle position in a string
- Passenger car intentional cut-in and cut-out
  - In front of the leader
  - Between vehicle 1 and vehicle 2
  - Between vehicle 2 and vehicle 3