Heavy duty CAV – fast or slow?

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2017 International Urban Freight Conference
October 18 2017
Agenda

• A technological tipping point
  • Brought about by CAV (connected and automated vehicles)
• Imposed on a century-old transportation system
• The fully-evolved future
• Packaging the technology for the HD sector
• The CAV prognosis for large trucks and buses
A technological tipping point

- Connected vehicles and infrastructure (CV)
- Automated vehicles (AV)
- Surrounded by:
  - Shared Mobility (SM), Big Data, Cybersecurity, Internet-of-Things, Smart Cities
- Enabled by:
  - Sensors, software, cloud services, computation, robotics, artificial intelligence, consumer electronics
Century-old transportation system

• Drivers, vehicles and infrastructure
• Tremendous incremental progress
  • For example, crash rates have declined
  • But not sustainable for another century
• New technologies cut right across the old silos
  • Safety, traffic efficiency, emissions, energy, economics
• The 21st Century mobility system is connected, automated, shared and electrified
Today’s transportation challenges

**Safety**
- 32,675 highway deaths in 2014
- 6.1 million crashes in 2014
- Leading cause of death for ages 11, 16-24

**Mobility**
- 6.9 billion hours of travel delay
- $160 billion cost of urban congestion

**Energy & Environment**
- 3.1 billion gallons of wasted fuel
- 56 billion lbs of additional CO₂

(3,978 large trucks & buses)

Source: USDOT
Scale of US commercial motivation

- In March 2016, General Motors paid $1B for Cruise Automation
- In February of this year, Ford invested the same amount in a joint venture with Argo AI
- The largest automated vehicle technology acquisition to date was Intel’s $15.3 billion purchase of Mobileye, a Tier-2 automotive supplier of object-detection systems
- Expanding mergers, acquisitions, partnerships on a daily basis
- The peleton has caught up!
CAV is made up of CV and AV
the moving parts
What is CV?

• Vehicles talk to each other 10 times per second
• Basic safety message is position, speed and heading
• Algorithms continuously monitor crash risk and warn drivers
• Many applications have been developed for safety, traffic efficiency, and energy efficiency
New York City

Key Facts
- 10,000 city-owned vehicles + Peds/Bikes equipped to test V2V and V2I technology throughout Midtown Manhattan
- Controller and RSE upgrades to support V2I at a number of intersections
- NYCDOT and Transcore are primary leads

Mobility and Safety Issues Goals
- Reduction in spot speeding
- Reduction in accidents in high incident intersections
- Improve Ped safety and reduce bus related accident rate
- Improve safety of disabled Peds using V2P
- Reduce accidents/delays involving low bridges
- Enforce truck route restrictions
- Improve Work Zone Safety
- Balance mobility in congested areas
- Reduce crashes, injuries and delays
City of Tampa

- Tampa-Hillsborough Expressway Authority - Focused on Mobility, Safety and Security:
  - Morning Backups
  - Pedestrian Conflicts / Pedestrian Safety
  - Wrong Way Entries
  - Traffic Progression
  - BRT Optimization / Trip Times / Safety
  - Streetcar / Auto / Ped / Bike Conflicts
  - Security and Privacy Protections and Management
What is AV?

• AVs cover a very broad range of functions, from interventions to assist the driver to full driverless capability
  • The term “automated vehicle” includes “autonomous vehicle”, having more reliance on on-board technologies
• The common feature of all AVs is the replacement of one or more human control functions with machine functions
• In order to describe an AV, it is necessary to consider:
  • The intended role of the driver
  • The intended operating environment
AV examples

• Automated Emergency Braking (AEB) to apply a car’s brakes in an imminent collision when the driver has failed to act
  • To be deployed voluntarily in 2022 subject to 2016 NHTSA agreement with 20 automakers
• Advanced multi-function cruise control that drives the car on a freeway
• Platooning of long-distance freight trucks on major highways
  • Following vehicles automatically travel behind the lead vehicle at short headways
  • Significant gains in fuel economy
• The vehicle takes over control traveling at very low speed in a traffic jam
  • Applicable to long-distance freight trucks when encountering a zone of intense congestion
  • Provides fatigue relief for the driver
The CAV Convergence

First Quarter Century

CV

- Pilots
- Rule & Infrastructure
- V2V & V2I

AV

- Trials & Automated Features
- Smart Cities & OEM Agreements
- Mobility Services; AV & V2X

2025

CAV Connected Automation

Second Quarter Century

Shared, Automated Mobility Services; Broad Ownership of Driverless Vehicles
The fully-evolved future
Use cases rule

- Short-range shuffling of parts
- Environments for driverless personal shuttles
- Driverless taxis
- Highly-automated vehicle with advanced/novel design
- Riderless delivery motorcycle
- Driverless delivery vehicle (light duty/heavy duty)
- eCommerce delivery bot
- Bus rapid transit
The Path Forward for CAVs

• There will be multiple stages on the path to CAVs employing Automated Driving Systems (ADS)

• Early adopters will manifest in zones, precincts, and corridors
  • Ride-sharing
  • eCommerce (city delivery)
  • Freight precincts
  • Shuttles and transit services
  • Bus rapid transit

• These early adopters are businesses/fleets, not individual consumers
  • But they interact with consumers

• Each form of commercial early adopter is a CAV use case, or set of use cases

• These use cases will influence consumers, and in fact “explain” and promote CAV to consumers
Heavy Duty Sector – CAV Value Proposition

• Taking advantage of technological advancements: differing interests
  • Move forward in more liberal states; build on current platooning efforts; apply technologies in corridors like I81 and I70
  • V2I offers a lot to truck operators
  • For some, AV is a driver-assist add-on for alternative energy and EVs
• Policy, Regulations, Productivity, Corridors, Logistics
  • Lack of HD coverage in House and Senate AV legislation opens the door to non-uniform rules applying to HD use of automation – HUGE issue
• Continuing access to cities
  • Issues extend to noise and emissions, but specific issues for eCommerce

Much more conservative than light duty sector
Questions to be addressed by the “ecosystem”

- What does the fully evolved future look like?
- How do we safely navigate the transition?
  - Human interaction with automation
  - Automated vehicles interacting with conventional vehicles
- What role does the infrastructure play?
  - Lanes, zones and corridors?
  - Connecting CAVs with the infrastructure (signals, roadworks etc)
- Data sharing and analytics
  - Who owns? Who has access?
HD sector prognosis

Fast
• Partnerships with state and local agencies
• Corridors and zones
• Technology bundling in cities
• CV can move quickly
• HD sector is advantageous for CV

Slow
• Disruption of drivers’ employment
• Consumer perception
• Non-uniform regulations
• Unsafe until it’s very safe

Connected, plus driver-friendly automation