Connected Automated Trucking: Latest Developments and Outlook

2017 Florida Automated Vehicles Summit
November 14-15, 2017
Day Two General Session

Richard Bishop
AUTOMATED DRIVING DOMAINS
Passenger Cars
Privately Owned, Low Utilization
Automated Mobility on Demand – “Robo-taxi”
Fleet Owned, High Utilization
Heavy Trucks
Fleet Owned, High Utilization
Truck Automation: An Attractive Investment

• Car market
  – complex and numerous players
  – competition with established suppliers
  – retail purchases (based on emotion)

• Truck market
  – business orientation >> Return on Investment (ROI)
  – trained technicians
  – regular maintenance
  – if ROI achieved, less cost sensitivity
AV Use Cases for Heavy Trucks: Driven and Driverless

Open Road
- Fuel Economy
  - Truck Platooning
- Productivity
  - Traffic Jam Assist
  - Highway Pilot
  - Automated Trailer Backing
  - Parcel Delivery Automation

Constrained Environments
- Trailer Switching
- Mine Hauling
- Drayage
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Automated Trailer Switching: Stepping Stone to Automation On-Road

Anheuser Busch Brewery, Jacksonville, Florida
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Truck Platooning Technology

Real-time V2C ODD Supervision

Network Operations Center

Connected Braking & Connected Acceleration

V2V wireless link
Radar
Radar
The Vital Role of V2V Connectivity in Truck Platooning

[Diagram showing the process of perception, reaction, and brake lag with and without V2V connectivity]
Platooning Benefits

• Fuel savings/Range extension
  – Independent test, 7.5% avg for both trucks
• Corresponding reduction in GHG & Criteria Pollutant emissions
• Inter-vehicle gap typically ranging from 30-60 feet
  – regular driving gap is well over 100 ft
• Economically viable with <1 year payback period for fleets
• High quality data generation for fleets & governments
“Following Too Closely:” Qualitative vs Quantitative Laws
Compliance with “Reasonable and Prudent” Following Distance Statutes

- Peloton Approach: Network Operations Center limits platooning to:
  - Multi-lane, divided, limited-access highways
  - Moderate or low traffic conditions
  - High traction conditions (no heavy rain, sleet, snow)
  - Appropriate topography (grades, curvature)
- Network Operations Center also provides over-horizon alerts on roadway conditions
Confirmed Allowance* of Truck Platooning
(*allowed in some form)
Platooning Research/Pilots/Demo’s

- FHWA-funded Caltrans-PATH-Volvo testing now
  - demo in September 2017
  - 3 truck platoons
- FHWA-funded Auburn University testing
  - demo’s this year
- US Army TARDEC w/Auburn University
  - Michigan>>Canada
  - Levels 1-4
  - demo in September 2017

- Texas Transportation Institute
  - 2015-2018 program
  - Level 2 platooning
  - pilot tests to assess impacts on infrastructure, operations
- Florida
  - Platooning Study:
    - Florida DOT
    - Dept of Highway Safety and Motor Vehicles
    - Florida Highway Patrol
    - Florida Turnpike
  - Pilot testing 2017-18
    - evaluate use and safe operation
Current Situation

- Current state of technology and commercial development
- Survey of regulatory approaches
- Role of standards
- Benefits
- Operational factors
- Driver considerations
- High level system requirements
- DATP interactions with other traffic

Deployment Implications

- Infrastructure
  - planning
  - operations
  - maintenance
  - design
- Public Safety
  - assessing/enforcing safety
  - vehicle system fitness
  - operations
- Administrative Processes
  - permitting / insurance
  - registration/titling
  - licensing (CDL)
Platooning: Commercial Development

• Peloton Technology
  – 2012 startup pioneering commercialization
  – commercial ops with fleet customers in 2018

• Daimler (Freightliner)
  – Recent testing of platooning system on roads in Oregon and Nevada
  – Will begin testing with fleet customers in 2018

• Navistar
  – will offer the Peloton platooning systems on trucks beginning in 2018
Evolution of Truck Platooning

- Level One product introduction imminent
- Within Fleet >> Inter-fleet
- Longer platoons
- Evolution of driver role in follower trucks to higher levels of automation
  - “driverless followers”
Truck Platooning: Information Resources

- **Heavy Truck Cooperative Adaptive Cruise Control: Evaluation, Testing, and Stakeholder Engagement for Near Term Deployment, 2017**
  - Auburn U., Peloton, Peterbilt Trucks, Meritor-Wabco, ATRI, Bishop Consulting
  - Phase Two Final Report: [http://eng.auburn.edu/~dmbevly/FHWA_AU_TRUCK_EAR/](http://eng.auburn.edu/~dmbevly/FHWA_AU_TRUCK_EAR/)

- **Lessons Learnt: European Truck Platooning Challenge 2016**
  - Dutch Rijkswaterstaat, Netherlands Ministry of Infrastructure and Environment
  - [www.eutruckplatooning.com/](http://www.eutruckplatooning.com/)

  - [www.truckingefficiency.org](http://www.truckingefficiency.org)

- **ATA Technology and Maintenance Council, Future Truck, 2015**
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Traditional Players (ATA and OEMs)

• Current Concepts:
  – driver support
  – enabling drivers to perform other tasks (depending on changes to Hours-of-Service regulations)

• Business case:
  – safety enhancement
  – enhancing driver’s job
  – creation of attractive new jobs based on new kinds of freight operations

Startups

• Current concepts
  – highway driverless: Level 4 exit-to-exit
  – street driverless: remote control

• Business Case:
  • reduced cost by replacing drivers with automation
Trucking Faces a Severe Driver Shortage

• “Perfect Storm”
• Conditions that make trucking operations ripe for automation also create the driver shortage:
  – Long hours with limited time for breaks
  – Conditions often stressful and not conducive to good health
  – Time away from cities/home
  – Challenge to maintain safety
• Average age of truck drivers ~55: generational retirements will exacerbate shortage
• Recruitment of new drivers and workers into trucking proving to be challenging
Truck Automation Technology Can Elevate Status of “Drivers”

• Driver-Assistive Truck Platooning
  – provides safety and fuel efficiency improvement
  – drivers experience a new form of driving teamwork

• Highly automated driving transforms work environment

• Potential for individual driver pay to increase
  – Different pay structures for time in vehicle not driving
Driver Shortage: Retirements & Recruiting Challenges

5 years: shortfall of 500,000 drivers
10 years: shortfall of 1,000,000 drivers
Platooning and Automation Impact on Driver Shortage

Increased Trucking vs Other Freight Modes

Automation Gradually Decreases Number of Drivers Needed
Automated Truck Technology Developers

**Traditional**
- Daimler (Freightliner)
- MAN
- Navistar
- PACCAR (DAF)
- Scania
- Volvo Group
- (suppliers)

**Startups (prior to 2017)**
- Azevtec
- Embark
- Peloton
- Starsky Robotics
- Tesla
- TU-Simple
- Uber ATG
- Waymo
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Level 4 Truck Automation Video: Embark Prototype on California Freeways

https://www.youtube.com/watch?v=5pYWhBQ7N4E&feature=youtu.be
Automated Trucks: Where From Here?

- **2018**
  - Level 1 platooning on highways

- **2020**
  - Rapid uptake of Level 1 platooning
  - Level 4 driverless systems on highways
    - restricted routes

- **2025+**
  - Level 3 Traffic Jam Assist (if HOS regulations change)
  - Level 4 driverless increasingly more prevalent
    - driverless followers in platoons
    - independent driverless trucks
Thank You

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