Truck Automation in the U.S.

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Why the interest in truck automation?

• Earlier adopters of automation than light-duty passenger vehicles, while the technology is still maturing and relatively expensive:
  – High-value vehicles, with high daily utilization and high operating costs produce faster return on investments that improve operational efficiency
  – More highly skilled drivers and fleet maintenance
  – Can provide useful service within limited Operational Design Domains constrained by technology immaturity
• For truck platooning: fuel cost savings from drag reduction
• For driverless Level 4 automation: expanding services now constrained by driver shortage, and reducing driver labor costs
Current U.S. Truck Automation Activities

System development and testing work, not in full public operation yet

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<th>Government</th>
<th>Industry</th>
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<td>Truck platooning on highways (mainly Level 1 longitudinal control, limited Level 2)</td>
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<td>Urban goods delivery, low speed (Level 4)</td>
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<td>Interstate highway driving only (Level 4)</td>
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<td>Special purpose, Level 4 low speed in closed sites (ports, warehouses)</td>
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Recent Truck Platooning Activities

- Research and development projects
  - Federal Highway Administration, Exploratory Advanced Research
    • Caltrans/PATH/Volvo/Cambridge Systematics
    • Auburn University/Peloton/Peterbilt
  - Department of Energy, SMART Mobility Program
    • PATH/Volvo
  - Texas DOT/ Texas Transportation Institute
  - U.S. Army TARDEC
- Commercial product development and demonstrations
  - Peloton Technology
  - Volvo/Federal Express demonstration
  - Freightliner (Daimler) trucks
3-Truck PATH/Volvo Platoon Demo for U.S. DOT in Public Traffic on I-66 Near Washington DC
New U.S. Government Plans for Truck Platooning

• Competition for field operational test to collect data on usage by truck fleets in regular operation (field testing to start ~2020)
• Research projects on:
  – Human factors issues for truck drivers and drivers of nearby vehicles
  – Truck maintenance and inspection needs
  – Determining safe following distances
  – Cybersecurity
  – Brake inspection policies and procedures
  – Hazard analyses
  – Extension from Level 1 to Level 2 automation
States Adjusting Regulations on Minimum Following Distance to Permit Truck Platooning

Source: Peloton Technology

- **Testing**
- **Full Deployment Allowed**
- **Limited Commercial Deployment**
- **2018 Legislation Pending**
- **In process already for 2019**
Automation of Low-Speed Urban Goods Delivery

- Level 4 automation in development to try to eliminate drivers for deliveries of small packages by light-duty vehicles
  - Modifications of existing vehicles
  - New purpose-built vehicles
  - Some very small vehicles (“beer coolers on wheels”)
- Recent interest among start-up companies led California to request inputs on definition of applicable regulations
- Companies include:
  - Nuro Robotics
  - AutoX Technologies
  - Ford
Prototype Local Package Delivery Vehicles

Nuro Robotics  AutoX  Ford pizza delivery
Prototype Delivery Robots (mainly for sidewalks)

- **Marble** ($10 M investment)
- **Robby Technologies** ($2 M investment)
- **Dispatch.ai** ($2 M investment)
- **Unsupervised.ai** (doorstep delivery)
Level 4 Automation of Highway Driving

• Industry efforts to develop trucks capable of driverless operation on some specific limited-access highways, generally:
  – Low-density rural areas for long hauls in light traffic
  – Driving between depots at freeway entrances/exits (not on local streets) – or remotely driven when off highway (Starsky)
  – Remote supervision by humans (varying levels of intervention)
  – Testing prototypes on public roads with safety drivers supervising

• Active companies include:
  – Embark (California – Texas testing)
  – TUSimple (Phoenix-Tucson highway testing and China port testing)
  – Starsky Robotics (Florida testing)
  – Waymo (Atlanta testing)
Level 4 Long-Haul Truck Prototypes

Waymo

Embark

Starsky

TUSimple
Special Purpose Level 4 Truck Automation in Restricted Sites

- Low-profile activities, very little public information
- Extensions of factory and warehouse automation technologies for low speeds in protected environments:
  - Short-distance, low-speed trailer or shipping container movements at warehouse and terminal yards
  - Airport terminal apron support vehicles
  - Trash collection
  - Snow removal
Summary of U.S. Truck Automation Status

• Emphasis of public agency R&D programs and major truck manufacturers on truck platooning (Level 1 automation)
  – Near-term opportunities within existing truck fleet operations
  – Risk of setback if DSRC communications are destroyed in current political environment

• Recent growth of interest in non-traditional approaches using Level 4 automation to replace drivers within narrowly-defined Operational Design Domains, and with new business models
  – Small urban pickup/delivery vehicle services
  – Highway-only driving between depots (long-haul, rural)
  – Speculative, disruptive start-up activities