Preventing Crashes
Saving Fuel
Connecting Trucks
Overview: Sampling of Connected & Automated Vehicle Solution Providers
Peloton DATP: Driver Assistance, Not Fully Automated Trucks
Presentation Roadmap

1. Market Overview for Driver-Assistive Truck Platooning (DATP)
2. Technology Overview of the Peloton System
Market Movement: Accelerating Global Activity in Truck Platooning Builds on Decades of R&D

EU - Platooning Challenge – 2016

EU (Sweden) - SARTRE 2009-Present

Germany – KONVOI 2005-09

Japan - ENERGY ITS 2009-12

Canada - PIT 2009

US – PATH, NREL, etc. ’90s and ongoing
Market Overview: CAV Truck Solutions including Platooning are increasingly widely supported

Many Companies Involved in Near Commercial and/or Development Systems:
Market Overview: Freight Trucking Scale and Major Pain Points

US Freight Trucking: $700 Billion in Revenues

- Fuel Cost: $100+ Billion for nearly 30 billion gallons of fuel
- 34%+ Operating Costs
- Accident Cost: $90+ Billion and 113 million gallons of fuel
- Industry Net Profit: 3%

Enhanced Fleet Economics & Safety

- Preventing Accidents
- Saving Fuel
- Improving Mobility
- Improving Decisions
Market Opportunity: Many Types of Fleets Can Platoon

Many Trucks Travel in Groups Today…

**LTL (Less than TruckLoad) Fleets:** Trucks travel hub-hub in groups by nature of operations

**Private fleets:** Trucks travel in groups on high density corridors

**Truck Load fleets:** Growing trend toward relay style operations w/ trucks in groups

…and can adopt platooning with few changes to dispatching
Market Investment: Peloton Strategic Investors

Successfully closed $60 million Series B Funding Round
Peloton Technology: We Start by Making Individual Trucks Safer at All Times

- Improved driver awareness with video & over-the-horizon alerts
- Active safety & collision avoidance systems always on
- Air disk brakes, ESC, LDW
- Safety monitoring and Event capture
- Vehicle-to-Vehicle communications
- Vehicle-to-Cloud connectivity
- Enhanced predictive maintenance
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Peloton System: Only Pairs of Trucks, Not Longer Chains
Peloton Driver-Assistive Truck Platooning System
Improving Safety, Driver Teamwork and Fleet Efficiency

Active Braking
Reduces the braking time from 1.5 seconds to 0.03 seconds

Platooning
Active Safety Systems linked
Both drivers steer at all times
Enhances team driving
Both trucks save fuel

Real-time Cloud Supervision
Platooning only…
– When safe
– Where safe
– How safe
Dynamic adjustment to conditions
Over-the-Horizon alerts and navigation
Live video from other driver’s view

• Look Ahead view of road ahead of lead truck for follow driver

• Both drivers in communication to share critical information
Safety: Connected Braking

An operator can safely stop without colliding with the preceding vehicle under manual driving conditions only by allowing enough distance for human perception and reaction.

Radar can lessen the assured clear distance needed to safely stop without colliding by automatically reacting to the preceding vehicle slowing.

By using a truck-to-truck wireless link, the follow truck reacts automatically to the activation of the lead truck brakes, before the lead truck actually begins to slow, ensuring no collision between two vehicles even in a full automatic emergency braking (AEB) event.
Safety: Handling Vehicle Cut-ins

Driver sees car cutting in and backs off

OR

If driver does not respond, system radar detects cut-in vehicle and automatically begins to back off follow truck

Follow truck will continue to back off to safe manual following distance (100+ ft) and then give full manual control back to follow driver
Collision Avoidance Systems can prevent many crashes

- Commercially available radar-based **Forward Collision Avoidance and Mitigation (FCAM)** Systems can reduce the frequency and severity of these commercial vehicle rear-end crash types.

- Con-way study:
  - 30 months w/ 12,600 tractors
  - **71% reduction in rear-end collisions; 63% reduction in unsafe following behavior**

- Volvo/USDOT study:
  - 3 years w/ 100 trucks
  - **80% of drivers preferred to drive w/ collision avoidance systems**
  - **37% reduction in “conflicts”** (i.e. hard braking, situations that could result in collision)
But Safety System uptake in US trucking has been slow

New Class-8 Trucks Sold w/ FCAM System

- EU regulations mandated FCAM systems on all heavy trucks since 2015, estimated to save 5,000 lives per year
- In US, Passenger car OEMs voluntarily pledge to make FCAM standard on all vehicles by 2022.
- No similar agreement on commercial vehicles in US, and years away from possible mandate.
- Systems can cost $2-3k upfront and have hard-to-measure payback for fleets
Peloton-Equipped Trucks are Safer Trucks at All Times

- **Save Fuel:** Application of Foundational Equipment to Improve Fuel Efficiency
- **Prevent Crashes:** Foundational Equipment and Technology to Improve Driver & Truck Safety

- V2V Platooning Capability
- Cloud-Connected Real-Time Alerts
- Air-Disc Brakes
- Latest Commercially Available FCAM System

J1939 - DSRC - GPS - Radar - Video
Peloton Technology: Best-in-Class Cybersecurity

Collaboration with Industry on Best Practices

Our Philosophy and Approach:

1. We use the strongest available, independently audited systems.

2. We encrypt all communication between trucks and with the Network Operations Center.

3. All communications are mutually authenticated.

4. We actively monitor for and defend against malicious attacks.

5. Our systems are continually improved through automatic over-the-air updates.
Fuel savings of 10% on rear truck and 4.5% on front truck

Verified savings at 40 foot gap at 64mph (NACFE)

Further independently testing by US DOE and US DOT

NREL & FHWA tests confirming savings at varying speeds, gaps of 75ft +
Driver Assistive Truck Platooning: Wider Benefits

• Safety: Crash reduction and crash congestion-related fuel savings
  – NTSB: Collision Avoidance Systems could reduce ~80% of rear-end crashes. NHTSA: $3.1B annual savings from full deployment of just currently available systems.
  – Con-way (now XPO) reduced crashes 86% by fully deploying active safety systems (FCAM and LDW)

• Health: Corresponding reductions in Diesel emissions

• Insight: High quality data generation for fleets & governments

• Mobility: Increased infrastructure and freight efficiency

• Economy: <1 year payback period for fleets
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Go-To Market: Pre-Delivery Installation approach leads way for initial Deployment

**Within Fleets**
- Trucks travelling in groups today
- Trials then Deployment w/ Major Fleets

**Between Fleets**
- Peloton as intermediary
- Fleets interested in linking with others

**Hardware Install Roadmap**
- Pre-Delivery
- Pre-Wiring
- OEM Option

**Partnerships**
- Truck OEMs + Braking System Suppliers + Fleets
Market Development: US Freight Arteries
Platooning focus: Multi-lane, divided, limited access highways
Market Development:
State Following Distance Laws: Two Vehicle Code Types

1. Fixed Numerical Minimum Following Distance Rule
   - Requires legislation or waiver

2. Variable and Discretionary “Reasonable and Prudent” Following Distance Standard
   - May obtain administrative acknowledgement that DATP can comply with the law
   - Several states have provided oral affirmation of legality
**Market Development: Industry-Govt Collaboration**

Industry-Govt collaboration, establishing best practices & creating deployment pathways

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<th>Federal/National</th>
<th>States</th>
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| • USDOT (FHWA) platooning projects  
  • CalTrans/PATH/Volvo/Peloton  
  • Auburn/Peterbilt/Peloton  
  • DOE Volvo Supertruck 2  
  • ARPA-E (Purdue-Cummins-Peloton)  
  • USDOT Smart City: SmartColumbus  
  • Industry Standards: ATA TMC  
  • Best Practices/Models for Deployment:  
    • AASHTO (CAV-ELT), CVSA  
    • Dialogue w/ CSG, other associations | • Commercial Approval (9 and rising): MI, TX, AR, TN, GA, SC, OH, NV, NC  
• Testing or Limited Trials also possible in 8 other states and rising: AL, AZ, CA, CO, FL, OR, UT  
• Further State Allowance Activity on track for 2017 - 18 (Legislative or Administrative)  
• State projects: TTI-TxDOT; Port of SD  
• Further Demonstrations, Fleet Testing & Trials over next 12 months |

**Funded Projects with:**

- [U.S. Department of Transportation](https://www.dot.gov)  
- [Federal Highway Administration](https://www.fhwa.dot.gov)  
- [FMCSA](https://www.fmcsa.dot.gov)  
- [NHTSA](https://www.nhtsa.dot.gov)  
- [NREL](https://www.nrel.gov)  
- [Peloton](https://www.peloton.com)
Thank You & Discussion

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