FHWA Level 1 Truck Platooning Research Program

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Outline

• What is Level 1 Truck Platooning?
• Previous FHWA Research
• Human Factors Truck Platooning Project
• Phase 1 Truck Platooning Early Deployment Assessments
What is Level 1 Truck Platooning?

- Two or more trucks platoon with vehicle-to-vehicle (V2V) communication.
- Longitudinal control only (throttle and brakes), driver steers the truck.
- Vehicles already equipped with production adaptive cruise control (ACC).
- Speed of lead truck either manually or automatically (ACC) controlled.
- Gap is typically based on time headway – consistent with driver preference.

Source: California PATH Program
Potential Benefits

- Energy and emissions savings from aerodynamic drag reduction.
- Reduced highway congestion (shorter following distance).
- Possible safety improvements from faster reaction times and supporting systems (e.g., Automatic emergency braking (AEB), air-disc brakes, etc.).
- Reduced driver workload.

Source: California PATH Program
Previous FHWA Research

• Naturalistic Truck Study
  – Mined existing datasets to quantify heavy-truck following behavior and expand the understanding of how heavy trucks follow light vehicles and other trucks.

• Exploratory Advanced Research (EAR) Projects
  – Caltrans/California PATH: Three-truck Level 1 Platooning System.
  – Auburn University: Two-truck Level 1 Platooning System.

• Antenna Placement Study
  – Modeled various configurations and terrains.
Human Factors Issues Related to Truck Platooning Operations

• Human Factors Truck Platooning
  – Goal: Investigate human factors issues associated with traveling near a truck platoon.

• Main issues researched:
  – Freeway entry/exit.
  – Visual indicator/other road user recognition of platooning.
  – Prior knowledge of other road users.

• Approach:
  – Sign Laboratory Study.
  – Driving Simulator Study.

Source: FHWA
Sign Laboratory Study

• Test comprehension for various visual indicators.

• Show clips of simulated trucks near highway entrance and exit and ask participants to report their understanding and likely actions.

Source: FHWA
• Subjects experience driving a passenger car in the presence of truck platoons:
  – Two-truck and three-truck platoons will be simulated.
  – Focus is on freeway entry and exit.

• Twinning with EC ENSEMBLE project:
  – ENSEMBLE is focused on the development and testing of multibrand truck platoon operations.
  – The “Twinning” component is on the driving simulator study, which has similar goals and objectives to the FHWA driving simulator study.
Truck Platooning Early Deployment Assessments – Goals

• To understand how truck platoons will operate in a realistic, operational environment.
  – Previous research involved limited testing and demonstration in a real-world environment.

• To inform State and local stakeholders that are making decisions related to truck platooning regulations.
Approach

• Assess various aspects of in-service truck platoons on their common delivery routes over an extended time period.
• Collect a variety of data, both technical and operational, related to the vehicles, environment, and drivers to assess safety, efficiency, and mobility impacts.
• Partner with and leverage current industry and State agency plans for truck platooning operations.
• Use a two-phase approach.
Two Phase Approach – Phase 1

Phase 1 – Concept Development

• Key *deliverables*:
  - Deployment Operational Concept.
  - Partnership Plan.
  - Test and Performance Evaluation Plan.
  - Phase 2 Readiness Assessment.
  - Phase 2 Proposal.

• Three Phase 1 Contracts were awarded in early March 2019.
• Each contract is worth approximately $500K with a nine-month Period of Performance.
Two Phase Approach – Phase 2

Phase 2 – Test / Deploy / Evaluate

• Key activities:
  - Establish partnerships.
  - Recruit and train truck drivers.
  - Test the system.
  - Execute deployment.
  - Evaluate and publish results.

• One or more Phase 2 awards.

• Only Phase 1 contractors are eligible to compete for Phase 2.

Source: FHWA
## Phase 1 – Initial Team Composition

<table>
<thead>
<tr>
<th>Lead</th>
<th>Platooning Tech</th>
<th>State/ Local</th>
<th>Academic</th>
<th>Fleet</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battelle</td>
<td>Volvo Group</td>
<td></td>
<td>Penn State, University of Michigan Transportation Research Institute (UMTRI)</td>
<td>Saia LTL Freight</td>
<td>Battelle, CAR, SAE International</td>
</tr>
<tr>
<td>California PATH</td>
<td>Volvo Group, California PATH</td>
<td>Caltrans, California Highway Patrol, I–10 Corridor Coalition</td>
<td>California PATH</td>
<td></td>
<td>Cambridge Systematics, Westat</td>
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<tr>
<td>CDM Smith</td>
<td>Robert Bosch</td>
<td>Columbus Region Logistics Council, Ohio DOT/Drive Ohio, Ohio Turnpike Commission</td>
<td>Ohio State University</td>
<td>Anheuser-Busch</td>
<td>CDM Smith, BGM Consulting, Sutra Research and Analytics</td>
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</tbody>
</table>
Phase 1 – Status

• Three teams are working with Noblis, the Phase 1 Independent Evaluator, to ensure a common understanding of performance measurement goals and expectations for evaluation plans.

• Noblis and USDOT team recently established a set of evaluation performance measure requirements.

• Competition Sensitivity
  – All three teams are vying for a Phase 2 award(s).
  – This limits the information that can be shared on the Phase 1 project.
  – Each team's approach and plans are not shared with others.
### Phase 1 – Performance Measure Requirements

<table>
<thead>
<tr>
<th>Performance Measure Category</th>
<th>No. of Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>OP – Platoon Operational Characteristics</td>
<td>4</td>
</tr>
<tr>
<td>S – Safety</td>
<td>12</td>
</tr>
<tr>
<td>M – Mobility</td>
<td>3</td>
</tr>
<tr>
<td>EE – Energy and Emissions</td>
<td>2</td>
</tr>
<tr>
<td>FLT – Fleet Operator and Driver Impacts</td>
<td>7</td>
</tr>
<tr>
<td>II – Infrastructure Impacts</td>
<td>3</td>
</tr>
<tr>
<td>SL – State and Local Government Impacts</td>
<td>2</td>
</tr>
<tr>
<td>VED – Vehicle Equipment Design Implications</td>
<td>3</td>
</tr>
</tbody>
</table>

USDOT has identified a priority level for each requirement within this project to recognize resource constraints and provide teams with flexibility in measurement strategies:

- Most Important.
- Important.
- Desirable.
Questions?