An Introduction to Automated Vehicle Platooning Technology and Automated Vehicle Legislation

March 4, 2019

IBT Safety and Health Department
Enjoli DeGrasse, Deputy Director

IBT Political and Legislative Action Department
Ali Anderson, State Legislative Director
Automated vehicles are those in which at least some aspect of a steering, shifting, or braking (safety-critical control function)
occurs without direct driver input.

• Also Know As: Autonomous Vehicles, Self-Driving Car, Driverless Vehicles, Intelligent Transport Systems

Freightliner, OTTO, Volvo, Mercedes, Caterpillar

These vehicles can be used in mines, at ports, on construction sites, and on our nations highways
The SAE defines 6 levels of automation from no automation to full automation. Definitions associated with each level of automation are minimum rather than maximum system capabilities for each level. A particular vehicle may have multiple driving automation features such that it could operate at different levels depending upon the feature(s) that are engaged.
Level 0
The human driver does all the driving.

Level 1
An advanced driver assistance system (ADAS) on the vehicle can sometimes assist the human driver with either steering or braking/accelerating, but not both simultaneously. 
**Adaptive Cruise Control OR Lane Keeping Assistance**; **Driver Assisted Vehicle Platooning Technology**
Must drive and perform other functions and monitor the driving environment

Level 2
An advanced driver assistance system (ADAS) on the vehicle can itself actually control both steering and braking/accelerating simultaneously under some circumstances. The human driver must continue to pay full attention ("monitor the driving environment") at all times and perform the rest of the driving task. 
**Adaptive Cruise Control AND Lane Keeping Assistance; Traffic Jam Assist**
Must monitor driving environment (system nags driver to ensure attention)

Level 3
An Automated Driving System (ADS) on the vehicle can itself perform all aspects of the driving task under some circumstances. In those circumstances, the
human driver must be ready to take back control at any time when the ADS requests the human driver to do so. In all other circumstances, the human driver performs the driving task.

Traffic Jam Pilot; Automated parking; Highway Autopilot; Advanced Vehicle Platooning Technology

May read a book, text, or web surf, but be prepared to intervene when needed

Level 4
An Automated Driving System (ADS) on the vehicle can itself perform all driving tasks and monitor the driving environment – essentially, do all the driving – in certain circumstances. The human need not pay attention in those circumstances.

Closed campus driverless shuttle
Valet parking in garage
Automated Tractor Trailers
‘Fully automated’ in certain conditions
May sleep, system can revert to minimum risk condition if needed

Level 5
An Automated Driving System (ADS) on the vehicle can do all the driving in all circumstances. The human occupants are just passengers and need never be involved in driving.

Plain language description of the SAE levels of automation

Automated taxi
Car-share repositioning system
No driver needed
Under the bonnet
How a self-driving car works

Signals from GPS (global positioning system) satellites are combined with readings from tachometers, accelerometers and gyroscopes to provide more accurate positioning than is possible with GPS alone.

Lidar (light detection and ranging) sensors bounce pulses of light off the surroundings. These are analysed to identify lane markings and the edges of roads.

Video cameras detect traffic lights, read road signs, keep track of the position of other vehicles and look out for pedestrians and obstacles on the road.

Ultrasonic sensors may be used to measure the position of objects very close to the vehicle, such as curbs and other vehicles when parking.

The information from all of the sensors is analysed by a central computer that manipulates the steering, acceleration and brakes. Its software must understand the rules of the road, both formal and informal.

Radar sensors monitor the position of other vehicles nearby. Such sensors are already used in adaptive cruise-control systems.

Source: The Economist
Figure 2 Several driver-assistance systems are currently using radar technology to provide blind-spot detection, parking assistance, collision avoidance, and other driver aids (courtesy Analog Devices).
Connected Vehicles

Enables cars to talk to one another
Allows nearby vehicles to exchange data on their position and use these data to warn drivers of potential collisions such as a stopped vehicle blocked from view, or a moving vehicle at a blind intersection.

V2V technologies fill in missing information when other vehicle sensors have gaps.

Unprecedented and transformative technology: Extendable to other vehicle types, road users, and infrastructure.
Allows infrastructure to communicate with vehicles to inform drivers about weather, traffic, work zones, and even potholes

- Allows for coordinated signal timing and enhanced parking information systems that may improve urban traffic flow

- Interim version of V2I Deployment Guidance released in early 2016
How do vehicles communicate?
Dedicated Short Range Communication (DSRC)

- Allows wireless communication between moving automobiles, infrastructure, and pedestrians via 802.11 radio frequency on the 5.9GHz band
  - Monitors: vehicle Speed, Direction, Position
- Passive communication: alerts driver of hazard
- Active communication: info from DSRC is sent to computer to control acceleration and braking.
- Problem: compatibility (manuf. propriety), sharing radio spectrum with WIFI companies, infrastructure upgrades needed, works best with mass adoption.

Dedicated short-range communication (DSRC) is a **wireless** communication technology designed to allow automobiles within the intelligent transportation system (ITS) to communicate with other automobiles or infrastructure technology. DSRC technology operates on the 5.9 GHz band of the **radio frequency** spectrum and is effective over short to medium distances.

DSRC technology can be used in either a vehicle-to-vehicle (V2V) or vehicle-to-infrastructure (V2I) format, and **communicates using transponders known as on-board units (OBUs) or roadside units (RSUs)**. In V2V, DSRC is used to allow vehicles to communicate with each other through OBUs. This communication is usually for safety reasons, such as to alert the driver of one car that the car in front of it is about to slow down. In V2I, an OBU in or on the vehicle communicates with surrounding infrastructure equipped with an RSU. This can also alert the driver to safety risks, such as that they are approaching a curve too quickly, or can be used to collect tolls and parking payments.
Automated vehicles are those in which at least some aspect of a safety-critical control function (e.g., steering, shifting, or braking) occurs without direct driver input.

Connected vehicles are those which use wireless technology to communicate among vehicles, roadside infrastructure, and other road users.

Connected automated vehicles are those which leverage autonomous and connected vehicle capabilities.

Intelligent Transport System is an operational system of various technologies that, when combined and managed, improve the operating capabilities of the entire system.

Self driving vehicles can take two paths

One path is to use the sensor technology solely and operate in a silo. The radar and bells and whistles replace the eyes and ears of a driver.
The second path also connects that vehicle digitally to the world around it. This is where a majority of the benefits for companies could be realized.
Intelligent Transport System (ITS)
Drone Trucks

http://www.fox13news.com/news/local-news/autonomous-truck-testing-florida?fbclid=IwAR3_BQM0ek7zrJM5gTwt0JkefXHKptY8eOU9yLZMn2g0yCKeQ4cWgRDbras

Embedded video
CMV Platooning
Components of Platooning

- Vehicle-to-Vehicle (V2V) connection
- L1: Vehicles are driver-operated
- Following drivers are under longitudinal control
- Hazard Alerts
- Active braking
AKA: Drafting, Tailgating
Cooperative Adaptive Cruise Control (forward ranging sensor, plus engine braking and transmission control) Disc Brakes
Fast highly reliable V2V communication (DSRC)
Informative driver-vehicle interface
Early detection and response to cut-in vehicles

SAE Level 2: lane position detection and automatic steering control
SAE Level 3: Central supervision, I2V communication
SAE Level 4: Extensive Safety Assurance, possibly dedicated truck lane or segregated traffic.

L3 Platoon: Drivers of following vehicles would have other jobs, remote supervision by lead driver or central
L4 Platoon: driver trails L0-L2 truck. Like a drone

(Autonomous Truck Platooning – no driver in following trucks)
During manual driving, safe following distances between trucks are maximized to allow time for driver perception, reaction, and brake lag in both trucks when responding to an obstacle ahead.

Adding a radar-based collision mitigation system cuts out driver perception and reaction, but still must allow for radar to detect the front truck slowing before the rear truck’s brakes can be applied.

In a platooning rear truck, the steering is manual but the braking is automatic. The Peloton Platooning System uses truck-to-truck wireless communication, allowing the rear truck to automatically initiate braking even before the front truck begins to slow. This nearly instantaneous reaction means trucks can safely follow at smaller distances and save fuel.
Example of SAE Level 1 Automated & Connected Vehicle

Embedded video
Platooning Pitfalls: Safety and Health Perspective

- Bendix Wingman Breaking System-malfunctions
- Driver disengagement
- Physical hazards to the trailing trucks
- Data centric misbehavior
- Human challenges from non platooning vehicles
  - i.e. vehicle cut-ins
  - Vehicle positioning benefit/ partner autonomy (?)

Driver disengagement (fatigue increases with automation)
Emergency situation: physical hazards (blown tire, unsecured load, load shifting)
Lead Driver Medical issue
Data centric misbehavior (delayed v2v communication)
Human challenges from non platooning vehicles (vehicle cut-ins)
Vehicle positioning (who enjoys the benefit of the reduction in fuel consumption)
  mainly a problem in situations where drivers from different companies platoon together.
OTHER SAFETY CONSIDERATIONS OF CMV PLATOONING

• Ergonomics: Human Machine Interface (HMI)
• Technological Malfunction
• Cybersecurity /Hacking
• Privacy
• Alarm Fatigue (DSRC Passive Alerts)
• Process Overload (fatigue)
• Workplace Stress/ Workplace Violence
Questions to Ask UPS prior to Platoon Testing?

1. Do you anticipate having Teamster represented drivers in the platooning trucks?
2. Do you anticipate having the platooning trucks carrying freight?
3. How many trucks will be in a platoon?
4. How active does the second driver need to be in regards to maintaining vehicle control?
5. With the issues drivers are experiencing with the current “Wingman” system, what steps are you taking to address the breaking malfunctions.
6. How does the company anticipate handling vehicle cut-ins between the platooning trucks?
7. Will drivers always remain in the trailing tucks of the platoon?
8. Where else has this system been tested? What kind of issues have come from the testing? Have there been any accidents involving platooning trucks? If so, please provide the accident reports from these?
Questions to Ask Prior to UPS Platoon Testing?

9. How has the company addressed the safety of the driver in the trailing truck in the event of an emergency (i.e. tire blowout, lost loads, projectiles /road debris from the leading truck, lead driver medical emergency)
10. Does UPS intend to use any driver physical state monitoring systems?
11. What is training will drivers receive prior to being in a platoon? Can you give us copies of the training program?
12. How long is the training program for the drivers? Please provide us with a copy of the training materials?
13. Will feeder drivers participating in the proposed testing of Peloton platooning technology be able to control the distance between the following truck and the lead truck? Please identify and explain any limits on the driver’s control of the following distance.
14. What distance or range of distances, in feet, will be maintained between the following truck and the lead truck during the proposed testing of Peloton technology?
15. How will UPS ensure this system cannot be hacked and driver privacy is protected?
16. Are there any other runs on which UPS is considering testing platooning technology?
Questions
Contact Info

Enjoli DeGrasse, MSPH, CIH
Deputy Director, Safety and Health Dept.
202-624-6960
degrasse@teamster.org
www.teamstersafety.org
Overview
Context, AV technology benefits (safety accessibility), but also a number of concerns that have not been addressed (jobs/job quality, safety, privacy, infrastructure) need to be mindful of these concerns as we move toward embracing the technologies.

How it will impact workers

Jobs: job loss, loss of quality union jobs
Safety: public vs. driver, fewer accidents, new technologies malfunction, experience drive still required to ensure that vehicles operate safely, health monitoring, adverse heath effects
Privacy: data concerns
Infrastructure: current infrastructure not set up to handled the volume, bridges
Autonomous trucks, platooning is first major automation push in the commercial sector, low level autonomination technologies that can be layered in such a way that a driver would still not be required, most legislation was passed this year, most does not require a safety operator, testing was not required in most states.

9 states with following statues that would prevent platooning
1. Platoon. Platoon means a group of individual motor vehicles traveling in a unified manner at electronically coordinated speeds at following distances that are closer than would be reasonable and prudent without such coordination.

2. Exemption [Insert all state following distance code sections] shall not apply to the operator of a non-lead vehicle in a Platoon.

Common Platooning Language

1. Language comes directly from ALEC and, presumably, UPS
2. No requirement that a driver be present, no limits on the number of trucks in a platoon, no limit on the proximity with which trucks may platoon, and no limits on the roads and conditions where a platoon may be conducted.
3. Also, if the state doesn’t object to the platoon plan it automatically takes effect with no follow up.
Platooning Policy Goals

- Require a CDL driver in vehicle
- DOT supervised testing
- Maintain a “reasonable and prudent” following distance requirement
- Limit platoon size and conditions
- Require additional liability insurance for carriers who platoon
- Require data collection and reporting
- Give drivers more control

1. If we introduced a platooning bill, what would it look like?
2. A CDL driver must be present in all vehicles in a platoon
3. No more than 2 trucks in a platoon
4. Platooning should only take place in optimal conditions (low traffic density, low population density, weather, etc.)
5. Require carriers have a $5 million liability insurance policy – 2 80,000lb trucks travelling within 40 feet of each other is extremely dangerous
6. Specify in statute that only the drivers can determine when and if they should operate in a platoon, and receive adequate training
7. Carriers should not be able to pressure drivers into platooning if driver feels unsafe
8. Track all instances of involuntary disengagement of platoon, whether or not there's an accident and submit to the state