

**MCSAC Task 17-01: Highly Automated Commercial Vehicles (HACV)
Discussion Notes from June 13, 2017, MCSAC Meeting**

Introduction

Task 17-3: The Agency requests that the Motor Carrier Safety Advisory Committee (MCSAC) provide recommendations concerning the issues the Federal Motor Carrier Safety Administration (FMCSA) should consider to ensure that the Federal safety regulations provide appropriate standards for the safe operation of highly automated commercial vehicles (HACVs) from design and development through testing and deployment. Specifically, the MCSAC should consider the application of the following regulatory provisions in title 49 CFR to HACV operations:

- (1) Part 383, Commercial Driver's Licenses;*
- (2) Part 391, Qualifications of Drivers;*
- (3) Sections 392.80 and 392.82, use of electronic devices;*
- (4) Part 395, Hours of Service of Drivers; and*
- (5) Part 396, Inspection, Repair, and Maintenance.*

Because the Federal Motor Carrier Safety Regulations (FMCSRs) include certain requirements that could be considered an obstacle to the on-road testing of HACVs, the operation of some HACVs on a public roadway without a person in the driver seat may occur only after some form of regulatory relief has been granted by FMCSA. FMCSA tasks the MCSAC with providing recommendations regarding prospective requirements for manufacturers or other entities requesting a pilot program and/or a temporary exemption to operate an HACV without a person in the driver's seat on a public roadway. We ask the MCSAC to identify data needs that the Agency should consider in developing the framework for a potential pilot program that would ensure an equivalent level of safety for HACVs as compared to having a driver operating the vehicle in the same operational design domain.

I. Discussion During Presentations

- A. FMCSA is researching how automation affects fatigue and time on task.
 1. The more a driver is removed from the operation of the vehicle, the more difficult it is to ensure that the driver remains vigilant enough to reengage when needed.
- B. The cost of these technologies is not discussed within the Motor and Equipment Manufacturers Association (MEMA). However, MEMA is working to identify all available financing mechanisms.
- C. There is currently no estimate on when the industry will reach Level 5 automation for tractor trailers.
 1. One study estimated that it will take between 3 to 5 years to reach Level 4 automation, though this is probably an aggressive estimate.
- D. Infrastructure updates will also be needed to support higher levels of automation.
- E. Society of Automotive Engineers (SAE) standards will need to take into account different domains, such as weather conditions, as Level 4 vehicles can only be automated under certain conditions or domains.
- F. Functional Safety of Automation

1. Trucks do not have multiple redundant systems as do aircraft or spacecraft.
 2. The automation system is designed to operate in the event of driver error or equipment failure.
 3. Automation is designed to allow a vehicle to fail “soft” instead of crashing.
- G. Lessons learned from automation use in mining and agricultural industries:
1. Agriculture and mining vehicles do not have to interact with other vehicles because of limited access to the sites where they are used;
 2. Even with geofencing and restricted lanes, there will still be other things in the domain (e.g., debris, animals) that a vehicle will need to be able to detect and avoid; and
 3. Automation is difficult to implement.

II. Issues FMCSA Should Consider When Allowing HACVs to Operate

- A. Some types of automation is similar to autopilot used in aircraft. FMCSA should review the Federal Aviation Administration (FAA) regulations on automation.
- B. How can FMCSA and the industry remove obstacles to implementing demonstration projects?
1. What are the regulatory barriers on the State, local, and Federal levels?
 2. Regulatory agencies need to determine who has jurisdiction in various areas e.g., vehicle standards and performance fall under the National Highway Traffic Safety Administration (NHTSA’s) jurisdiction.
- C. Regulatory Issues
1. Private industry should not be able to determine safety rules.
 - a. Private industry should be involved in shaping safety rules in collaboration with various governments.
 - b. States seem to be in a race to change rules to allow demonstration projects.
 - c. FMCSA needs to gather information from States and other entities that are already in the process of developing requirements for autonomous vehicles.
 - i. FMCSA should work with the States to determine what the regulations should entail prior to enacting legislation and regulations.
 - ii. The American Association of Motor Vehicle Administrators (AAMVA) has an autonomous vehicles working group.
 2. As technology transitions to more fully autonomous vehicles, regulations will need to progress with the technology.
 - a. Changing technology will create training issues for law enforcement.
 - b. The Commercial Vehicle Safety Alliance (CVSA) needs to know the technology that is available in order to develop standards for inspections.
 - c. FMCSA should move forward with developing regulations to allow at least Level 1 automation.
- D. FMCSA and the industry should ensure that they have acceptance from the public and from drivers whose role may change over time as the technology develops.

- E. For liability and enforcement purposes, the vehicle will need to record who is driving the vehicle at all times.
- F. Impacts on Drivers
 - 1. Driving in a platoon is different from the way commercial motor vehicle (CMV) drivers have been trained to drive or are used to driving.
 - 2. Training will be essential for drivers to understand how and when to take back control.
 - 3. Driver Fatigue and Attention
 - a. How do you keep a driver from getting fatigued if he or she is not fully in control of the vehicle?
 - b. Fatigue is more of an issue for automation Levels 1 through 4 and less of an issue with fully automated vehicles (Level 5) that do not require an attentive driver at all times.
- G. Automation technologies have been proven in Europe to reduce fatalities.
- H. Design and Development Considerations
 - 1. FMCSA needs to keep pace with what it needs to know about or do regarding the technology.
 - 2. Regulations will need to cover issues such as what equipment is being used, how to mount the equipment, and how an inspector can ensure that a sensor or other item is working.
 - 3. FMCSA will need to review each piece of equipment on the truck that the new technology interacts with and determine how to inspect them.
 - 4. FMCSA should work with other partners to ensure there are performance testing standards.
 - 5. How much of the information about these technologies is proprietary? Who will own the information needed to conduct an investigation?
 - 6. Feasibility of Automation in Different Domains
 - a. Will these technologies be allowed only in controlled environments?
 - b. The thresholds between approved and not approved domains will need to be narrowly defined to account for variations in road conditions.
 - c. Environments in which this technology can be used will likely expand as the technology develops.
 - d. SAE does not yet define domains (e.g., ice, snow, rain).
 - e. Can trucks be among the first vehicles that can be fully autonomous on the open road?
 - 7. FMCSA should collaborate with the industry to understand how stakeholders want to use this technology and when different technologies will be available.
 - a. Does industry want to use it only in some limited circumstances (e.g., short point-to-point routes that are used frequently)?
 - b. How can the public be involved in this process when the industry does most of the research?
 - c. A lot of companies are interested in platooning.
 - d. FMCSA should address safety rules for the technologies that are likely to be available the soonest.
 - e. Demonstration projects have shown that the state of the art is further ahead than regulators and enforcement agencies realized.

8. Existing technologies (e.g., lane assist) are not completely reliable and still require a driver to be in control of the vehicle.
- I. Certain types of loads should be excluded from automated vehicles.
 1. What requirements should be on the systems in order to allow various levels of automation?
 - a. Permissibility may depend on the level of automation and road conditions.
 - b. Cybersecurity issues are of paramount concern for certain materials.
 2. Hazardous Materials
 - a. If the technology is not good enough for hazardous materials, it is not good enough for any load.
 - b. When will the technology be proven good enough to use for hazardous materials transport? When does it make sense to use it?
 - c. The main motivation for using this technology is safety.
 3. Radioactive materials (e.g., waste isolation pilot plant (WIPP) shipments) should not be transported using Level 4 or 5 automation.
 4. Extended loads should not be on automated vehicles.
- J. FMCSA should keep in mind that some of these technologies offer safety benefits.
- K. FMCSA does not have authority over intrastate loads but State requirements for intrastate vehicles must be compatible with Federal requirements.
 1. Most automated shipments are anticipated to be intrastate, and States will compete to have those companies in their States.
 2. FMCSA should make 49 CFR part 350 (Motor Carrier Safety Assistance Program and High Priority Program) compatible with autonomous technology.
- L. FMCSA will need to determine which technologies work with different infrastructure setups.
- M. For technology developers, it can be difficult to identify which technologies fall into which levels.

III. How Could Current Regulations Apply to HACVs?

- A. It is currently unclear how to regulate vehicles that are not operated by humans.
- B. Commercial Drivers Licenses (CDLs)
 1. For all levels of automation, CMV drivers might need training about how to use the technology and how to know it is operating correctly.
 2. Pre-trip inspection requirements will need to be updated for all levels of automation.
 3. Would a driver need an endorsement to drive vehicles with certain levels of automation?
 - a. If there is a driver in the vehicle, should that person be required to have a CDL?
 - b. Could a commercial passenger carrier vehicle have a passenger manager who is able to stop the vehicle, instead of someone with CDL, if operated in a limited domain?
 - c. The need for a CDL or endorsement could depend on the definition of the driver and his or her role.

- C. Driver Qualifications
 - 1. A driver that is medically unqualified now could be qualified to drive under certain levels of automation.
 - 2. At Level 3 and Level 4, there probably should not be any changes because the driver needs to be ready to take back control.
- D. Use of Electronic Devices (e.g., cell phones)
 - 1. The use of electronic devices probably should not be allowed during any level of automation.
 - 2. Maybe electronic devices could be allowed with Level 5 technologies if the driver does not need to be able to take control.
 - 3. If a vehicle with Level 4 automation technology stays within the approved domain, should it be treated like Level 5 with regard to using electronic devices?
- E. Hours of Service (HOS) regulations may not be needed if a driver is not operating the vehicle.
- F. Inspection, Repair, and Maintenance
 - 1. There will need to be a way to know that all of the technologies are working.
 - 2. Inspections will need to be changed to include new technologies, with substantially more detailed inspections for fully automated vehicles.
- G. Parts and Accessories Necessary for Safe Operation
 - 1. FMCSA may need to change requirements based on the technologies used.
 - 2. For example, the ideal location of a camera is outside of the currently allowed 4 inches above the top of the wiper zone.

IV. Recommendations on Requirements for Pilot Programs

- A. Operational Design Domains
 - 1. Testing can be done in environments that have no interference by pedestrians or other obstacles.
 - 2. A graduated program could allow technologies to operate in highly controlled domains and then move to less controlled domains as the technology is proven to work.
- B. Data needs for developing a pilot program framework:
 - 1. Pilot programs will need data that demonstrate a technology's ability to operate in certain operational domains before moving to less controlled domains.
 - 2. Data on how frequently a technology fails or passes will be needed.
 - 3. There will need to be a variety of test environments of roadway conditions to gather data on performance on different pavement conditions.
 - 4. Data will need to demonstrate the ability to achieve safety objectives with a gradual progression toward less driver interaction with the vehicle.
 - 5. The Federal Highway Safety Administration (FHWA) might have data on platooning technology.
 - 6. Data needs will be different for pilots that are testing different technologies in various stages.
 - 7. FMCSA should ask technology providers to share the data they have that has proven that their technology works.

C. Liability

1. For the pilot test in Colorado, the technology company (Otto) was asked to increase their liability coverage significantly above the FMCSR requirements.
2. This is an opportunity to require higher levels of financial responsibility.
 - a. On the other hand, would it be fair to increase requirements if the technology makes trucks safer?
 - b. If CMVs become substantially safer at Level 4 or Level 5 automation, insurance rates might be much lower, even for higher levels of coverage.
 - c. Additional financial responsibility could be required from either carriers or the technology manufacturer.

D. Public Assurance and Public Awareness

1. Signage might be needed to indicate that roads are used by driverless vehicles, but it may be difficult to keep up with changes if domains grow very quickly.
2. Law enforcement and the public will need to become educated about truck platooning so they are less alarmed when they see trucks following so closely.
 - a. There is debate about whether an information campaign is needed if the trucks are safer without a driver.
 - b. Knowing that platooning is safer could help increase public assurance.
 - c. Education will be needed to change how cars interact with those vehicles.
3. What are the public's performance expectations? How much better is this than a human?
4. Ports of entry and State agencies will need to be aware of how platooning vehicles work.

E. FMCSA might need to develop additional requirements for drivers in pilot programs.

F. Platooning Issues

1. What happens if the last vehicle gets caught at a red light? Can the platoons be broken up?
2. Can traffic lights be programmed to know a platoon is coming through?
3. Infrastructure might need to be improved to accommodate platoons.