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# Commercial Vehicle Operations: Moving Ahead with Automation

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Transportation Research Board 93<sup>rd</sup> Annual Meeting

Automated Vehicles: Key Technical and Operational Challenges

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# ACVO RNS Guide

Understanding Opportunities and Challenges  
Documenting Research Needs

## Automated Commercial Vehicle Operations Breakout Session Guide

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*This approach will allow us to discuss key topics of interest, prioritize issues related to those topics, and develop research needs statements – all within a limited timeframe*

### Breakout Session Overview

This breakout session will focus on research needs concerning how automated heavy vehicles could have an effect on commercial vehicle operations (CVO). It is important to note that CVO represents the transport of goods and services (e.g., truckload operations, less-than-truckload, motorcoach/bus charter services) and it is covered by strict regulations. Myriad policies and regulations for CVO could be impacted by more advanced levels of automation. For example, 49 CFR Part 395.2 – Hours of Service (HOS) defines Driving Time as “all time spent at the driving controls of a commercial motor vehicle in operation.” However, definitions for NHTSA-defined automation Level 3 and higher suggest that the driver cedes control of the vehicle for what could be extended periods of time. Could this potentially require a modification of this definition or prescribe a new concept of HOS? Another interesting aspect for CVO is the high turnover rate for drivers; could we accept less-skilled operators (no Commercial Driver’s License needed) because a higher level of automation alleviates the need for a highly trained driver? There are also many use cases where just a lead vehicle might need a professional driver and the other commercial vehicles could simply follow (i.e., platoon). These and many more aspects could not happen without advanced sensor technology and algorithms. However, for CVO, the algorithms studied thus far mainly focus on fuel efficiency, speed harmonization, and other aspects that – up to this point – might not result in changing levels of user acceptance throughout a route. These are only a few of the issues at hand that could be developed during this breakout session.

### Goals and Objectives

**What will we accomplish?** Using a deliberative approach, we will move toward a group decision regarding future CVO research needs. Specifically we will:

1. Work in small groups to identify and prioritize research gaps within three broad topic areas.
2. Come together as a full group to identify the top three priorities and develop research needs statements to support those priorities.

**How will we do that?** We will do that by engaging in a deliberative dialogue in which we:

- Consider a number of issue areas and associated topics within each.
- Discuss the OPPORTUNITIES and CHALLENGES associated with each research option – its research potential, drawbacks, and trade-offs.
- Get beyond the initial positions people hold to their deeper motivations – the things they consider to be the most valuable for continuing research.
- Weigh carefully the views of others and appreciate the impact various options would have on what others consider valuable.
- WORK THROUGH conflicting emotions that arise when various options that arise when various options pull and tug on what people consider valuable.

### What to Expect

#### Day One – Understanding Challenges and Opportunities

##### Stages of the Issue Prioritization Efforts

##### Welcome

- The session leader will introduce the issue area and review session goals and objectives.

##### Topic Breakout Sessions

- Participants will join the topic breakout sessions of their choice.
- Moderators will introduce the topic area.

##### Ground Rules

- Everyone will review the desired outcomes and agree on ground rules.

##### Getting Started

- Take a few minutes for each participant to talk about their personal experiences with the issues. The facilitator may want to begin by reviewing the problems underlying the issue.

##### Deliberation

- Participants will examine all the options. An approximately equal amount of time should be spent on each issue choice.

##### Prioritization

- Taking into consideration the need to develop research need statements, group members will prioritize their top two issues. The remaining issue priorities will be noted for use as a guide for future research needs.
- The group will prepare an overview of the research needs associated with the top two priority issues; these issues will be presented to the full Automated CVO group during the second session.

##### Closing Thoughts

- Participants will reflect on what has been achieved.

#### Day Two – Documenting Research Needs

##### Stages of the RNS Development Efforts

##### Welcome

- The facilitator will re-introduce the issue area and summarize day one activities

##### Ground Rules

- Everyone will review the desired outcomes and agree on ground rules.

##### Getting Started

- The facilitator will briefly summarize the Day One activities for newcomers.

##### Deliberation

- A member of each Topic Breakout Group will present their group’s top two research issue priorities.
- Participants will examine all the priority options. An approximately equal amount of time should be spent discussing each choice.

##### Prioritization

- Taking into consideration the need to develop full research need statements, group members will prioritize their top three issues. The remaining issue priorities will be noted for use as a guide for future research needs.

##### Documenting Research Needs

- Participants will break into three groups to complete three Research Need Statements (RNS). Participants will be free to move between groups, contributing to each RNS.

##### Closing Thoughts

- Participants will reconvene and reflect on what has been achieved.

# Overview

- **Background**
- **Breakout Session Review**
- **Discussion of Automated Commercial Vehicle Operations (ACVO) Research Opportunities**

# Background

- **Commercial Vehicle Operations (CVO) represents the transport of goods and services (e.g., truckload operations, less-than-truckload, motorcoach/bus charter services) and is covered by strict regulations.**
  - 49 CFR Part 395.2 – Hours of Service (HOS) defines Driving Time as “all time spent at the driving controls of a commercial motor vehicle in operation.” [FMCSA]
  - However, Level 3 and higher suggests that “it enables the driver to cedes full control of all safety-critical functions” for potentially extended periods of time. [NHTSA, May 30, 2013]
- **CVO faces additional challenges**
  - High driver turnover rate
  - Driver shortage
  - Fuel cost

# Deliberative Process Overview

- **Worked together in small groups to identify and prioritize research gaps within three broad discussion areas.**
- **Came together as a full group to identify the top three priorities and develop research needs statements to support those priorities.**



# Understanding ACVO Challenges

- **Three working groups: Business Case Issues, Technology Issues, and Human Factors Issues**
- **Discussed the OPPORTUNITIES and CHALLENGES associated with approximately 50 research options – its research potential, drawbacks, and trade-offs to determine the most immediate research needs.**



# Discussion Topic Areas

## ➤ Business Case Issues

- Logistics
- Smart Tractor/Dumb Trailer(s)/Automation Challenges For CMVS in North America
- Hours of Service

## ➤ Technology Issues

- Platooning – Simulation and Modeling
- Platooning – Protocol Development
- Platooning – Field Platooning

## ➤ Policy and Human Factors Issues

- Licensing and Training Programs
- Human Factors Related Issues – HMI
- Human Factors Related Issues – Health and Wellness

# Identifying Opportunities

- Each work group presented the 2 most immediate policy questions/research needs.
- Full ACVO breakout group discussed ranked each alternative.
- Result was the identification of 3 key research needs.



# Immediate Priority Areas

ACVO Priority Issues	Votes
AVCO: Applications and Benefits	9
Components of Automated Commercial Vehicle Training	9
Factors for Dynamic Optimal Platoon Ordering	7/7*
Faults, Failures, and Failover	7/5*
Driver Skill Degradation in Automated Commercial Vehicle Operators	5
Smart Truck/Dumb Trailer(s) Interface	2

\*A run-off vote was held to determine the 3<sup>rd</sup> priority topic.

# Research Needs by Topic Area

## ➤ Business Case Issues

- ACVO: Applications and Benefits

## ➤ Technology Issues

- Factors for Dynamic Optimal Platoon Ordering

## ➤ Policy and Human Factors Issues

- Components of Automated Commercial Vehicle Training

# ACVO: Applications and Benefits

- **Problem:** It is not clearly quantified which CVO applications/use case scenarios (e.g., platooning) would benefit from a certain level of automation and how feasible that state of automation might be.
  - How could each application take advantage of a particular technology or level of automation?
  - Suggest presenting solutions at a functional level and then identify technologies satisfying given functional needs.



# ACVO: Applications and Benefits (2)

## ➤ Research Objectives:

1. Investigate the impact of automation applications on different CVO segments (e.g., truckload operations, less-than-truckload, motorcoach/bus charter services, local operations).
2. Look for how applications could use technology (pull) instead of how the applications could fit a technology (push).

		Solution		
		Low Speed Platooning	High Speed Platooning	Automatic Backing Assist
Segment Needs	TL	Use Case 1	Use Case 2	Use Case 3
	LTL	Use Case 4	Use Case 5	Use Case 6
	3PL	Use Case 7	Use Case 8	Use Case 9

# Factors for Dynamic Optimal Platoon Ordering

- **Problem:** Individual CMVs have different attributes impacting the optimal order in a platoon, and conditions will change dynamically.
  - Determining which are critical to optimal operation is dependent upon scenario(s).
- **Research Objective:** Identify key attributes (e.g., vehicle, driver, regulations, fleet) and relative priority that determines the optimal CMV order for efficiency and safety of the platoon depending on the application.



# Components of ACMV Operator Training

- **Problem:** Automation at Levels 2 and 3 (under the NHTSA taxonomy; or, Levels 2-4 under the SAE taxonomy) introduces potential issues that are not present in current CMV operations.
  - Individual Commercial Driver License (CDL) holders may interact with a variety of manual and automated CMVs.
  - ACMVs may include operational concepts as varied as platoons and discrete vehicles.
  - There is a need to ensure a minimal skill level in Commercial Driver License (CDL) holders prior to licensure, as well as ensure that CDL holders maintain those skills throughout their operational career.
    - Skills include maintaining awareness of the vehicle state, ensuring that CDL holders are aware of proper procedures for interacting with automated features and with protocols for joining and breaking from vehicle platoons.

# Components of ACMV Operator Training (2)

## ➤ Research Objectives:

1. Determine what training and skill maintenance needs specific to ACMV are present.
2. Identify optimal training approaches that prepare CDL holders for the operation of ACMV.



**Thank You!**

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