



Automated Vehicle Technologies in CMV's

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TRUCKS WILL BECOME INCREASINGLY AUTOMATED IN THE FUTURE

DRIVER ENGAGEMENT WILL
DECLINE STAGE BY STAGE



STAGE 0
No
Automation



Driver is fully engaged all the time, warning signals might be displayed



STAGE 1
Driver
Assistance



Automation of individual function, driver fully engaged – Driver may be "feet off" (when using ACC) or "hands off" (when using Lane Keep Assist)



STAGE 2
Partial
Automation



Automation of multiple functions, driver fully engaged – Driver may be both "feet-off" and "hands off", but eyes must stay on the road



STAGE 3
Conditional
Automation



Automation of multiple functions, driver responds to a re-quest to intervene – Driver may be "feet-off", "hands off" and "eyes off", but must be able to resume control quickly



STAGE 4
High
Automation



Automated in certain conditions, driver not expected to monitor road – Vehicle can operate without a driver in specific situations, e.g. highway driving



STAGE 5
Full
Automation

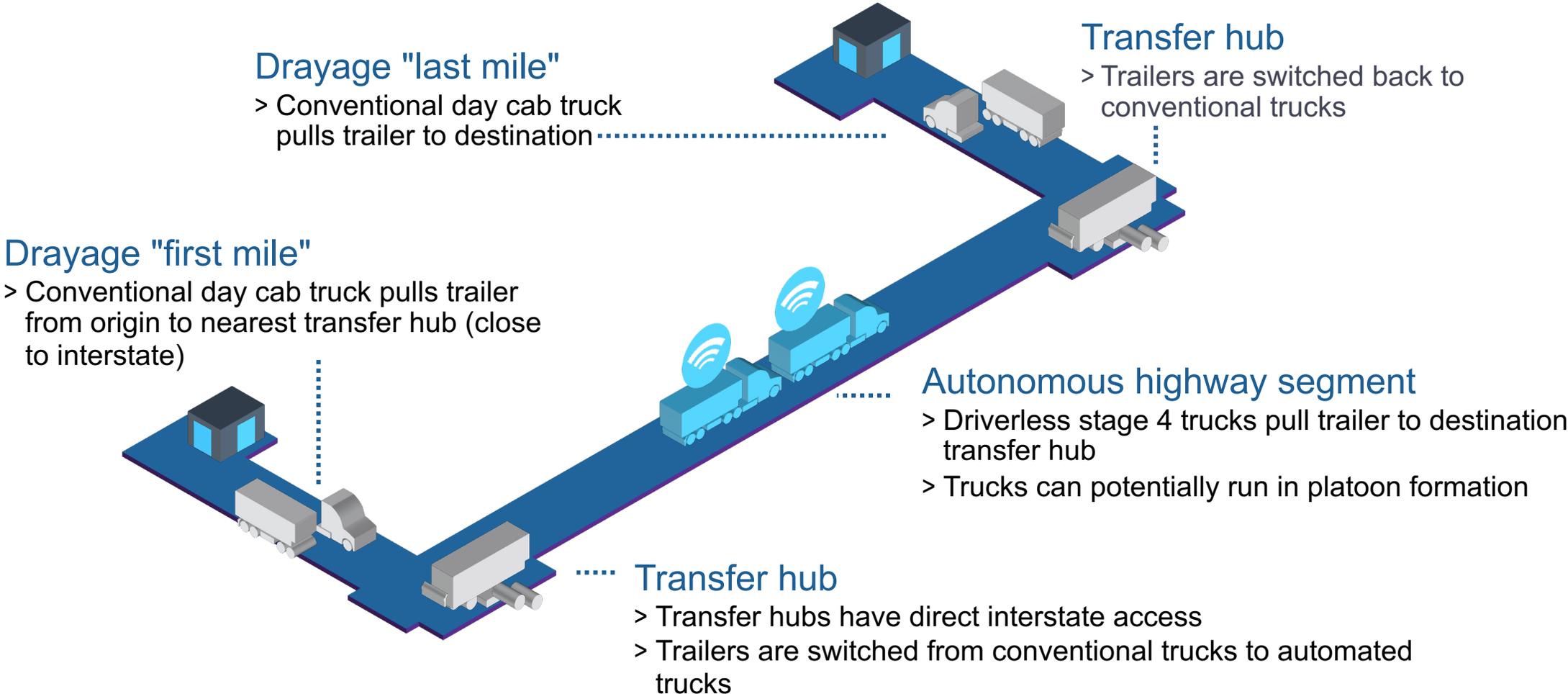


Situation independent automated driving – Driver has no responsibility during driving



DRIVERLESS AUTOMATED TRUCKS CAN SIGNIFICANTLY CHANGE THE LANDSCAPE

Transfer hub model overview

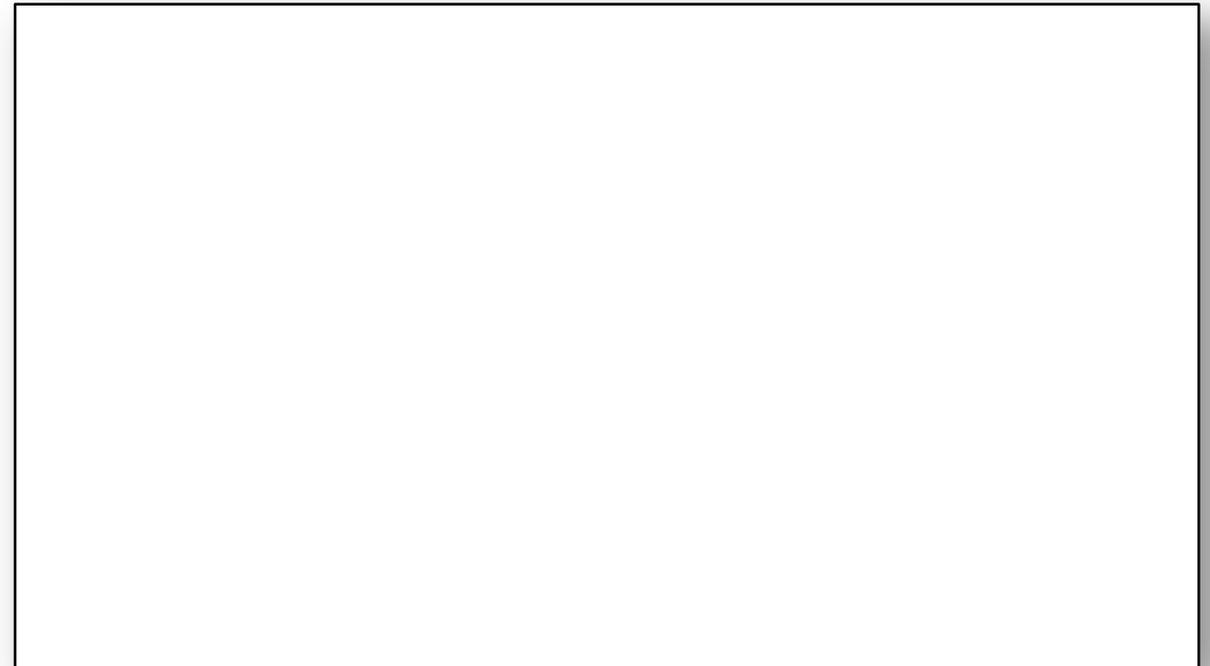


Source: Roland Berger

DRIVERLESS TRUCKS WILL ROLLOUT IN PHASES ACROSS INDIVIDUAL LANES

Two-Phase Approach

Animated Rollout



- > Embarck Trucks will follow a two phased approach:
 - > Phase 1: Sunbelt states in 2024+
 - > Phase 2: Remainder of the Lower 48 in 2026+

- > Within each phase, individual lanes will be added to the Embarck Coverage Map based on freight volume demand
- > Opening only 4% of interstate miles in the US opens up 50% of freight ton miles

Why Autonomous?

POTENTIAL RESULTS

Improved safety

Assists with Labor Shortage

Improved Efficiency -
Lower Cost

Energy savings

CONCERNS

Cybersecurity

Public Acceptance

Job displacement

Regulatory requirements

STATUS

Driver assist features

Increasing State acceptance

Fully autonomous cars
available by 2030 or
before

Billions invested

BUILDING BLOCKS OF AUTONOMY

The Building Blocks of Autonomy

Prepared by  VISION SYSTEMS INTELLIGENCE

Level of Integration

AUTONOMOUS SOLUTIONS

PROCESSING

SENSORS

CONNECTIVITY

MAPPING

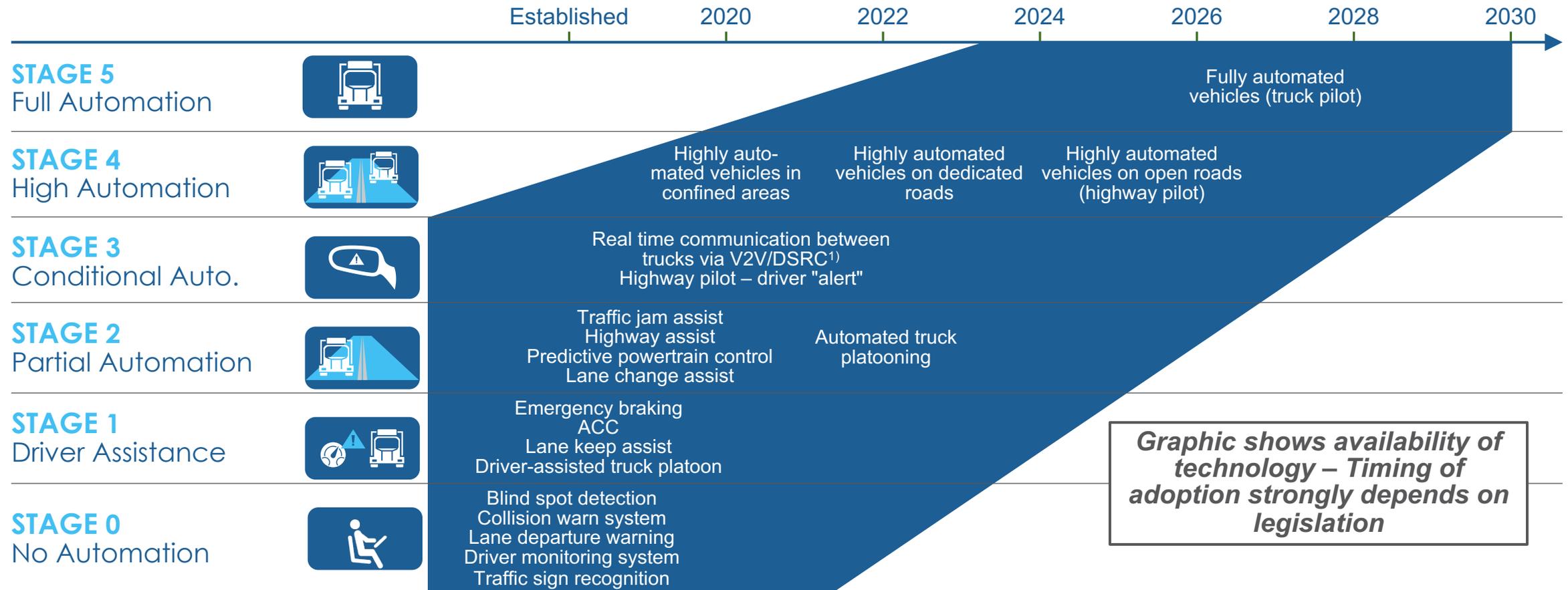
ALGORITHMS

SECURITY/SAFETY

DEVELOPMENT TOOLS

TECHNOLOGY FOR DRIVERLESS OPERATION ON INTERSTATES WILL BE AVAILABLE BY 2025

Automated freight vehicle development paths



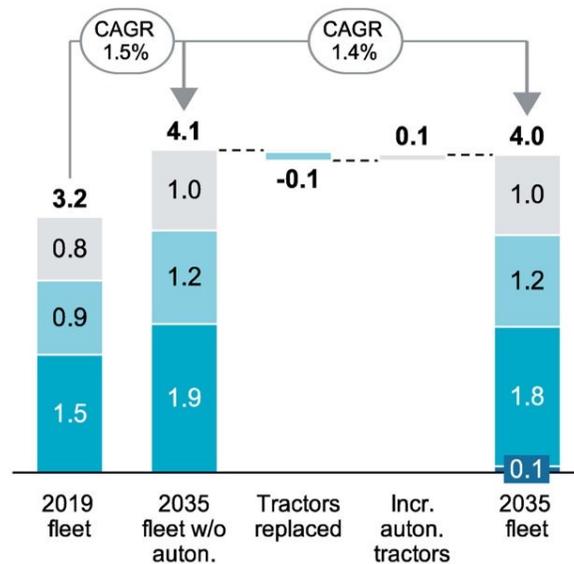
Graphic shows availability of technology – Timing of adoption strongly depends on legislation

DRIVER IMPACT – FORECASTED IN 2020

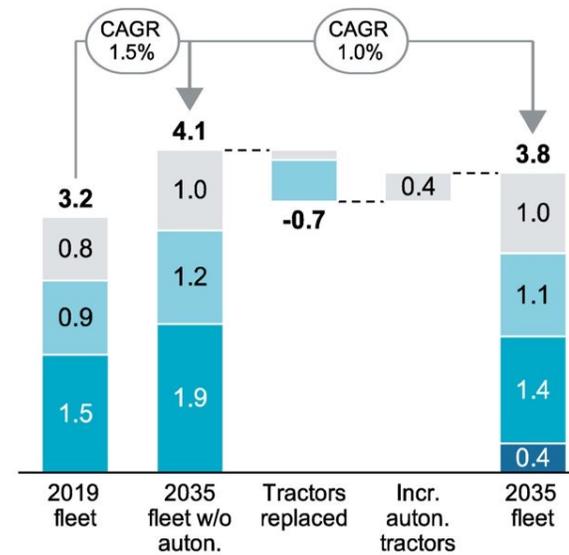
Due to the higher productivity of autonomous trucks fewer trucks will be needed and the Class 8 fleet composition will change

Class 8 truck fleet size and composition [m units]

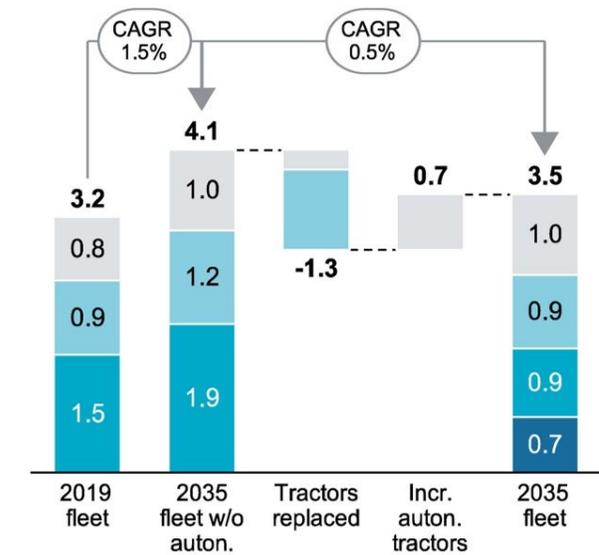
Low adoption scenario



Mid adoption scenario



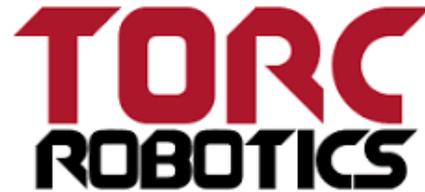
High adoption scenario



> As autonomous trucks can be operated almost continuously, fewer trucks will be needed to haul the same freight
 > Overall growth in freight traffic will still lead to absolute fleet growth, also in high adoption scenario

Legend: Straight truck (grey), Daycab (light blue), Sleeper (dark blue), Autonomous (dark blue)

AUTONOMOUS PROVIDERS



CURRENT AV COMPANY/OEM ALIGNMENT

TORC
ROBOTICS



WAYMO



Aurora



PACCAR



VOLVO

tu simple → **NAVISTAR**


EMBARK



PACCAR



VOLVO



NAVISTAR

CURRENT AV COMPANY/OEM/CARRIER ALIGNMENT



CURRENT AV COMPANY/OEM/CARRIER ALIGNMENT

TORC
ROBOTICS



WAYMO



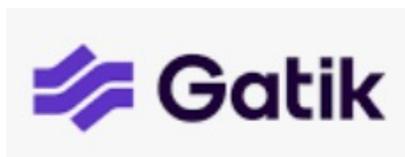
Aurora



PACCAR
VOLVO



CURRENT AV COMPANY/OEM/CARRIER ALIGNMENT



AV CARRIER'S PERSPECTIVE

- Motivations to Deploy AV: Safety, Labor Gap, Efficiency/Cost
- AV will be part of the supply chain over next decade
- Forward-leaning, innovative, data driven, transportation and logistics companies will be in the best position to determine where AV should be deployed
- Deployment will be slow and incremental beginning with the easiest operational domain design (Interstate, southern states)
- The transportation ecosystem risk should be evaluated or established with a net overall risk reduction in mind and not necessarily a one-for-one replacement of existing regulations
- OEMs that have relationships with carriers will be the predominant way that AV initially enter the market
- Even with moderate to high adoption of AV, more drivers will be needed to meet demands of economic growth
- Customer collaboration to build transportation ecosystem efficiencies (ie: coordination of loading/unloading, reduced wait times of AV)
- The public will accept unmanned trucks IF they are substantially safer than manned trucks, the data supports it, and the story is accurately told



THANK YOU!

FMCSA Automated Vehicle Activities Update

2022 Southeast CMV Safety Research Summit

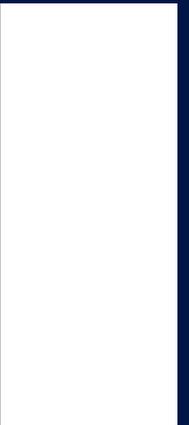
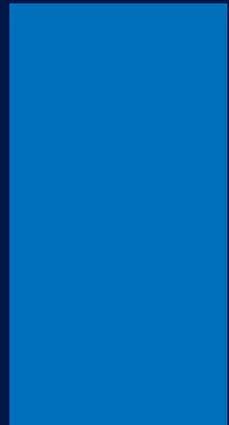
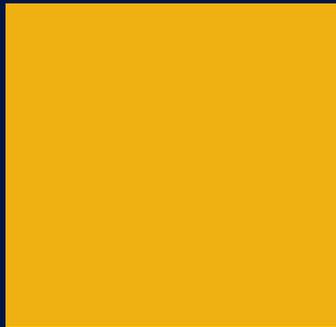
May 17, 2022

Jeff Loftus, RD&T Chief, FMCSA Technology Division, jeff.loftus@dot.gov



U.S. Department
of Transportation

Federal Motor
Carrier Safety
Administration



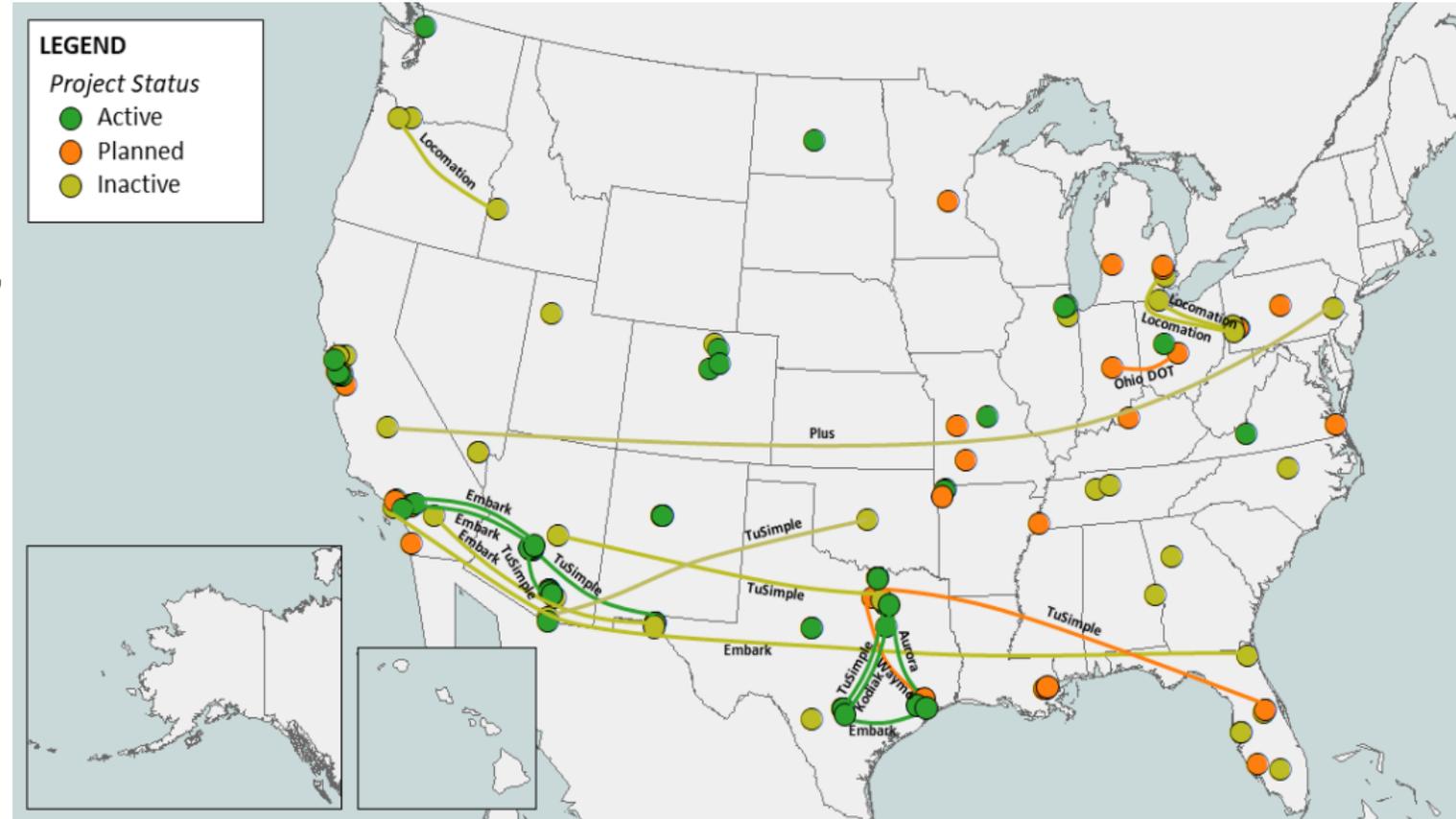
Agenda

- Current State of Commercial Motor Vehicle (CMV) Automated Driving System (ADS) Testing in U.S.
- FMCSA ADS regulatory activities
- FMCSA ADS research efforts

Current State of Automated CMV Testing in U.S.

MAP OF U.S. AUTOMATED TRUCK TEST SITES (PAST, PRESENT, AND PLANNED)

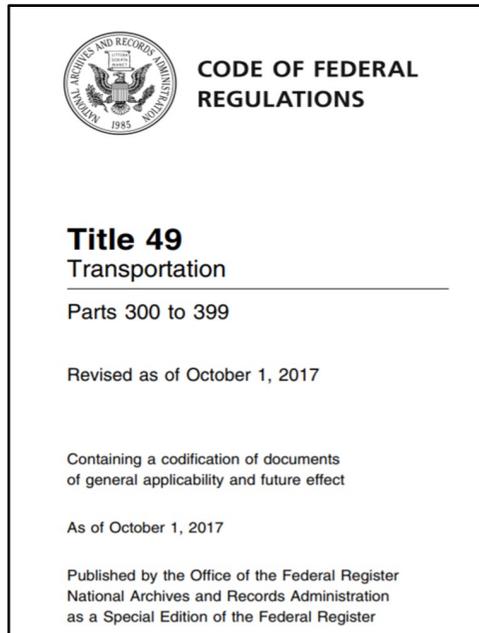
- Number of active CMV tests in US: **38**
- Number of automated CMVs being tested: **117**
- Number of States with testing: **28**
- Number of States with most testing: **TX, CA, and AZ**
- Partnerships forming between ADS developers, motor carriers, and maintenance networks
 - Gatik and Walmart
 - Waymo and UPS
 - TuSimple and DHL
 - Locomotion and Wilson Logistics, PGT
 - ADS developers and Ryder
- Early deployment sites
 - Interstate-10
 - Texas Triangle (Dal, Hou, San Ant)
- Driver out testing
 - TuSimple, 80 mile runs in AZ
 - Gatik, 7-mile loop, 12 hrs/day since Aug 2021 in AR
 - Outrider, 1,000 yard moves at distribution center in IL



Note: Cross-state routes are represented by two points connected by a line (line does not represent actual route).

Source: Volpe, January 2022

FMCSA ADS Regulatory Activities



- Listening Sessions (2017, 2018)
- Request for Comments (2018)
- Motor Carrier Safety Advisory Council (MCSAC) (2017, 2018)
- Advanced Notice of Proposed Rulemaking (ANPRM) (2019)
 - 180 comments received
 - Organizations generally supportive
 - Drivers generally opposed
- NPRM (2022)

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FMCSA-2018-0037

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311 results for "FMCSA-2018-0037"

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Results per page: 25

Sort By: Best Match

Featured Result - Docket ID: FMCSA-2018-0037
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Automated Driving Systems (ADS) for Commercial Motor Vehi...

Agency: Federal Motor Carrier Safety Administration (FMCSA)

Summary: Automated Driving Systems (ADS) for Commercial Motor Vehicles (CMVs); Request for Comments Concerning Federal Motor Carrier Safety Regulations (FMCSRs) Which May Be a Barrier to the Safe Testing and Deployment of ADS-Equipped CMVs on Public Roads

FMCSA's ADS Research Scope

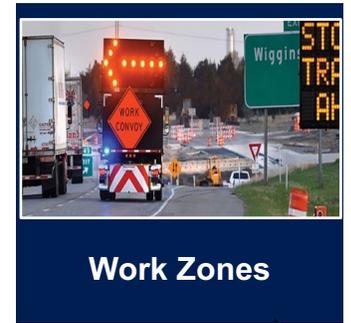
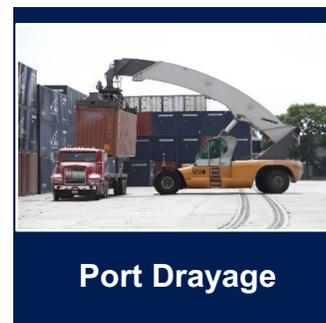
- **Conduct research** to inform safety equivalency decisions for waivers, exemptions, and pilot programs
- **Focus efforts** on the intersection of automated CMVs and public safety officials
- **Identify and promote best practices** for industry's use of automated CMVs

Automated CMV Evaluation (ACE) Program Overview

- Multi-faceted research, development and test program
- Utilization of FHWA-developed open-source software
- Testing of actual vehicles at various locations
- Government, academic and industry partnerships



Focus Areas



ACE Research Program Activities

- Developed ADS Research Plan (2018)
- Equipped three trucks with ADS technology (2018-2020)
- 2021 Accomplishments
 - Prototype roadside enf. in-motion automated CMV status checks
 - Draft cybersecurity reference testing plans for fleets
 - Initiated AV research for emergency response and work zones
- 2022 ADS Projects:
 - Electronic inspections
 - Human--ADS team driving
 - Human factors in ADS-equipped CMVs
 - Automated hazard triangle deployment



**ACE Program Demonstration:
Law Enforcement Interaction with an
ADS-equipped CMV**

Law Enforcement Interaction Demonstration

What Participants Will See on Video:

- Tractor-trailer (L3) automation and Law Enforcement vehicle (Tahoe)
- Tahoe requests automation status of tractor-trailer via dedicated short-range communication (DSRC).
- Tahoe receives response that tractor-trailer is L3 automated and follows to request additional information.

Reason for Demonstration:

- To show how the ACE Program can help FMCSA demonstrate proof-of-concept recommendations.

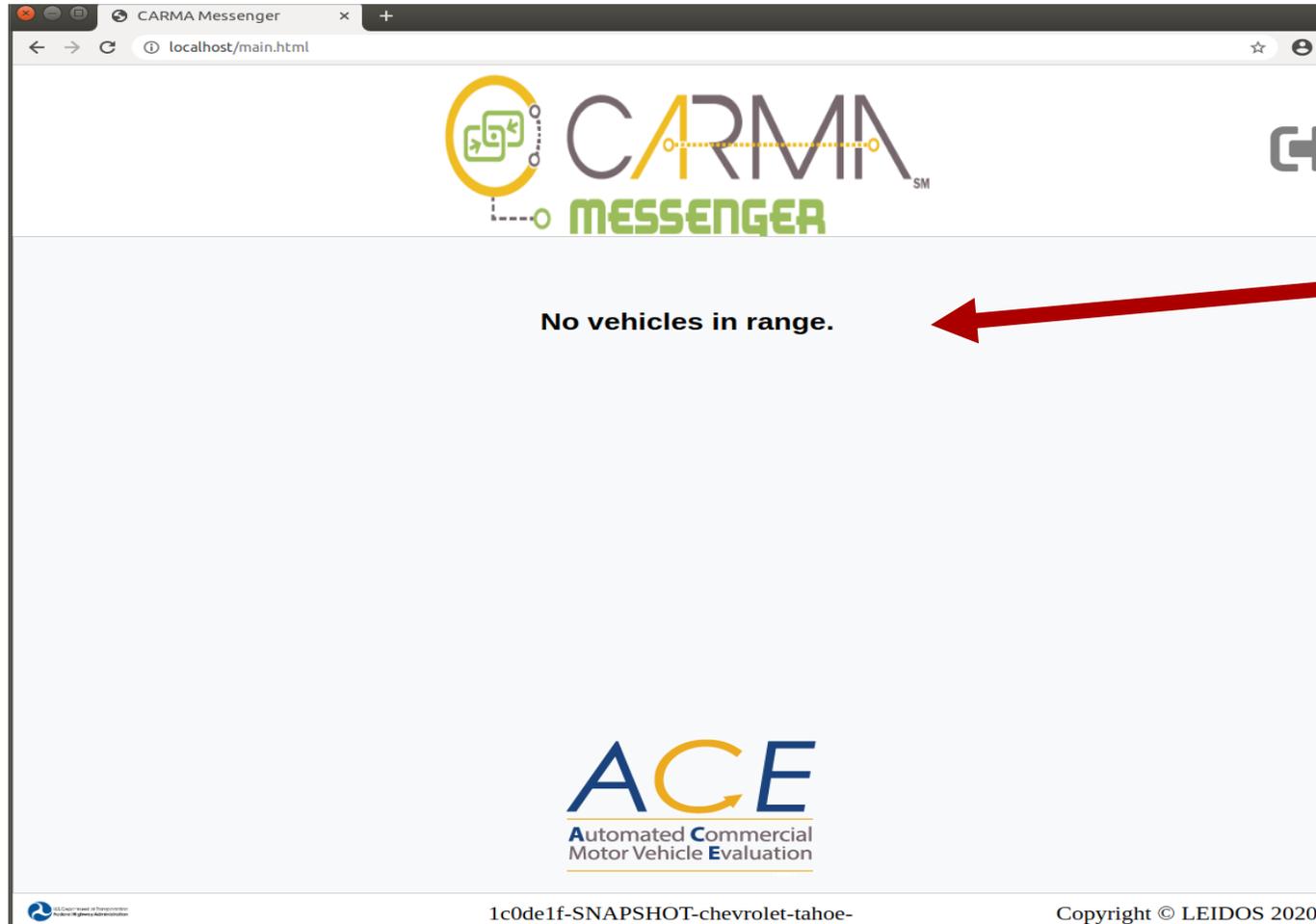


VIN				LICENSE PLATE		PERMIT REQ
1FUJGHDV0CLBP88		DOT-10003		No		
34						
CARRIER NAME			USDOT #	ISS		
FMCSA Tech Division			DOT 1	25		
LAST STATE INSPECTION		ADS PRE-TRIP CHECK	ADS HEALTH STATUS	ADS AUTO STATUS		
2020-01-01						
LAST ADS CALIBRATION		WEIGHT(LBS.)	ADS SOFTWARE VERSION			
2020-02-01		65,000	NULL			
2020-11-12 18:54:11						

SAFETY LOG
ACE
Automated Commercial Motor Vehicle Evaluation

1c0de1f-SNAPSHOT-chevrolet-tahoe- Copyright © LEIDOS 2020

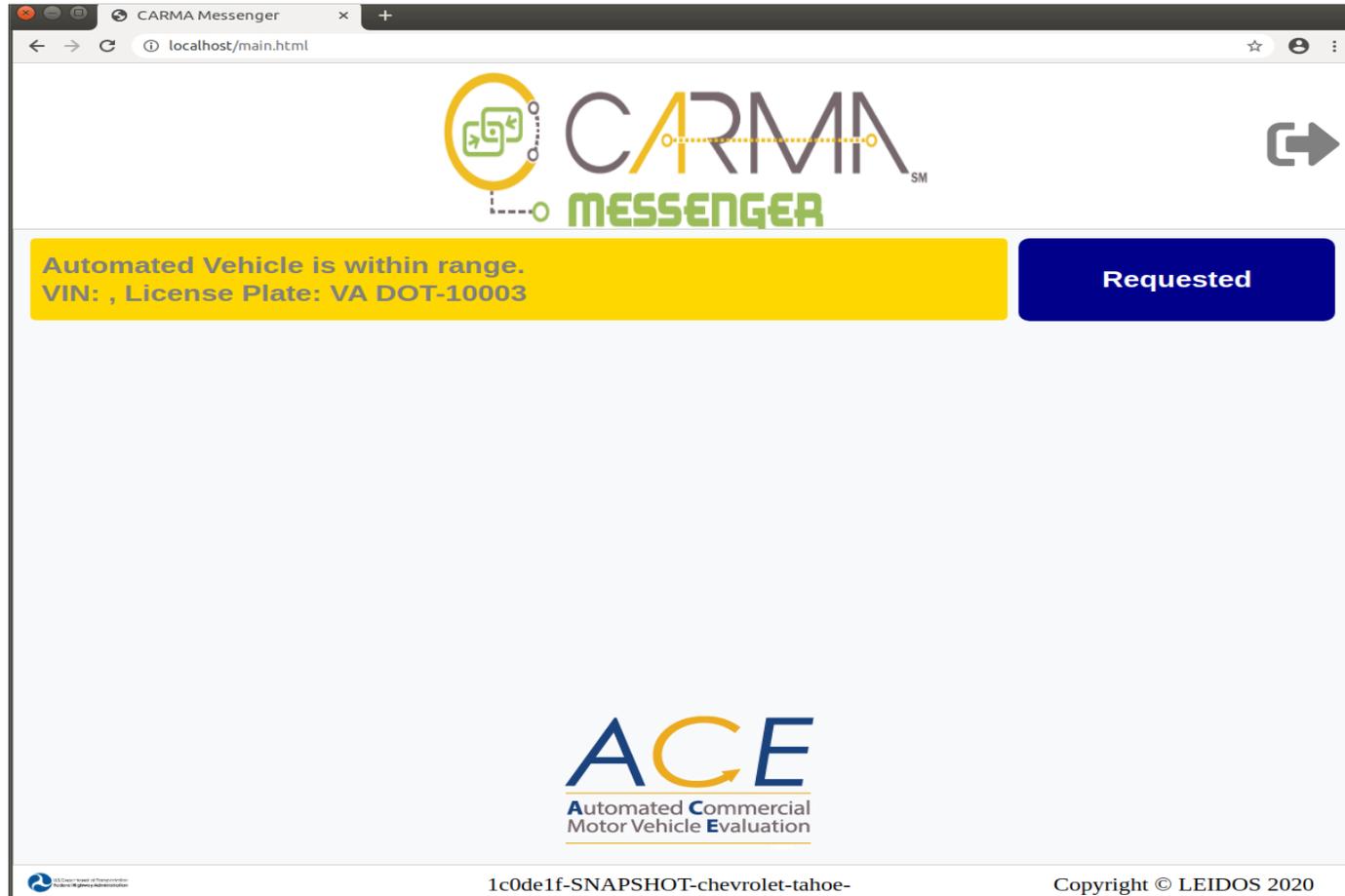
In Motion Electronic Confirmation – Are Any Automated Trucks Out There?



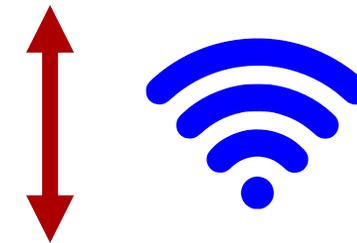
The screenshot shows a web browser window titled "CARMA Messenger" with the address bar displaying "localhost/main.html". The main content area features the "CARMA MESSANGER" logo at the top, followed by the text "No vehicles in range." in the center. At the bottom, there is the "ACE Automated Commercial Motor Vehicle Evaluation" logo. The footer contains the text "1c0de1f-SNAPSHOT-chevrolet-tahoe-" and "Copyright © LEIDOS 2020".



In Motion Electronic Confirmation – “Automated Truck is Within Range”



The screenshot shows a web browser window titled "CARMA Messenger" with the URL "localhost/main.html". The page features the "CARMA MESSENGER" logo at the top. A yellow notification bar displays the text: "Automated Vehicle is within range. VIN: , License Plate: VA DOT-10003". To the right of this bar is a blue button labeled "Requested". At the bottom of the page, the "ACE Automated Commercial Motor Vehicle Evaluation" logo is visible. The footer contains the text "1c0de1f-SNAPSHOT-chevrolet-tahoe-" and "Copyright © LEIDOS 2020".



In Motion Electronic Confirmation – “Query Response Sent”

CARMA Messenger

localhost/main.html



VIN: 1FUJGHDV0CLBP8834
LICENSE PLATE: DOT-10003
PERMIT REQ: No

CARRIER NAME: FMCSA Tech Division
USDOT #: DOT 1
ISS: 25

LAST STATE INSPECTION: 2020-01-01
ADS PRE-TRIP CHECK: 
ADS HEALTH STATUS: 
ADS AUTO STATUS: 

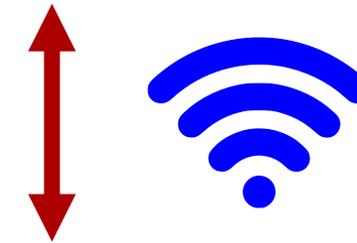
LAST ADS CALIBRATION: 2020-02-01
WEIGHT(LBS.): 65,000
ADS SOFTWARE VERSION: NULL

2020-11-12 18:54:11

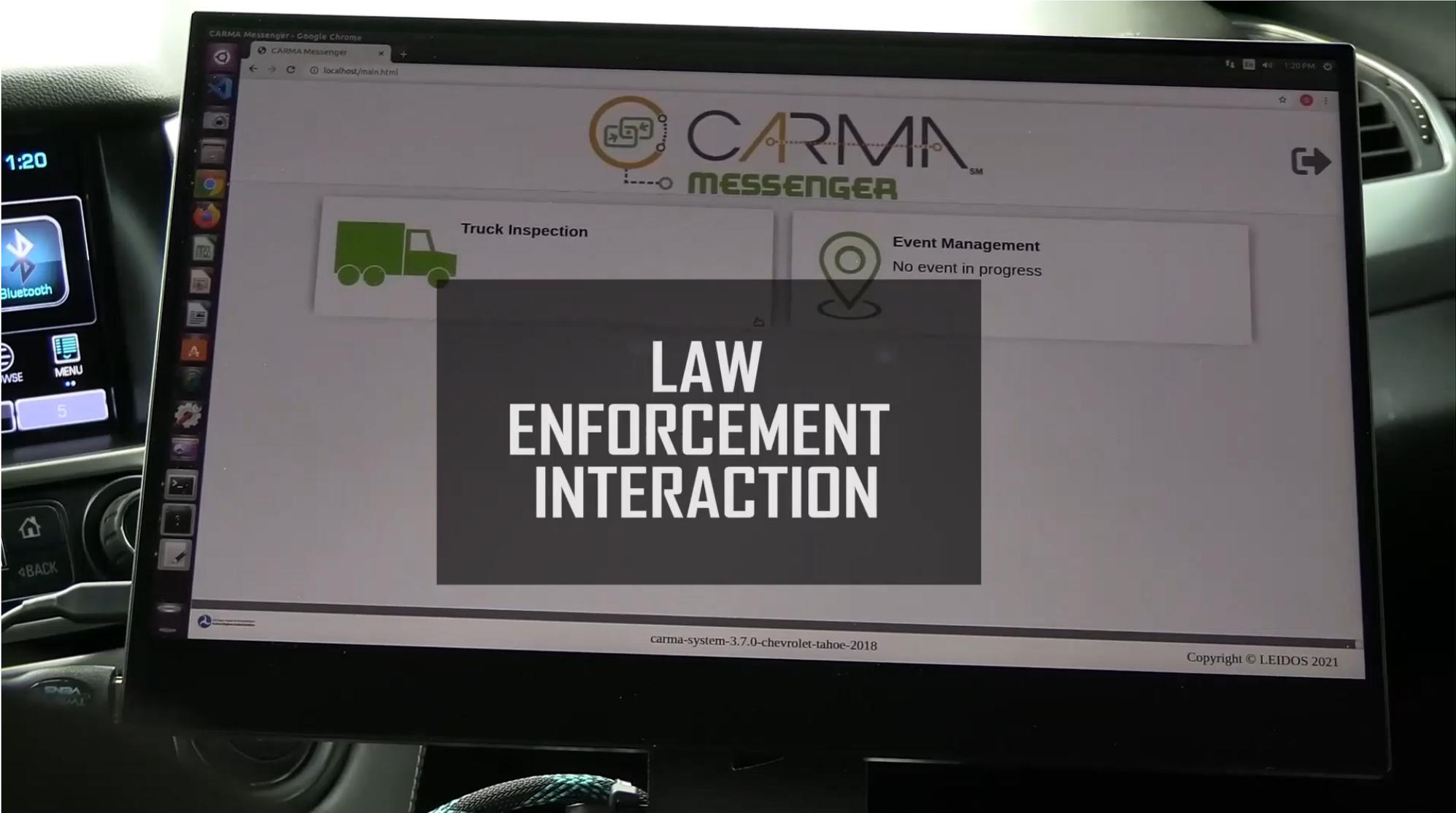


SAFETY LOG
ACE
Automated Commercial Motor Vehicle Evaluation

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Law Enforcement Interaction Demonstration Video



Thank You