Transportation is Advancing Rapidly, Will Commercial Insurance Keep Up the Pace?

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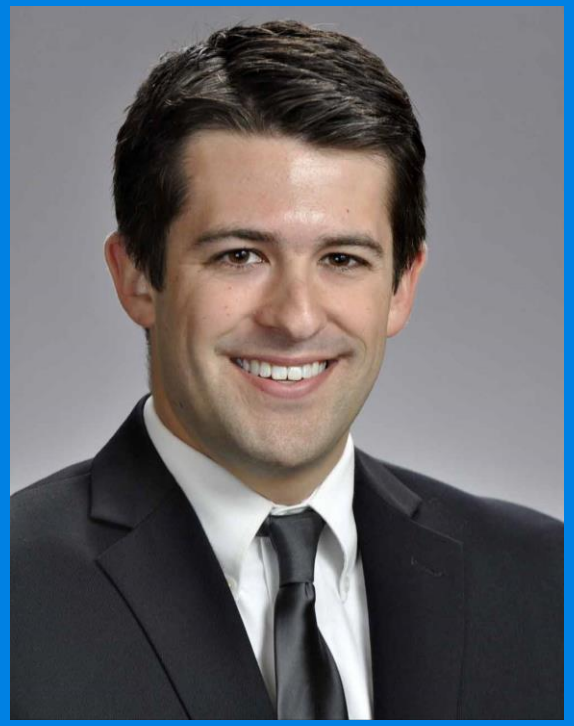
Casualty Actuarial Society Webinar

December 17, 2020

Milliman

Bios and Introduction



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Overview

1. Background
2. CAV Use Cases
3. Risks and Insurance
4. Implementation
5. Conclusions/Questions

Background

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The next 15 years in transportation will be more transformative than any time in our history

- Highly automated vehicles will begin to enter and disrupt the market
- Downtown cores and interstates will be the first movers
- Crashes will decrease and the types of crashes in the mix will change
- The transition offers many challenges and unanswered questions

ACES

WiRover
Seamless high bandwidth connectivity on the move

V2V
V2I
V2X

IoT

CV

SV

AV

EV

Poll Question

What vehicle technology will have the biggest impact on the auto insurance industry in the next 20 years?

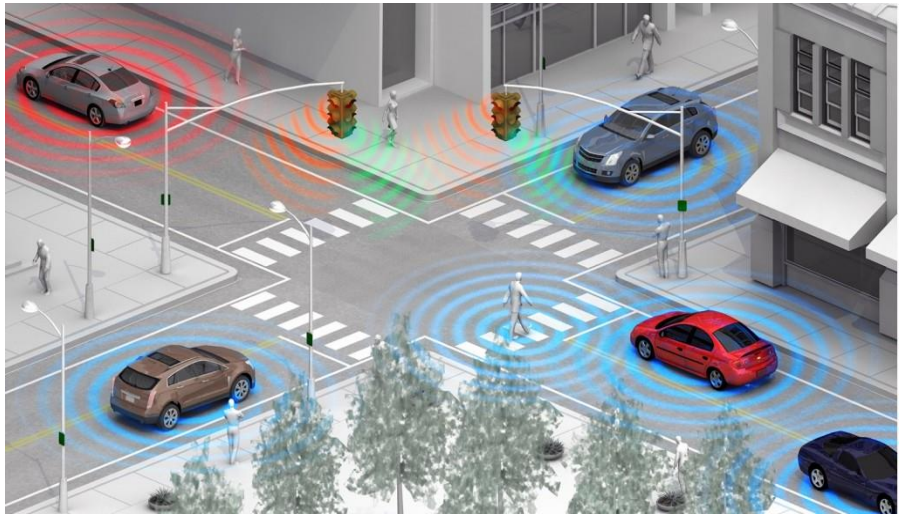
- Personal AVs
- Connected and Automated Trucks
- Electric Vehicles
- Connected Vehicle Technology
- Shared Vehicle Ecosystem

Advanced Driver-Assistance Systems (ADAS)

SAE Levels of Vehicle Automation

0	1	2	3	4	5
No Automation	**Driver Assistance**	**Partial Automation**	**Conditional Automation**	**High Automation**	**Full Automation**
Zero autonomy; the driver performs all driving tasks.	Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design.	Vehicle has combined automated functions, like acceleration and steering, but the driver must remain engaged with the driving task and monitor the environment at all times.	Driver is a necessity, but is not required to monitor the environment. The driver must be ready to take control of the vehicle at all times with notice.	The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.	The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle.

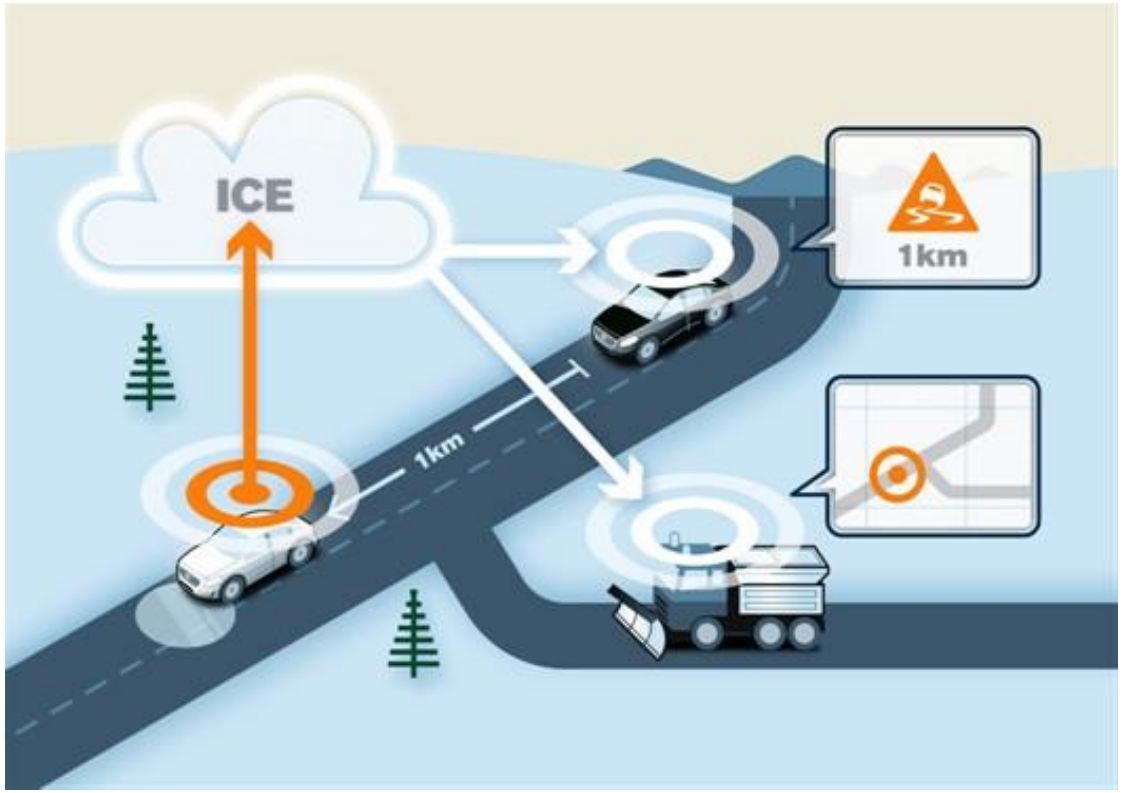
Connected Vehicles – Overview



- Vehicle-to-Vehicle (V2V)
- Vehicle-to-Infrastructure (V2I)
- Vehicle-to-Anything (V2X)
  - Pedestrians
  - Bicycles / motorcycles / mopeds
- Connected everything – Internet of Things
- Basic Safety Messages (BSM) broadcast every 1/10th of a second
  - Vehicle position, speed, heading, acceleration, size, brake system status
- Vehicles and infrastructure need to be equipped to gain benefit

Vehicle to Infrastructure Communications Red Signal Runner at Intersection Warning

Vehicle to Vehicle Communications
Road Hazard Notification



Vehicle to Anything Communications Turning Crosswalk Pedestrian Warning

Source: NYC CV Pilot

Connected Vehicle Applications

V2I Safety

- Red Light Violation Warning
- Curve Speed Warning
- Stop Sign Gap Assist
- Spot Weather Impact Warning
- Reduced Speed/Work Zone Warning
- Pedestrian in Signalized Crosswalk Warning (Transit)

V2V Safety

- Emergency Electronic Brake Lights (EEBL)
- Forward Collision Warning (FCW)
- Intersection Movement Assist (IMA)
- Left Turn Assist (LTA)
- Blind Spot/Lane Change Warning (BSW/LCW)
- Do Not Pass Warning (DNPW)
- Vehicle Turning Right in Front of Bus Warning (Transit)

Road Weather

- Motorist Advisories and Warnings (MAW)
- Enhanced MDSS
- Vehicle Data Translator (VDT)
- Weather Response Traffic Information (WxTINFO)

Environment

- Eco-Approach and Departure at Signalized Intersections
- Eco-Traffic Signal Timing
- Eco-Traffic Signal Priority
- Connected Eco-Driving
- Wireless Inductive/Resonance Charging
- Eco-Lanes Management
- Eco-Speed Harmonization
- Eco-Cooperative Adaptive Cruise Control
- Eco-Traveler Information
- Eco-Ramp Metering
- Low Emissions Zone Management
- AFV Charging / Fueling Information
- Eco-Smart Parking
- Dynamic Eco-Routing (light vehicle, transit, freight)
- Eco-ICM Decision Support System

Agency Data

- Probe-based Pavement Maintenance
- Probe-enabled Traffic Monitoring
- Vehicle Classification-based Traffic Studies
- CV-enabled Turning Movement & Intersection Analysis
- CV-enabled Origin-Destination Studies

Mobility

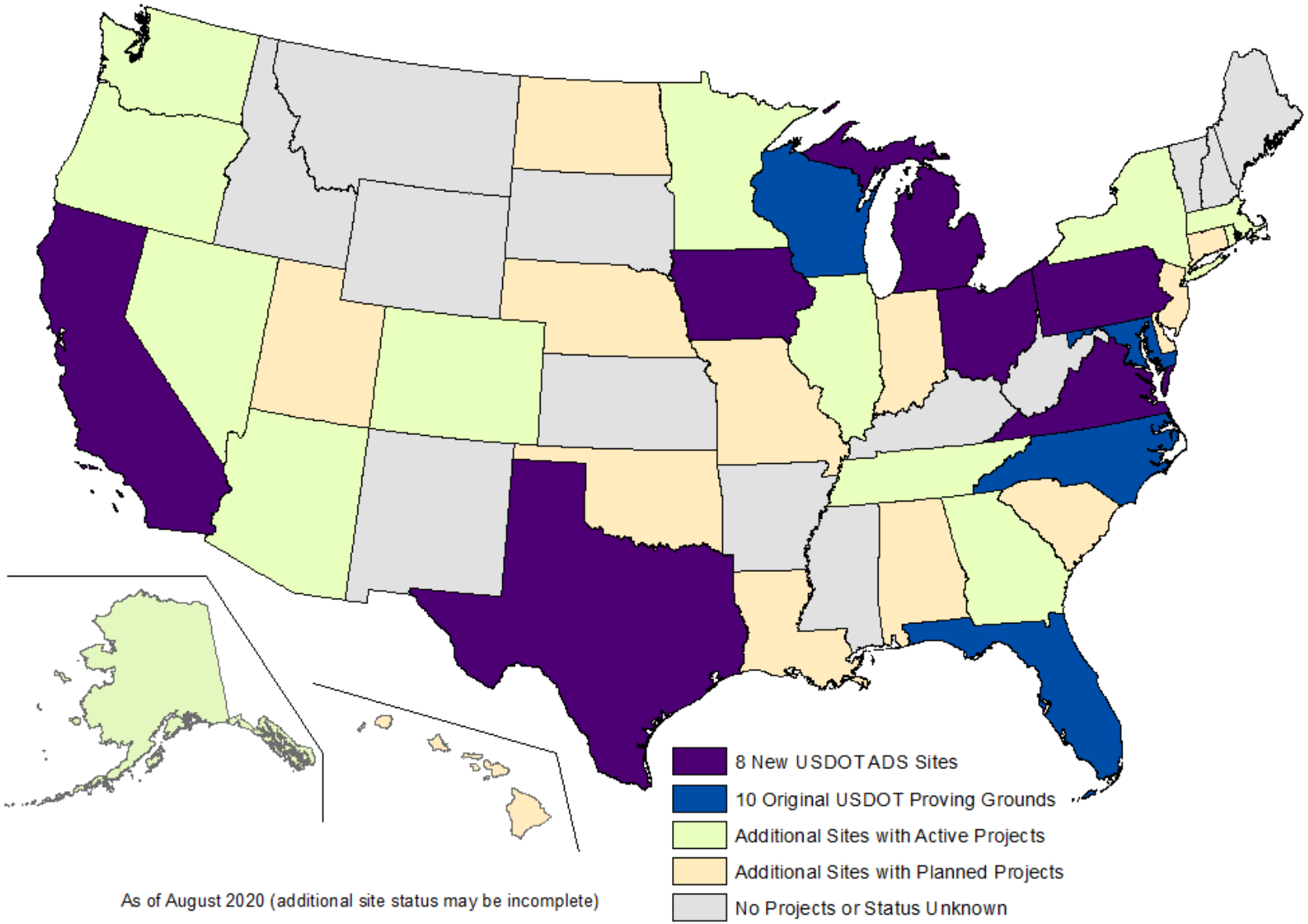
- Advanced Traveler Information System
- Intelligent Traffic Signal System (I-SIG)
- Signal Priority (transit, freight)
- Mobile Accessible Pedestrian Signal System (PED-SIG)
- Emergency Vehicle Preemption (PREEMPT)
- Dynamic Speed Harmonization (SPD-HARM)
- Queue Warning (Q-WARN)
- Cooperative Adaptive Cruise Control (CACC)
- Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG)
- Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)
- Emergency Communications and Evacuation (EVAC)
- Connection Protection (T-CONNECT)
- Dynamic Transit Operations (T-DISP)
- Dynamic Ridesharing (D-RIDE)
- Freight-Specific Dynamic Travel Planning and Performance
- Drayage Optimization

Smart Roadside

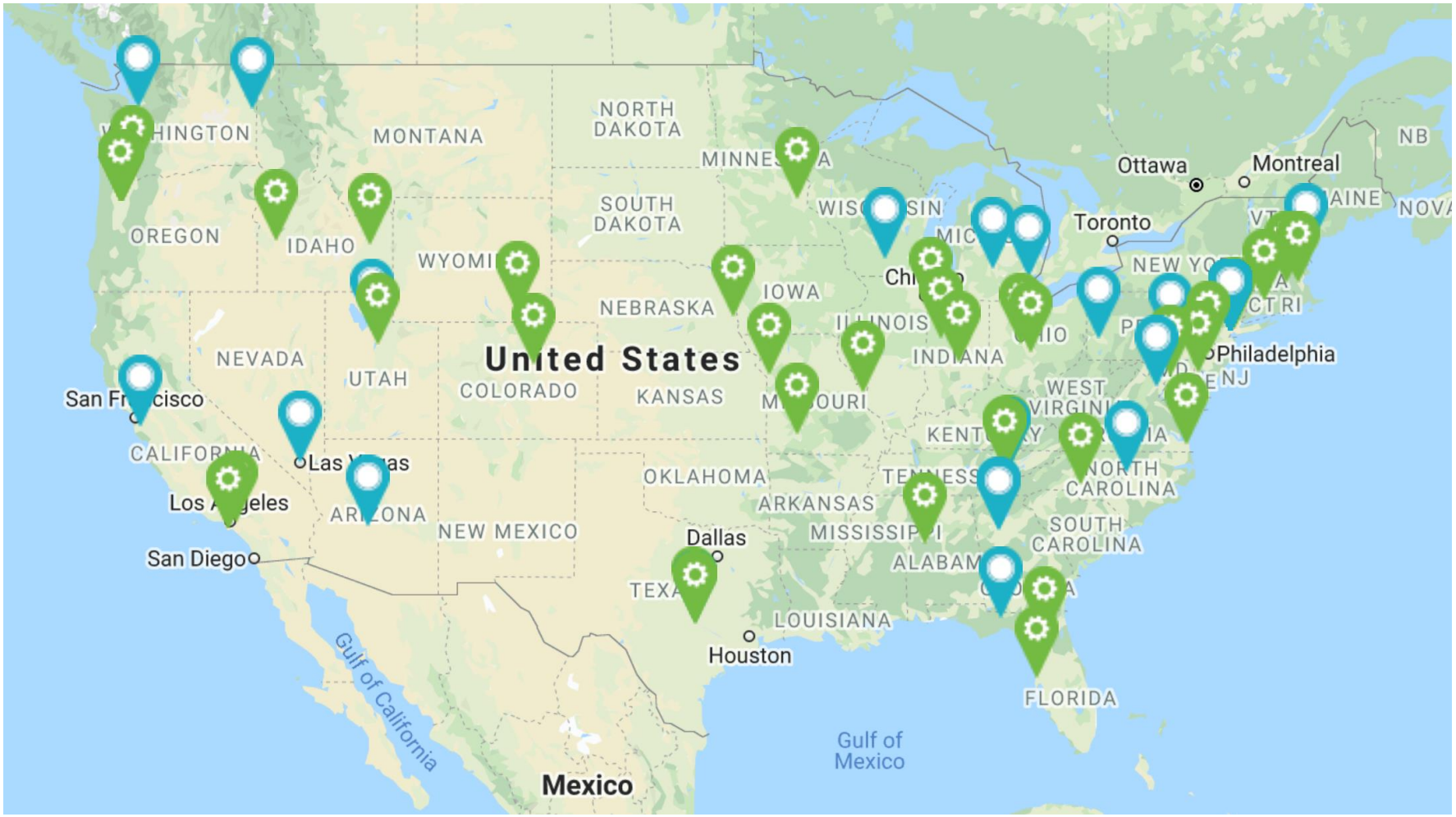
- Wireless Inspection
- Smart Truck Parking

U.S. Department of Transportation 7

Where is the AV research happening in the US?



Where is the CV research happening in the US?



SPaT deployment underway

SPaT deployment operational

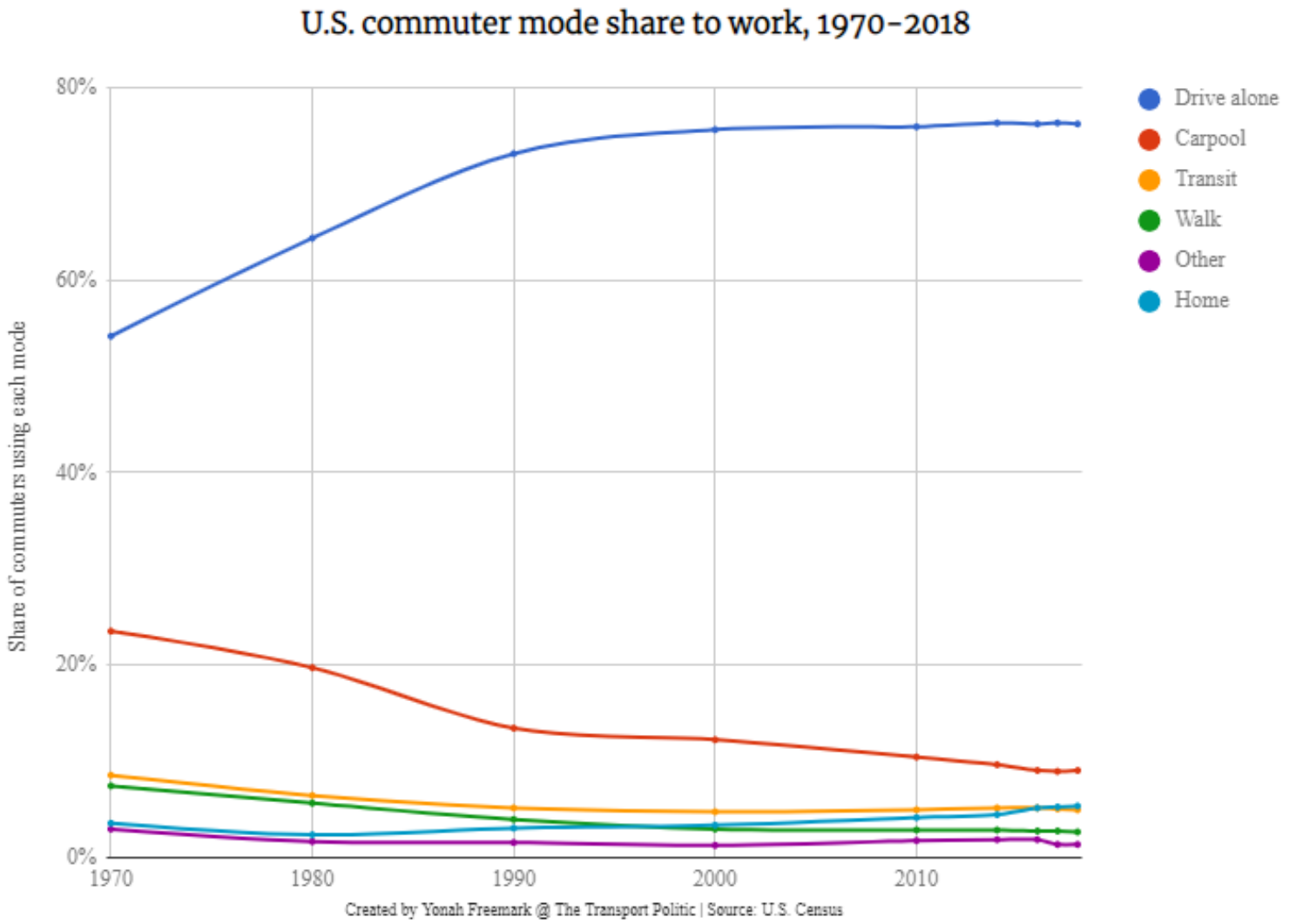
As of December 4, 2020

CAV Use Cases

CAV Use Cases: Shared Mobility

Personal Mobility Choices

The rise of the SOV (single-occupant vehicle)



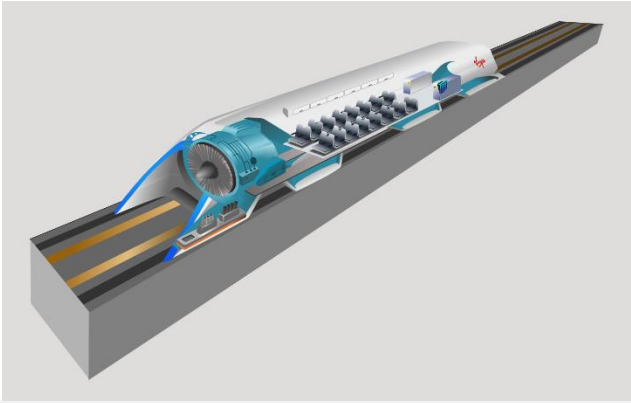
Why do people prefer personal mobility?

- Instant availability
- Point-to-point direct access
- Personal accoutrements
- Perception of time savings / actual time savings
- Perception of cost savings / actual cost savings
- Perception of increased safety / actually safer
- They've always done it that way

- To key to improve usage of shared mobility
  - more options need to be available

Shared Mobility Options

- Traditional sharing – public transit (bus/rail), taxi cabs
- Car sharing – Zipcar, car2go
- TNCs (Transportation Network Companies) – Uber, Lyft
- New business models – Turo, taxi apps
- New vehicles – automated microtransit, Hyperloop, delivery bots
- Complementary modes – Scooters, e-bikes, moped, bike share



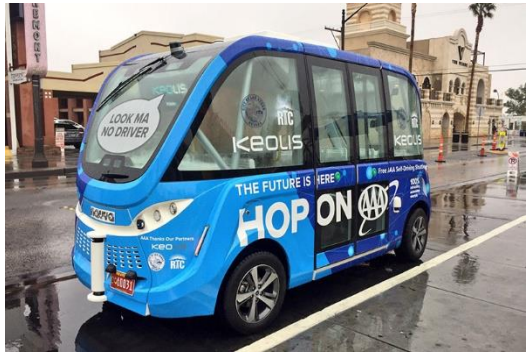
Mobility as a Service (MaaS)

- Single payment system for multiple modes
- Applications compare fastest/cheapest routes
- Automated fare systems
- Integration of private transit modes
- Incentives for car sharing
- Complete trip integration

Source: APTA

CAV Use Cases: Shuttles

Automated Shuttles – An Overview



- Low-speed shuttles and autonomous neighborhood electric vehicles (NEVs)
  - First/last mile routes
  - Neighborhood routes
  - Campus routes
- High-speed shuttle busses
  - Community routes
  - Local deliveries
- Fixed or on demand service

WiscAV ACES Shuttle – Project Vision

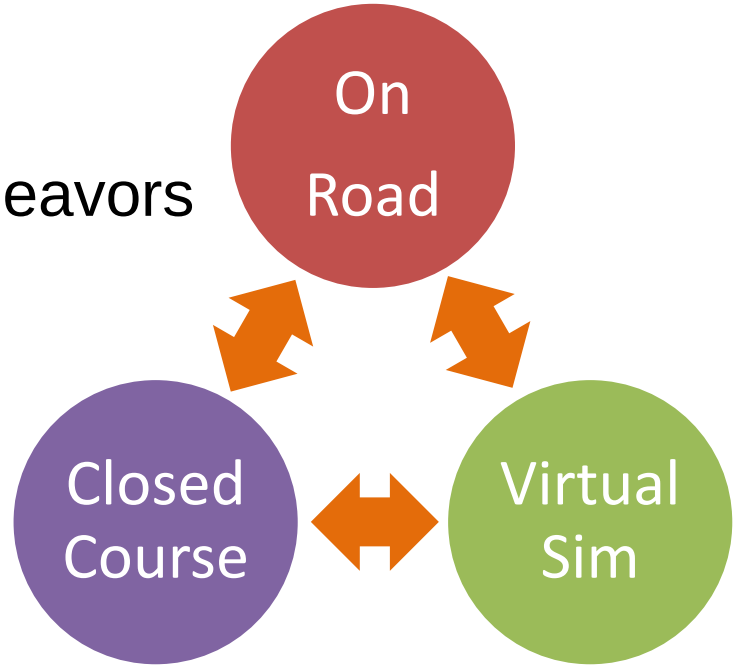
Execute → Inspire → Organize → Explore

Execute: Deploy shuttle safely and visibly

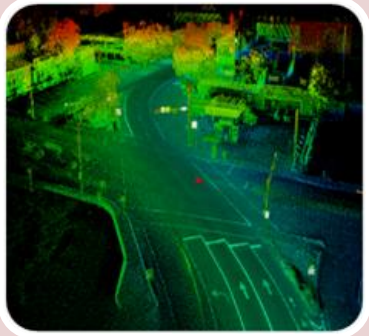
Inspire: Engage community and invigorate entrepreneurial endeavors

Organize: Catalyze R&D in automated and connected vehicles

Explore: Collect and translate data into meaningful information



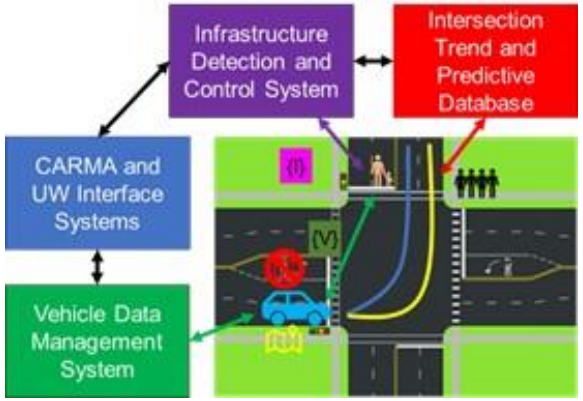
Operational Plans – Safety and Mobility Data

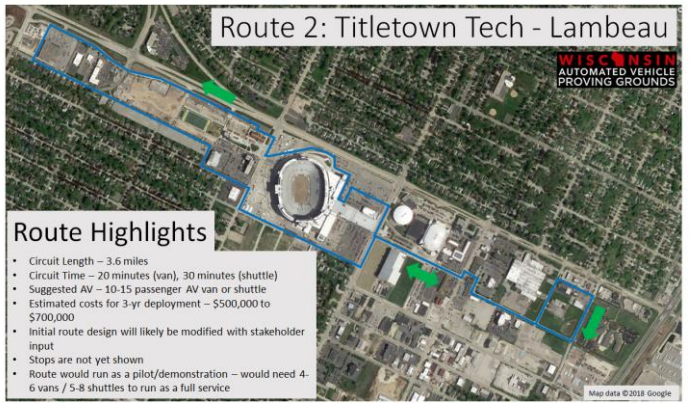
ROADWAY INTERACTIONS	USER INTERACTIONS	SYSTEM DATA	OPERATIONAL DATA	CONNECTED DATA
				
Other Vehicles	User Acceptance	Basic Vehicle Data	Operating Limitations	Vehicle to Infrastructure
Pedestrians	Passenger Comfort	Sensor Data	Obstacle Detection	Vehicle to Anything
Bicyclists	Usage Statistics	Operating Data	Winter Performance	External Sensors
Infrastructure	Survey Responses	Vehicle Security	Changing Traffic Patterns	Data Processing

Wisconsin Shuttle Projects – Concepts to Reality

<u>Routes</u>

- Madison First/Last Mile Route
- UW-Madison Route
- Community/Technical College Routes
- Brown County AV Route(s)
- Racine CAV Project
- Southeast Aging and Disabled Transit





<u>Vehicle Testing</u>

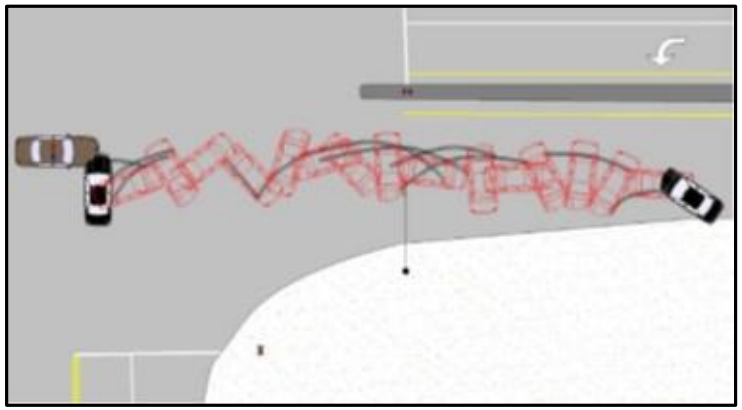
- Integrating vehicles with transit (dynamic routing)
- Closed course scenario testing and standards development
- High speed AVs on freeways, rural two-lane arterials
- Data collection and analysis

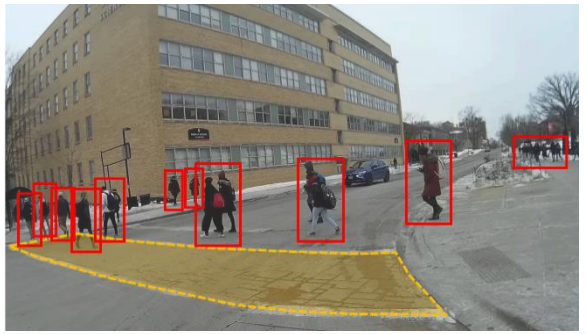
Madison Shuttle Project – Who's Involved?

- City of Madison
  - Department of Transportation (Traffic Eng., Parking Utility, Metro Transit)
  - Mayor's Office
  - Office of Business Resources / Economic Development
  - Madison Transportation Commission
  - Citizens (Alders, Neighborhood Associations)
- UW-Madison
  - Engineering (Civil and Environmental, Mechanical, Electrical, Industrial Systems)
  - Planning
  - Computer Science
  - Design Innovation Lab
  - Administrators (Transportation Services, UWPD, Community Relations, Risk Management, Corporate Relations, Legal)
- Public/Non-Profit
  - Downtown Madison, Inc.
  - Madison Central BID
  - Greater Madison Chamber of Commerce
  - Dane County and RSVP of Dane County
  - Greater Wisconsin Agency on Aging Resources
  - Wisconsin Rural Partners
  - WisDOT, WSP, Wisconsin DMV
- Industry
  - CapEast Businesses (Festival Foods, Gebhardt, Brink, Big Top Sports, Old Sugar Distillery, Bos Meadery)
  - American Family Insurance
  - Madison Gas and Electric
  - AVPG Test Tracks (MGA, Road America)
  - Others (Green Cab, Schmidt's Towing, Mandli, Continental Mapping, Epic, TAPCO, local entrepreneurs)

Engaging Stakeholders

- User Acceptance
  - Community demonstrations
  - Vulnerable road users
  - Equitable access
  - Outreach/Public Reaction
- Law enforcement and traffic records data needs
- Registration / licensing / insurance
- Transit integration / training
- City and state data needs





Poll Question

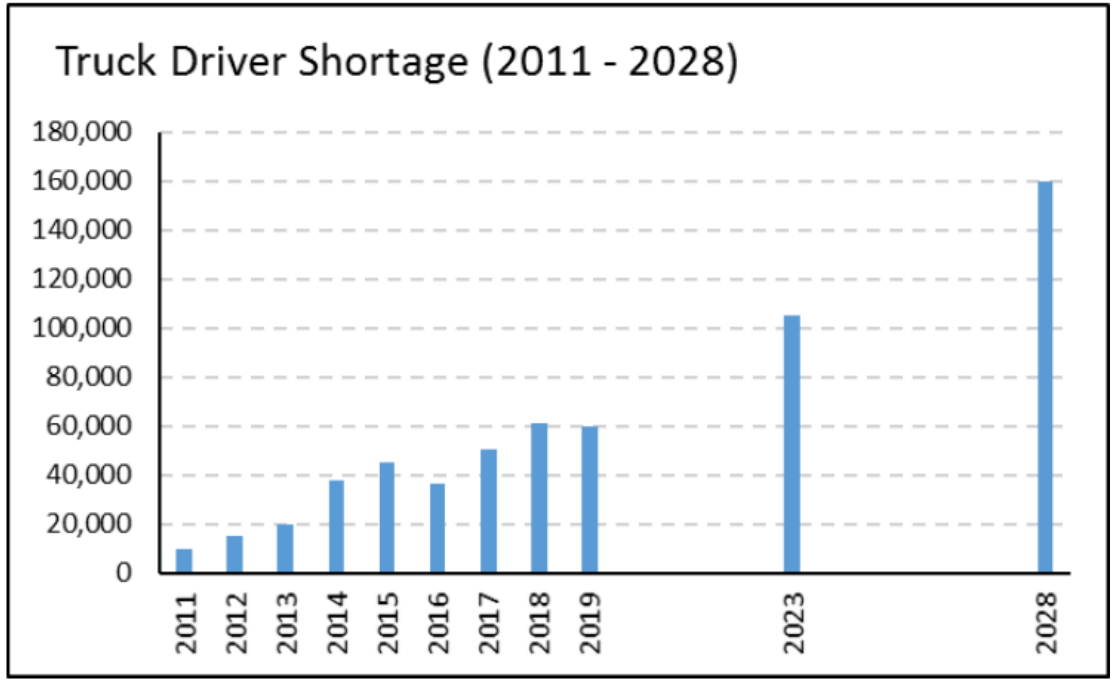
What is the biggest barrier to AVs entering the market today?

- Technology (A.I., Vehicle Equipment, Software, etc.)
- Cybersecurity
- Infrastructure Readiness
- Legal and Liability Concerns
- Public Perception
- Public Policy
- Vehicle Cost
- Insuring the Vehicle

CAV Use Cases: Trucking

Trucking Industry Today

- Trucks move **71.4% of all freight** tonnage in the U.S.
- Freight volumes have continued to rise since the Great Recession
- **Median driver age is 47** in trucking industry, compared to 42 for all industries
- Shortage of drivers for last 15 years
  - ✓ 2018: **60,800 drivers short**
  - ✓ 2028: projected **shortage of 160,000**
- Shortage is amplified by the struggle to find qualified drivers
- Causes of Shortage
  - ✓ Driver Demographics – Age
  - ✓ Lifestyle – Extended Periods Away
  - ✓ Job Alternatives



Source: American Trucking Associations / BLS

Key Milestones

Global

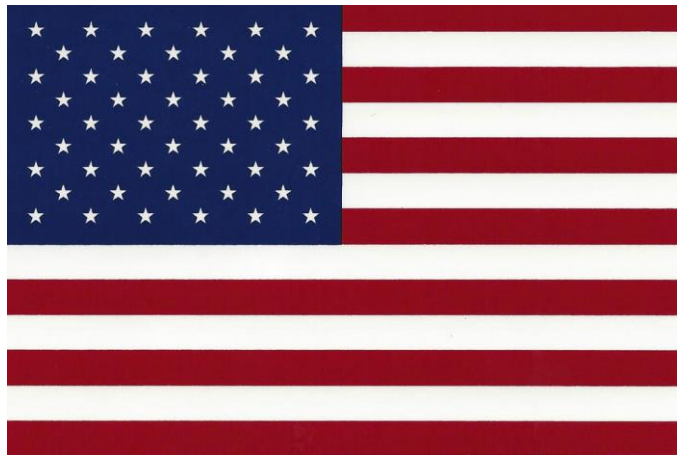
Intrastate

Interstate

April 2016

October 2016

February 2018



Source: The Verge / Wired / TheDrive

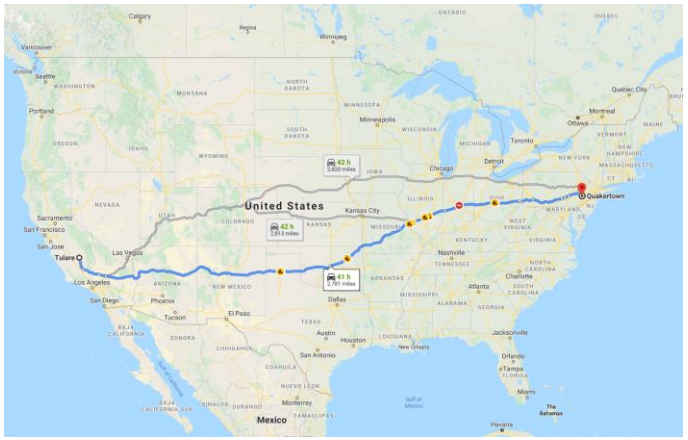
Key Milestones Since Then

Look No Hands

June 2019

Long Haul

November 2019



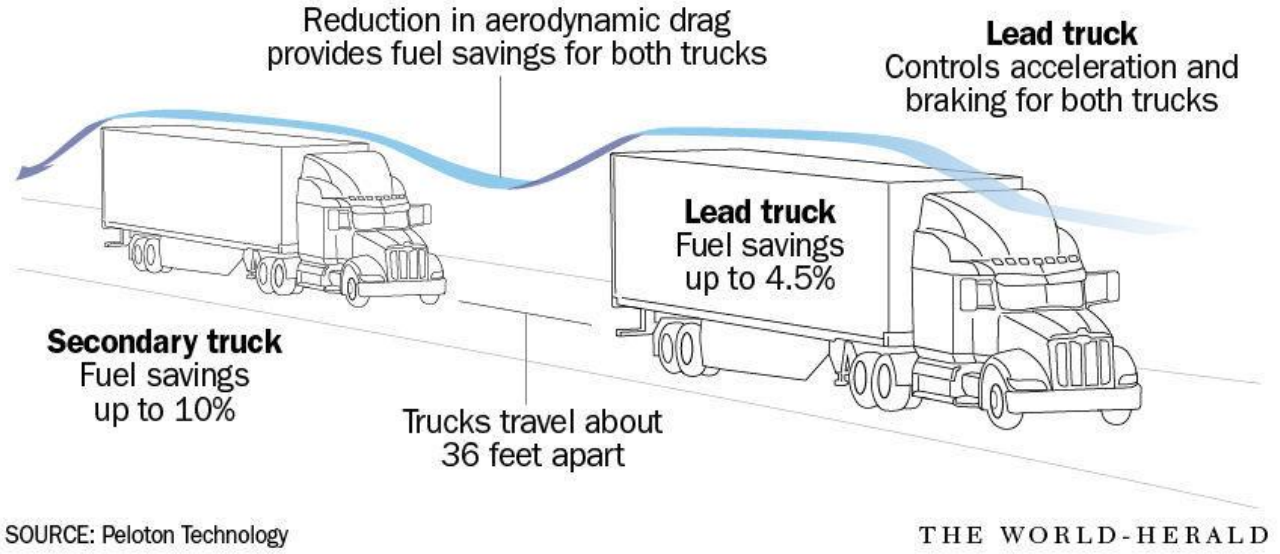
Wider Audience

March 2020

Platooning

- Operation
  - Maintains distance via wireless communication, radar, and GPS
  - Primarily performs “straight-line” adjustments
  - Alert driver is still needed for direction changing maneuvers
    - Possibly remove drivers from trailing trucks down the road
  - Start with 2-3 trucks in each “platoon”

- Fuel Savings: 5-10% reduction in fuel cost, varies by length
- Potential impacts on
  - Frequency
  - Severity
  - Roadway congestion
    - Possibility for dedicated truck lanes
- Cyber concerns



Retrofit Integration

- System includes
  - LIDAR, radar, high precision cameras
  - Power steering, braking system, GPS
  - Custom computer/software
- Safety driver required in many states
- Improved efficiency and driver experience
  - Less frequent stops
  - Driver able to multi-task
  - Driverless on certain routes (highways)
    - Requires additional infrastructure
- Cyber concerns
- Cost is unclear

Photo: Wired

Originally Manufactured

- Similar pros/cons to retrofit
  - Improved efficiency
  - Remove driver from cab
  - Cyber concerns
  - Cost is unclear
- Theoretically more reliable
- Focused on electric
  - Better for environment
  - Fuel savings
  - Lower travel range

Photos: AutoBlog / Forbes

Poll Question

Imagine you are a decision maker at a company that ships products across the country. What price would you be willing to pay for one autonomous truck?

- I'm not interested
- Up to $100k
- Up to $150k
- Up to $200k
- Up to $250k
- Up to $500k
- I'm interested at any price. This will save us truckloads of money in the long run.

Follow-up Question

What are some of your considerations when deciding how much to spend on the truck?

Players in the Autonomous Truck Realm

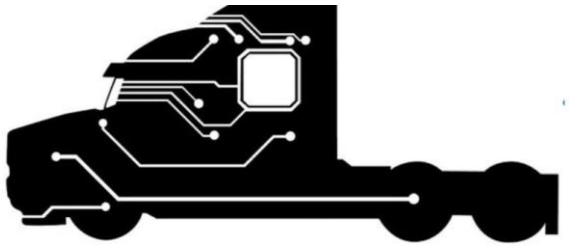
图森 tuSimple

EMBARK

TESLA

VOLVO

plus.ai



Phantom Auto

EINRIDE

WAYMO

DAIMLER

Recent Developments

TuSimple

- Partners
  - UPS
  - USPS
  - McLane (food delivery)
  - U.S. Xpress
  - Navistar
  - Penske
  - ZF Friedrichshafen
- Autonomous Freight Network
  - Phase 1: 2020-2021
  - Phase 2: 2022-2023
  - Phase 3: 2023-2024

Risks and Insurance

Lines of Business Affected by CAV

1. Commercial Auto
2. General Liability
3. Workers' Compensation
4. Inland Marine
5. Cyber

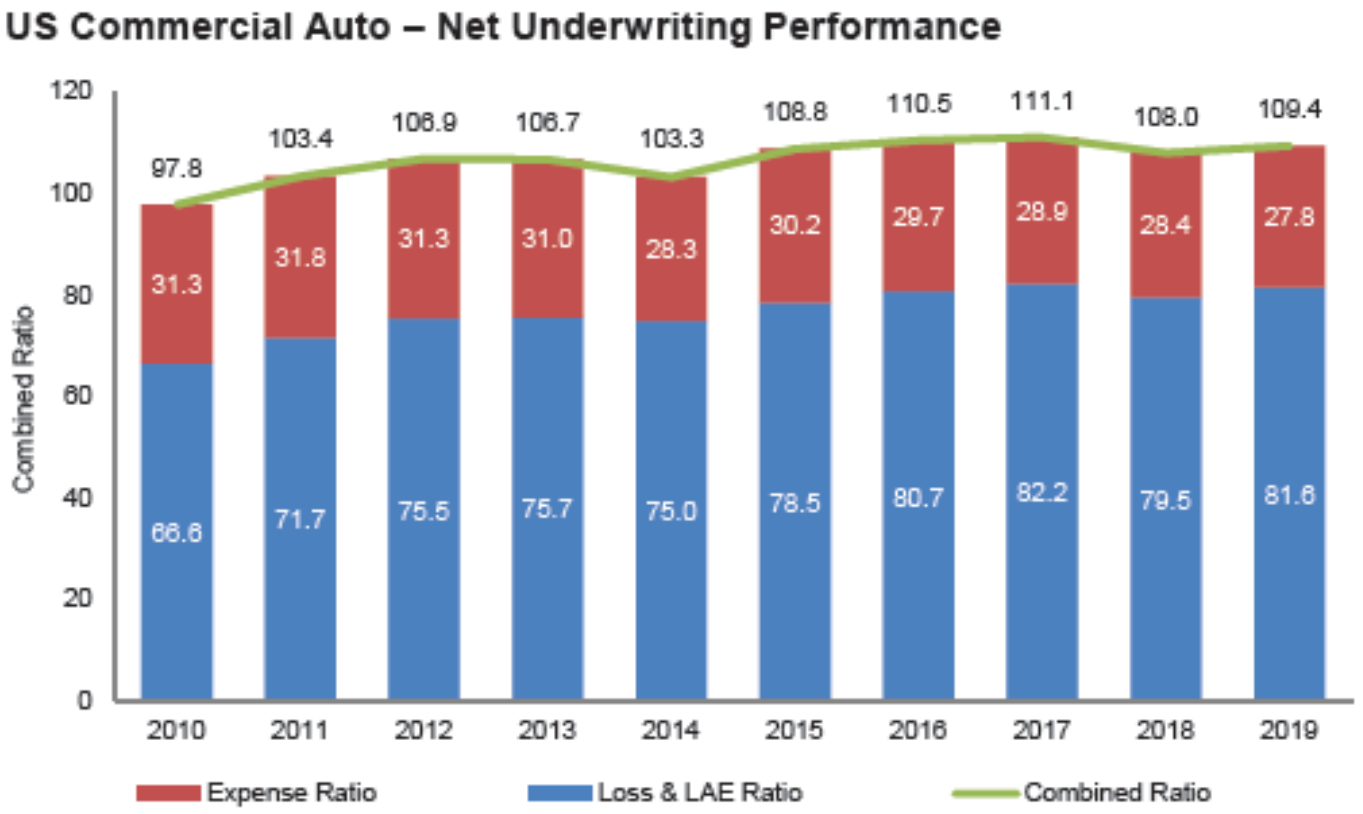
Poll Question

In your opinion, which of the following is the largest area of insurance losses related to commercial vehicles today?

- Commercial Auto
- General Liability (Product or Premise)
- Workers' Compensation
- Inland Marine (Cargo Theft/Damage)
- Cyber Liability
- Other

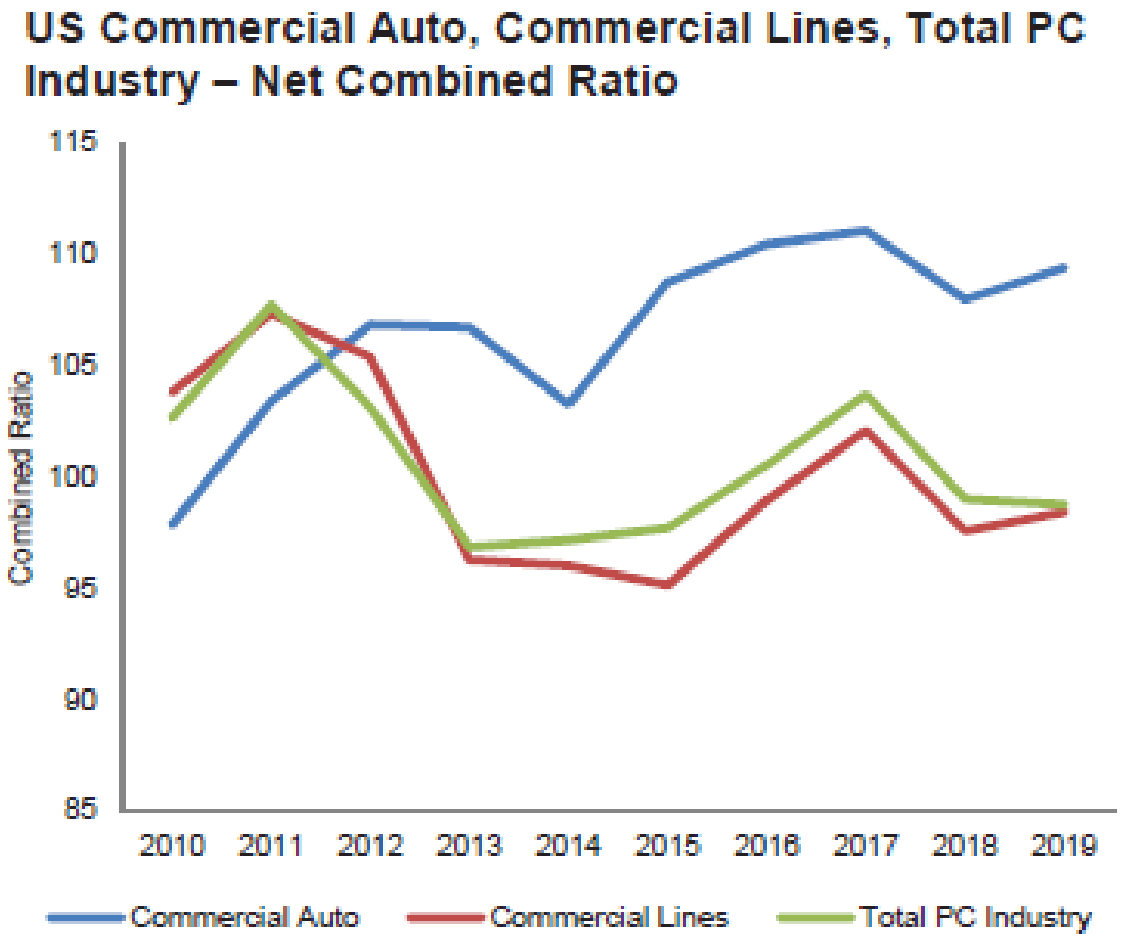
Commercial Auto

- Deterioration driven by
  - Nuclear verdicts
  - Distracted driving
  - Inadequate safety precautions
  - Slow to adapt current tech and modeling techniques
- Loss adjustment expense growth due to costlier litigation
- Litigation is a serious concern
  - Social inflation
  - Litigation financing



Source: AM Best

Commercial Auto



Source: AM Best

- Compounded rate increases in recent years (some carriers had consecutive double digit increases)
- COVID impact
  - Exposure change depends on industry
  - Less traffic = Lower Freq, Higher Sev
- Focus on implementing technology to help monitor driving and increase efficiency
  - TELEMATICS IS KEY!

Commercial Auto

- Driver error causes about 90% of crashes
  - ✓ Roughly 70% in the case of trucks
- About 4,136 people died in large truck crashes in 2018
  - ✓ 67% were passenger vehicles occupants
  - ✓ 16% were large truck occupants
- Driver fatigue is often a contributor
  - ✓ Federal hours-of-service regulations restrict the time on the road
  - ✓ Surveys indicate some drivers violate this
- Loaded trucks go 20-40% farther than cars when braking

Source: Insurance Institute for Highway Safety

Commercial Auto w/ CAV

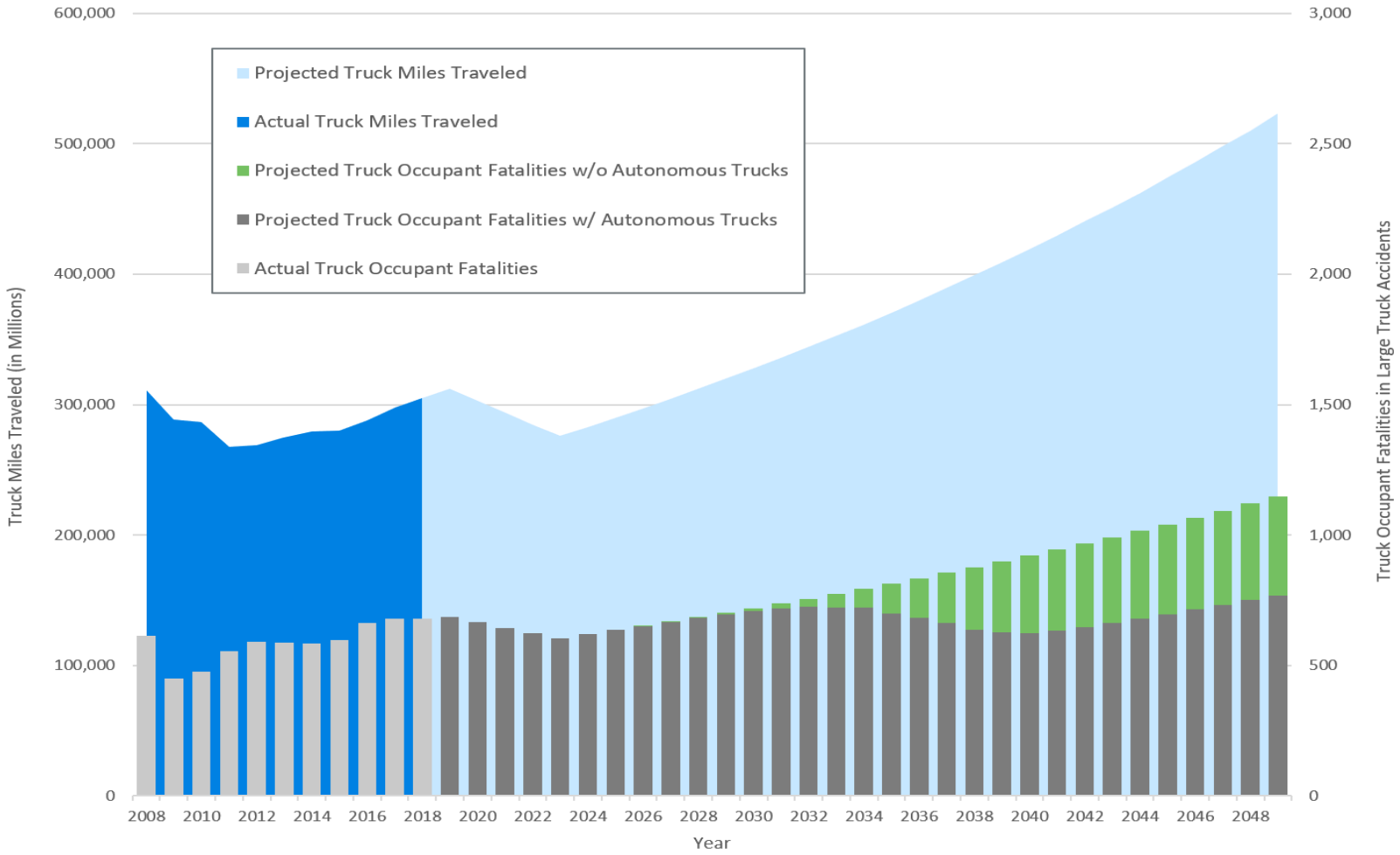
- Driver error causes about 90% of crashes +Reduced but not eliminated (1/3)
  - ✓ Roughly 70% in the case of trucks
- About 4,136 people died in large truck crashes in 2018 +Less crashes?
  - ✓ 67% were passenger vehicles occupants
  - ✓ 16% were large truck occupants +Driver may not be in cab or in a safer position
- Driver fatigue is often a contributor +Driver could rest in cab (level 4+)
  - ✓ Federal hours-of-service regulations restrict the time on the road
  - ✓ Surveys indicate some drivers violate this
- Loaded trucks go 20-40% farther than cars when braking +Quicker response

-Cyberattacks on moving vehicles causing crashes, Terrorism

Source: Insurance Institute for Highway Safety

Commercial Auto w/ CAV

Projection of Truck Miles Traveled and Truck Occupant Fatalities



Source: Milliman analysis including data from IIHS and McKinsey & Company

Commercial Auto

- 5,977 pedestrians died in vehicle crashes in 2017
  - ✓ Estimated that an additional 137,000 sent to emergency room
  - ✓ 1.5 times more likely to be killed in car crash than passengers
- 47% of pedestrian deaths involved alcohol
  - ✓ 17% driver is >.08 BAC
  - ✓ 33% pedestrian is >.08 BAC
- Typical characteristics of pedestrian accidents
  - ✓ Urban areas
  - ✓ Non-intersection
  - ✓ Night

Source: CDC / NHTSA

Commercial Auto w/ CAV

- 5,977 pedestrians died in vehicle crashes in 2017 +Less pedestrians hit?
  - ✓ Estimated that an additional 137,000 sent to emergency room
  - ✓ 1.5 times more likely to be killed in car crash than passengers
- 47% of pedestrian deaths involved alcohol
  - ✓ 17% driver is >.08 BAC +AV can't drink
  - ✓ 33% pedestrian is >.08 BAC –AV may have difficulty predicting irregular behavior
- Typical characteristics of pedestrian accidents
  - ✓ Urban areas +Likely see CV advancements sooner
  - ✓ Non-intersection –Irregular behavior
  - ✓ Night –Visibility concerns

Source: CDC / NHTSA

General Liability

Product

Premise

General Liability w/ CAV

Product

Premise

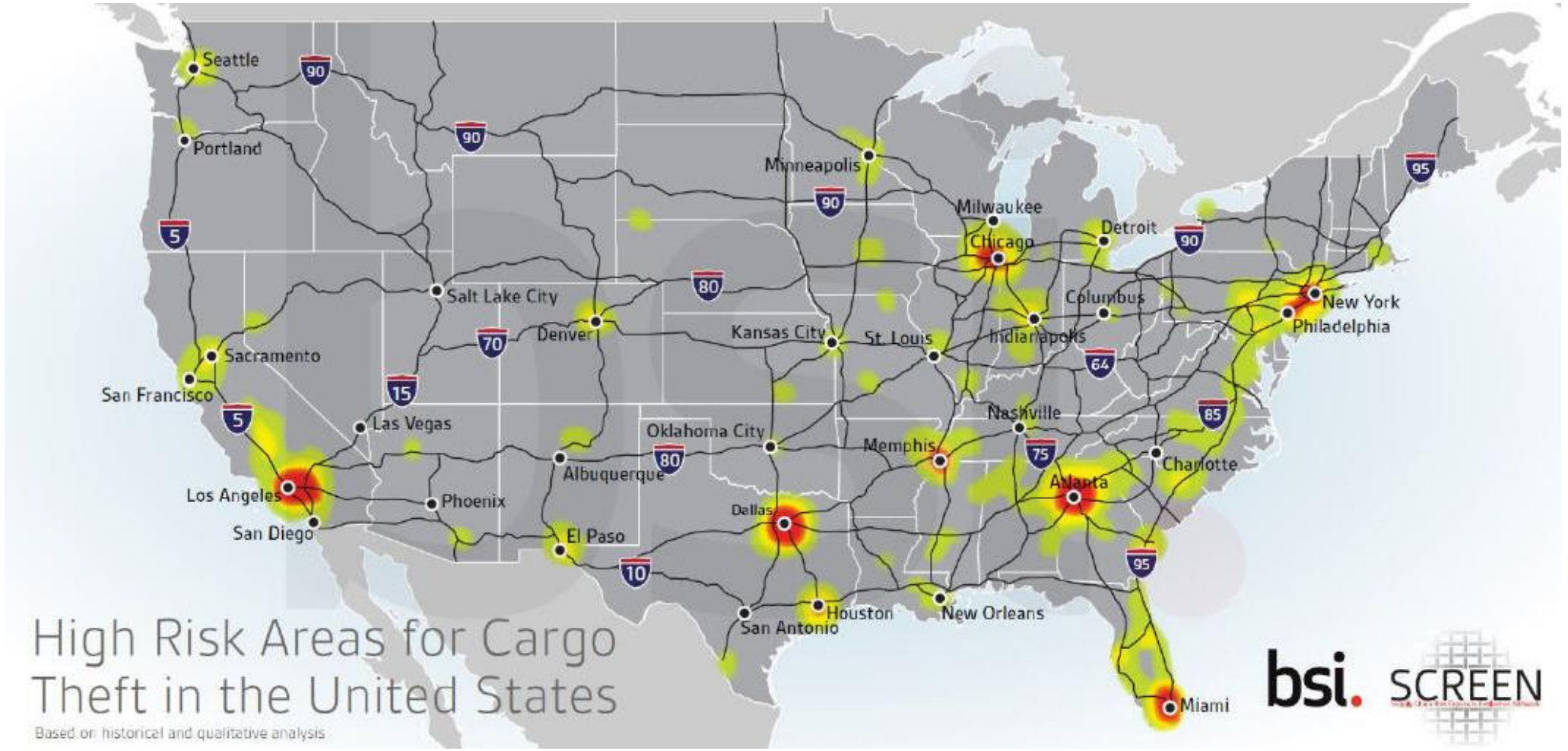
Workers' Compensation

- Injury from vehicle accidents
- Repetitive motion injury
  - ✓ Long hours spent in the same position
- Lifting/Overexertion injuries when loading and unloading cargo
  - ✓ Improper lifting form, fatigue, and rushing are all contributors

Workers' Compensation w/ CAV

- Injury from vehicle accidents +Less frequent, less severe
- Repetitive motion injury
  - ✓ Long hours spent in the same position +Driverless for long highway segments
    +Possibly able to move around?
- Lifting/Overexertion injuries when loading and unloading cargo
  - ✓ Improper lifting form, fatigue, and rushing are all contributors +Driver could rest
    +More likely to be on time
    +No driver for low speed

Inland Marine



Picture: XtraLease

Inland Marine

- FBI estimates that $15-$30 billion of cargo is stolen every year
  - ✓ Average shipment value stolen is around $200,000
- Most theft occurs within the first 4 hours of a route
- Areas around certain cities and highways are particularly vulnerable
- Many instances of theft committed by drivers

Source: XtraLease / XL Catlin

Inland Marine w/ CAV

- FBI estimates that $15-$30 billion of cargo is stolen every year
  - ✓ Average shipment value stolen is around $200,000
- Most theft occurs within the first 4 hours of a route +Guarantee a 4+ hour start
- Areas around certain cities and highways are particularly vulnerable
  +Easier to continue driving through high risk areas
- Many instances of theft committed by drivers
  +Driverless segments, more external monitoring

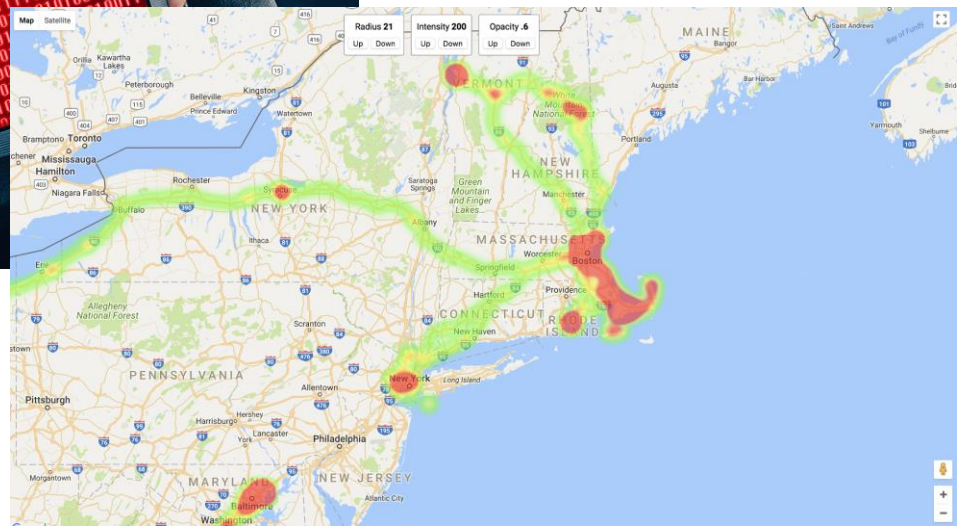
-Digital piracy

-Driverless delivery targeted

Source: XtraLease / XL Catlin

Cyber

Cyber w/ CAV

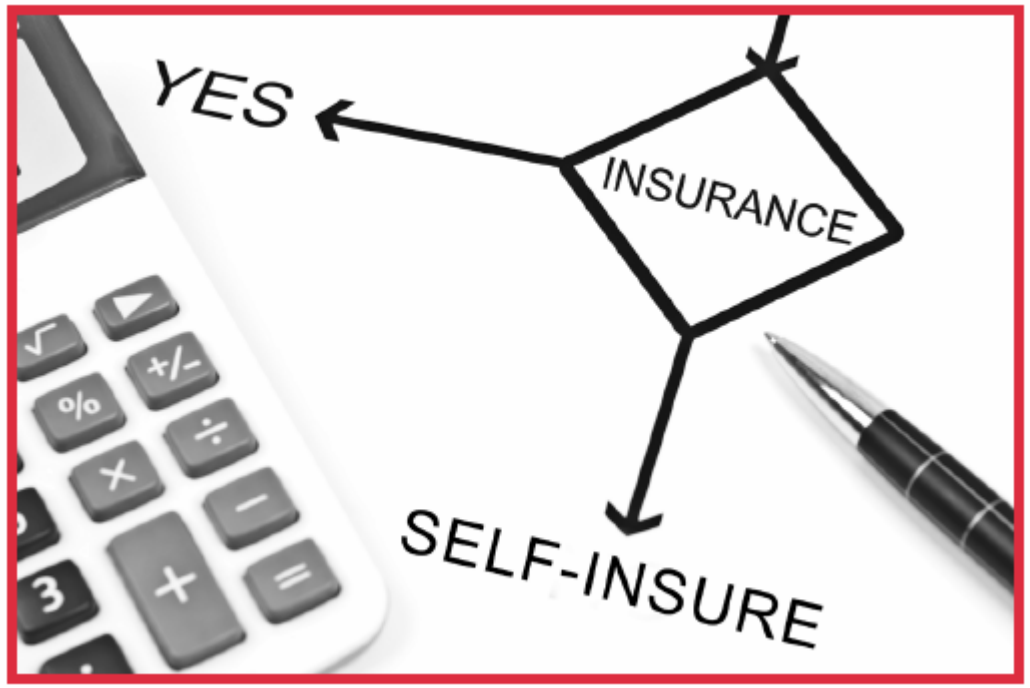


Poll Question

In the future, which of the following will be the largest area of insurance losses related to commercial vehicles?

- Commercial Auto
- General Liability (Product or Premise)
- Workers' Compensation
- Inland Marine (Cargo Theft/Damage)
- Cyber Liability
- Other

Insuring Autonomous Vehicles



- Some manufacturers have announced that they will accept responsibility for accidents due to malfunction
  - Generally seem to be self-insuring this risk due to lack of coverage options
- At least one insurer has explicitly said that it is willing to write policies for autonomous vehicles (AXA XL), others have policies in the works
  - Could include liability, property damage, theft, cyber, care/custody/control, and business interruption
- Manufacturers have shown interest in creating their own auto insurance programs
  - Could help sell AV with limited insurance options

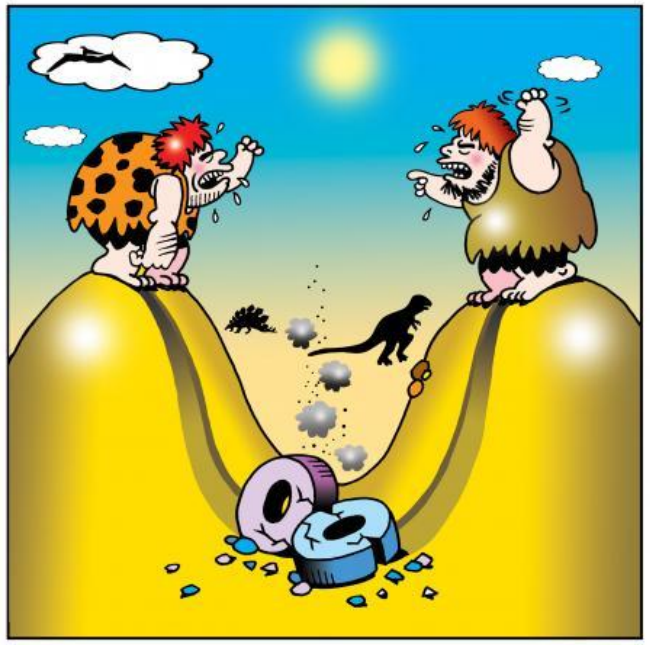
Source: AXA XL

Insuring Autonomous Vehicles

- Changes in underwriting and pricing strategies
  - Shift from focus on driver to focus on technology and maintenance
- Changes in policy language
  - Could lead to policy gaps if not careful
- Speculative Liability Structures
  - Status Quo & Subrogation / Product Liability First / Others
- New Boutique Insurance Products

Insurance Complications

- Assignment of risk
  - ✓ Is the manufacturer liable? If so, which manufacturer (sensors, software, truck)?
  - ✓ Determining percentage of driver error?
  - ✓ Was the vehicle properly maintained leading up to the accident?
- Lack of data
- Lack of available coverage
- Structure of Liability
  - ✓ Status Quo & Subrogation
  - ✓ Product Liability First



Implementation

Poll Question

Who will be at-fault for a fatality resulting from a crash between two Level 4 or 5 automated vehicles?

- The human driver
- The vehicle manufacturer
- The OEM of the failed equipment
- The road owner (e.g., state Department of Transportation)
- A combination of these
- No one, fatal crashes will no longer exist

Benefits of ACES / CAVs

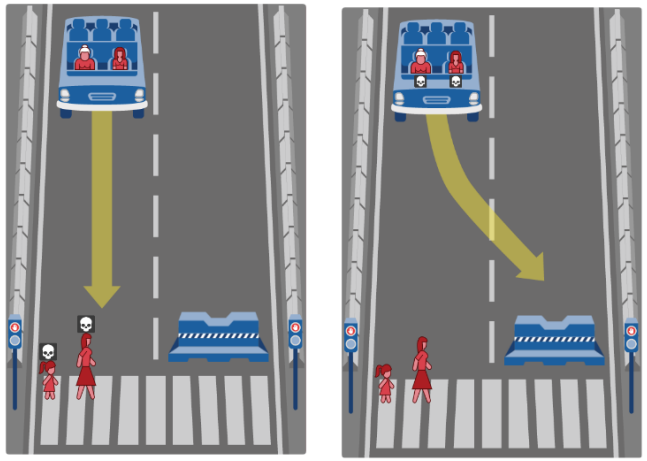
- Connected Vehicles (CVs)
  - Less time spent stopped at signals
  - Enhanced safety at intersections, in work zones, and in adverse weather
  - Reduced congestion without building more roads
- Advanced Driver Assistance Systems (ADAS)
  - Increased safety of specific driving tasks
  - Increased fuel efficiency / reduced emissions
- Automated Vehicles
  - Time freed from driving task for other tasks such as work, interaction with passengers, viewing scenery, sleep, etc.
  - Vehicle sharing increases / ownership not as necessary
  - Mobility options for those currently unable to drive
  - Decreased congestion?

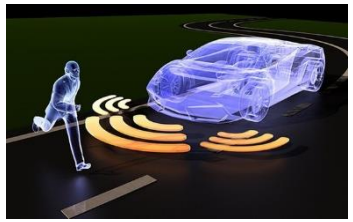
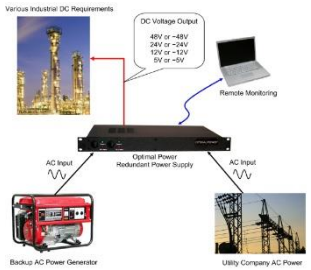
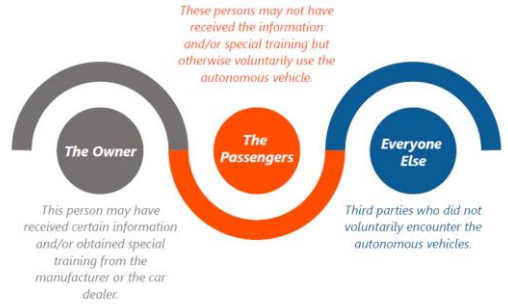
Largest Challenges Surrounding AV/CV

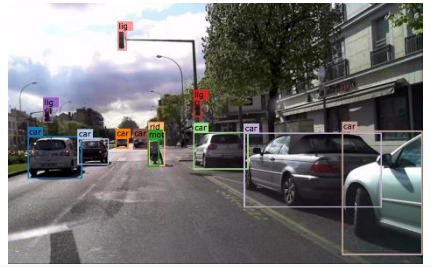
- Complex Driving Situations
- Vehicle Cybersecurity
- Information Privacy
- Vehicle Ethics
- Crashworthiness
- System Disengagements / Driver Re-Engagement
- Deep Learning / Artificial Intelligence
- Vehicle Assertiveness
- Fault Tolerance / Fall Back
- Vehicle Maintenance
- Liability / Legality / Crash Data
- User Acceptance / Equity / Jobs



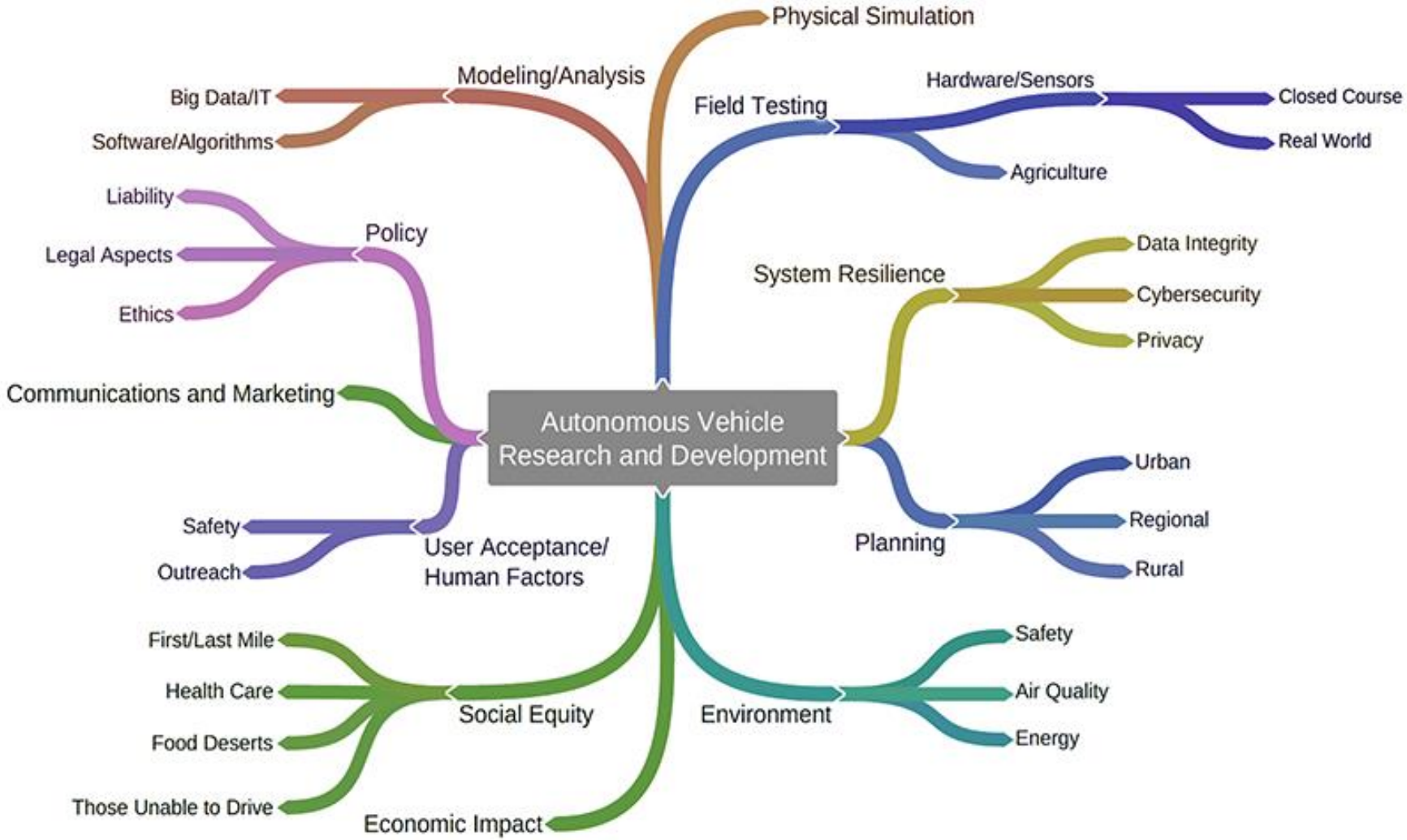



Breadth and Complexity of AV R&D



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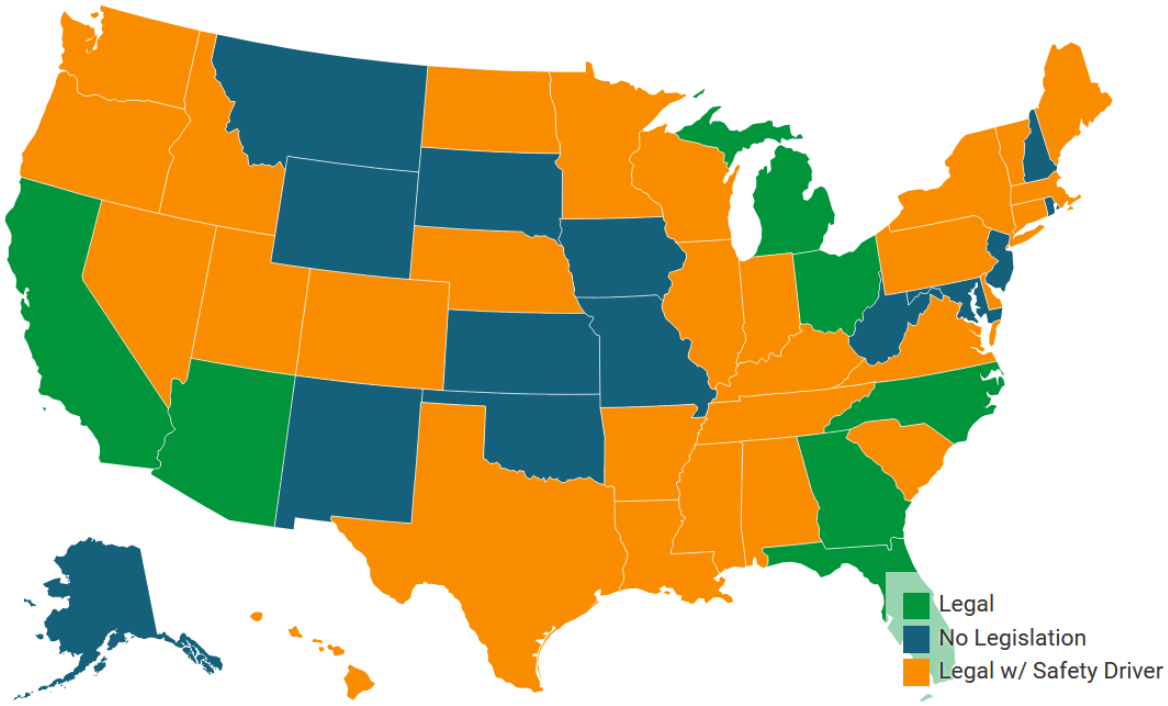
Government Oversight of CAVs

- International Standards (ISO, Country Conventions, etc.)
- Federal (USDOT, NHTSA, FHWA, Congress)
  - Federal Motor Vehicle Safety Standards (FMVSS)
  - Ensuring American Leadership in Automated Vehicle Technologies Automated Vehicles 4.0
  - Various congressional acts
- State
  - Wide range of ambiguous/outdated statutes
  - Vehicle registration
  - California safety reporting
- Local
  - AVs on city/municipal roads
  - Neighborhood associations / wards
- Other
  - University, corporate, etc.

Current AV Legislation

States with Autonomous Vehicle Legislation



Legend: Green – Legal
Orange – Legal w/ Safety Driver
Blue – No Legislation

States that Authorize Vehicle Platooning

Legend: Red – No exemptions for platooning vehicles
Yellow – Some authorization w/ restrictions
Green – Full authorization of platooning

Photos: Lifewire / CEI

(An) AV Timeline

2015
- driver assistance common
- some partial automation available to consumers

2020
- limited / conditional AVs widely available to consumers

2025
- autonomous shared mobility fleets are common

2030
- high automation required in all new vehicles

2040
- human operation is the exception in many places

2060
- transition to driverless largely complete
- fleet turnover continues…

2100

- Any estimate is debatable
- We are only at the beginning of a long transition period

2063?

Conclusions

Conclusions

- The next 15 years in transportation will be more transformative than any time in our history
- Not just Personal! – Commercial uses like TNCs, shuttles, and trucking are gaining traction
- Not just Auto! – It will see a significant impact, but will not be the only LoB affected by CAV
- Insurance response is in early stages and will likely be a key piece
- Opportunities still exist to influence future insurance structures
- Benefits in safety and convenience are increasing the desire to adopt CAV
- Keep this on your radar, wide-scale implementation is closer than it seems

Questions

Thank You

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Stay Engaged

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Thank you

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