New Risk on the Road
Autonomous Vehicles and Public Entity Risk
Session Summary

In this session, we will review:

• Illustrations of practical application on our roads today and a look at the future of the technology

• Current legislation, rules and risks associated with autonomous vehicles and related technology

• Legal, ethical and risk management issues
Objectives

• Understand evolution of autonomous vehicles, V2V and V2I technology

• Recognize associated rule-making bodies

• Learn risks public entities face, and shape a risk management framework
Five Levels of Automation

**Level 1**
System controls at least one control function: acceleration, steering or braking

**Level 2**
System controls multiple control functions at the same time: acceleration, steering or braking

**Level 3**
System controls all functions: acceleration, steering and braking; driver expected to respond under certain conditions

**Level 4**
System controls all functions with no driver intervention under certain conditions

**Level 5**
System controls all functions with no intervention under all conditions
The Illusion of Level 5
Enabling Technology
Enabling Technology – Sensors

**Ultrasonic**
- Sends out sound waves; echo reveals exact location of object (Think: bats)
- Detects obstacles in immediate vicinity at low-speed application, such as parking

**Image Sensors**
- Detects color and font; multi-position; capable of 3D imaging
- Interprets traffic signs, traffic lights, lane markings; back up for other systems

**Radio Detection and Ranging (RADAR)**
- Sends out electromagnetic waves; reflected waves identify how far an object is and how fast it is approaching
- Tracks speed of other vehicles in real time; short- and long-range surround vehicle; provides system redundancy

**Light Detection and Ranging (LIDAR)**
- Scans with non-visible laser; creates 3D image of environment
- Allows obstacles to be correctly identified; combined with cameras
Communication

Systems use Dedicated Short-Range Communications (DSRC) technology to exchange basic data at high transmission rates.

**Vehicle to Vehicle (V2V)**
- On-board sensors
- Cloud

**Vehicle to Infrastructure (V2I)**
- Roads
- Traffic signs
- Traffic lights
- Parking

**Vehicle to Everything (V2X)**
- Evolution that joins V2V, V2I with Vehicle to Pedestrian (V2P) or Vehicle to Government (V2G)
- Combines 5G cellular, Wi-Fi
The V2V and V2I security system consists of three primary components:

1. A Security Credentials Management System (SCMS) is the entity that issues, distributes and revokes security credentials for devices operating in the system

2. Devices must have valid certificates to communicate

3. Devices will need to securely receive new certificates via a communications network, enabling two-way encrypted communications between an SCMS a device and roadside infrastructure
Data, Data and More Data

Massive amount of data
- RADAR ~10–100 KB per second
- Cameras ~20–40 MB per second
- Ultrasonic ~10–100 KB per second
- GPS ~50 KB per second
- LIDAR ~10–70MB per second

4,000 GB per vehicle … per day
Level 1–2 Vehicle Application

**Assisted Backing Up and Parking**
- Rear automatic braking
- Backup camera
- Cross traffic alert

**Maintaining Safe Distance**
- Adaptive speed control
- Traffic congestion assist
- Forward collision warning
- Automatic emergency braking (vehicle and pedestrian)

**Safe Lane Navigation**
- Lane departure
- Blind spot detection
- Adaptive lighting
Automated Vehicle Application

• Consumer
• Commercial transportation fleet
• Mass transit
• Ride share and on-demand taxi
Consumer Acceptance

Affordability
• OEM
• Aftermarket

Acceptance
• Understanding
• Perception

Attitude
• Open road
• Trust
Security system
Provides and verifies V2V security certificates to ensure trust between vehicles

GPS, DSRC antennae

In-vehicle components

Dedicated Short Range Communications (DSRC) radio
Receives and transmits data through antennae

GPS receiver
- Provides vehicle position and time to DSRC radio
- Provides timekeeping signal for applications

Driver-vehicle interface
Generates warning issued to driver

Memory
Stores security certificates, application data, and other information

Safety application electronic control unit
Runs safety applications

Vehicle’s internal communications network
Existing network that interconnects components

This in-vehicle equipment can consist of either a single, integrated unit or a discrete set of components

Sources: Crash Avoidance Metrics Partnership and GAO.
Highly Autonomous Vehicle (HAV) Crash Rates

Figure 1. SHRP 2 NDS and Self-Driving Car Crash Rates per Million Miles
Reimagine Public Transit

- Analyze big data
- Create efficiency
- Long-term value
- System integration
  - Route planning
  - Passenger security
  - Digital fares
  - Demographics
Get Goods From Here to There

“Platooning”
Linking of two or more trucks in a convoy, using connectivity technology and automated driving support systems.

- Changing role of driver
- Environmental impact
- Cost of goods impact
- Regulatory framework
A Realistic Timeline

Autonomous Vehicle Fleet Projections
(as a percentage of all vehicles on the road)

2020's: Large Price Premiums
(01%-02%)

2030's: Moderate Price Premiums
(10%-20%)

2040's: Minimal Price Premiums
(20%-40%)

2050's: Standard on Most New Vehicles
(40%-60%)

Source: GHSA
Fast Facts

Speeding
10,111 fatalities in speed-related crashes cost Americans $40.4 billion each year.

Red lights
900 people a year die and 2,000 injured. Nearly 50% are pedestrians and occupants of vehicles hit by red-light runners.

Fatigue
803 fatalities. Estimated at 21% of fatal crashes, 13% of crashes resulting in severe injury and 6% of all crashes.

DUI
10,000+ people were killed in DUI crashes in 2018. Accumulated cost of $44 billion each year.
High Impact V2V Technology

If two technologies, Left Turn Assist (LTA) and Intersection Movement Assist (IMA) are implemented across fleet, says NTHSA:

- 400,000 to 600,000 crashes avoided
- 190,000 to 270,000 injuries eliminated
- 780 to 1,080 saved lives each year
Federal Agencies
Various roles and responsibilities

- National Highway Transportation and Safety Administration
- United States Department of Transportation
- National Transportation Safety Board
- Federal Communications Safety Board
- Consumer Safety Commission
- Department of Homeland Security
U.S. Congress
Recent legislation regarding autonomous vehicles

USDOT
1. Prioritize safety
2. Technology neutral
3. Modernize regulations
4. Encourage consistent regulatory and operational environment
5. Prepare proactively
6. Protect and enhance consumer freedom
State Legislatures

Role of State legislatures

1. Prepare infrastructure
2. License human drivers
3. Register vehicles in their jurisdiction
4. Enacting and enforcing traffic laws and regulations
5. Conducting safety inspections
6. Regulating motor vehicle insurance and liability
First Steps for State Legislatures

Consider how to allocate liability among ADS owners, operators, passengers, manufacturers, and other entities when a crash occurs.

Determine who (owner, operator, passenger, manufacturer, other entity, etc.) must carry motor vehicle insurance.

Consider rules and laws allocating tort liability.
NCSL Database

• In 2017, 33 states have introduced legislation.

• Twenty-nine states have enacted legislation related to autonomous vehicles.

• Governors in 11 states have issued executive orders related to HAV

• As of March 15, 2019
  • 23 States
  • 70 bills
2019 UT H101

Status – Passed House and Senate – to the Governor

• Defines terms related to autonomous vehicles
• Allows the operation of a vehicle in the state by an automated driving system
• Exempts a vehicle with an engaged automated driving system from licensure
• Provides protocol in case of an accident involving an autonomous vehicle
• Requires a vehicle equipped with an automated driving system to be properly titled, registered, and insured
• Preempts political subdivisions from regulating autonomous vehicles in addition to regulation provided in state statute
Impact on local communities

Challenges and opportunities

Defining parameters
- Who
- When
- Where

Mobility Policy Framework
- Equity and accessibility
- Pilots & Partnerships
- Economic modelling
- Land use and design
Impact on local communities

Integrated mobility plan
• Public transit
• Ride share
• Micro-mobility solutions
• Pedestrian traffic

Law enforcement and emergency response
• Enhanced safety
• Response time
• Resource deployment

Healthcare
• Reduction in frequency and severity of accidents
Public Entity Automobile Liability

Dallas – 20 months
• 2,500 crashes 1,300 at fault
• $3.2 million in claim payments to third parties

Impact on cost allocation
• Shifting loss patterns
  • Emergency vehicles
  • White fleet
  • Yellow fleet
  • Heavy equipment

Changes in relative valuation of physical assets
Cost to Replace Infrastructure

Traffic Signal: $3,000 to replace; could be up to $100,000 if damage to traffic signals overhead.

Fire Hydrant: $2,500 more if complete replacement required

Stop Sign: $525 to fully replace

Parking Meter: $700 to replace damaged meter

USPS Mail Box: $750 to replace a damaged blue mailbox

Concrete Barrier: $42 to $130 per linear foot
HAV Risk Management Framework

• Overall security protocols are owned, governed and promoted at the highest level of the applicable organization

• Security risks are assessed and managed appropriately and proportionately, including those specific to the supply chain

• Organizations need product aftercare and incident response to ensure systems are secure over their lifetime

• The security of all software is managed throughout its lifetime
HAV Risk Management Framework

• The storage and transmission of data is secure and can be controlled

• The system is designed to be resilient to attacks and respond appropriately when its defenses or sensors fail

• Systems are designed using a defense-in-depth approach

• All organizations, including sub-contractors, suppliers and potential third parties, work together to enhance the security of the system