Looming on the Horizon: Autonomous Vehicles

Jim Hedlund
Highway Safety North

MN Toward Zero Deaths Conference
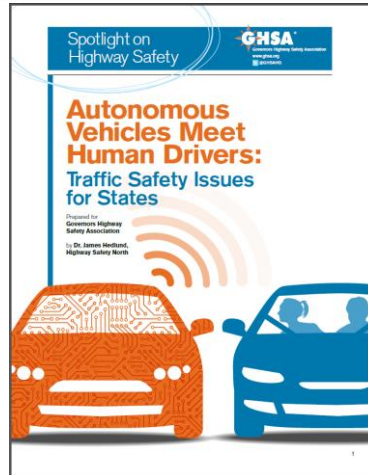**October 26, 2017**
St. Paul, MN

In the next 25 minutes

- **AV 101**
  - What's an autonomous vehicle (AV)?
  - What's on the road now?
  - What's coming and when?
  - What does the public think about AVs?
  - What are current state laws on AVs?
- **Traffic safety issues for states**
  - AV testing
  - AV operations
  - What should states do
  - What should national organizations do

2

Report released Feb. 2, 2017

Autonomous = self-driving, right?

So what's the challenge?

- **When all vehicles are autonomous:**
  - The passenger economy: transportation as a service
  - No crashes (at least none due to driver error – about 94% currently)
- **And it's coming soon**
  - 26 states and DC with AV legislation or executive orders
    (and AVs probably can operate in most states without law changes)

States with Enacted Autonomous Vehicle Legislation

NCSL October 2017

www.ghsa.org   @GHSAHQ

5
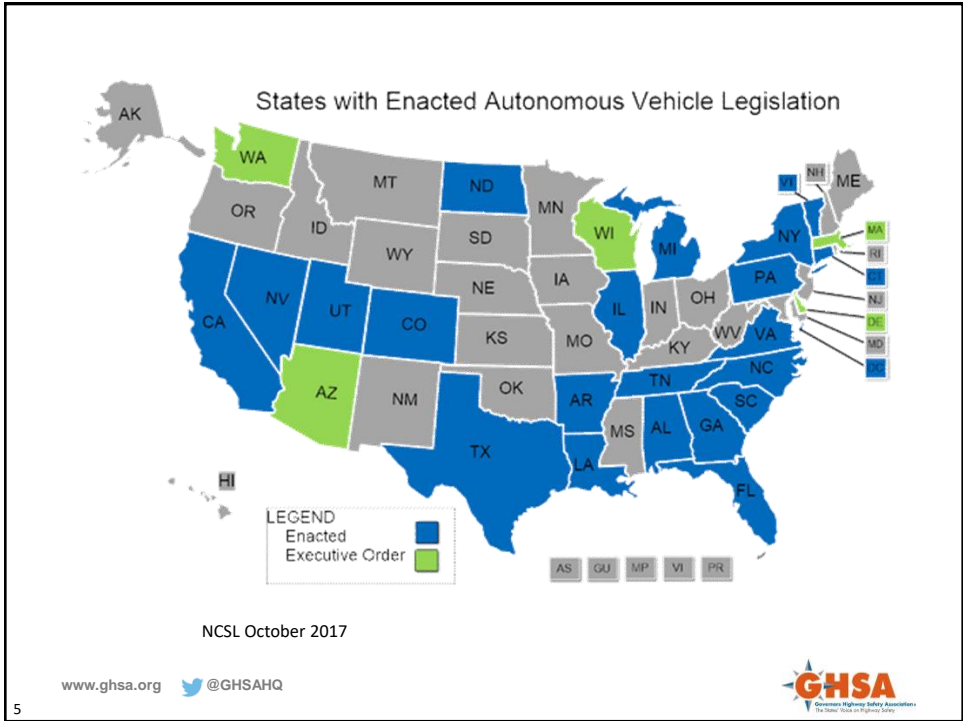
But …

- **It's far more complicated than that**

6

What's an AV?

- **Level 0: no automation, driver in complete control**
- **Level 1: driver assistance**
  - Cruise control or lane position, driver monitors at all times
- **Level 2: occasional self-driving**
  - Control both speed and lane position in limited situations, like Interstates; driver monitors at all times

  ****

- **Level 3: limited self-driving in some situations, like Interstates**
  - Vehicle in full control, informs when driver must take control
- **Level 4: full self-driving under certain conditions**
  - Vehicle in full control for entire trip, such as urban ride-sharing
- **Level 5: full self-driving at all times**

GHSA

7

What's on the road now?

- **Level 1 available for many years**
  - Adaptive cruise control, lane-keeping assistance
- **Level 2 available now**
  - Tesla Autopilot
- **Levels 3-5 coming soon**
  - Waymo (Google) test fleet: 3 million miles as of May 2017
  - Uber in Pittsburgh, Tempe; Lyft in Boston; pizza delivery in Ann Arbor
  - 38 companies with AV testing permits in CA as of October 2017 – up from 12 in March 2016
  - By 2020: available (perhaps) from Audi, BMW, Ford, Tesla, Volvo, VW; Delphi, Lyft, NuTonomy, Uber, Waymo …
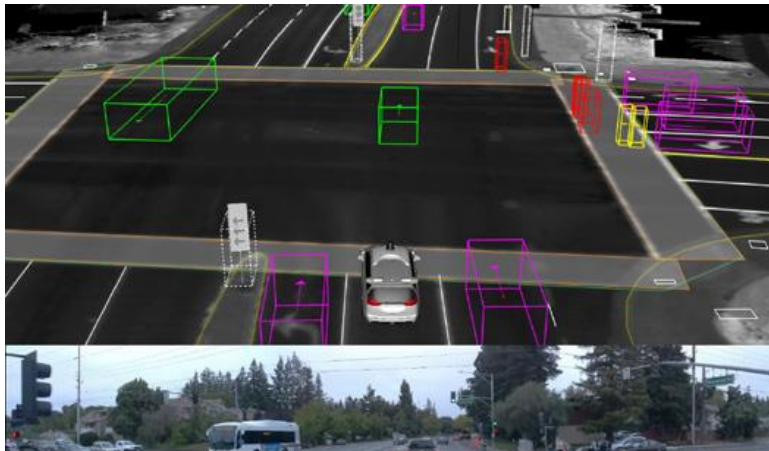
GHSA

8

The AV begins with a map

9

Senses what's around it

10

Predicts where things will move

11

And chooses route and speed

12

What's coming and when?

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

Percent of 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%)

Lower Estimate / Higher Estimate

Source: GHSA

GHSA
Governors Highway Safety Association
The States' Voice on Highway Safety
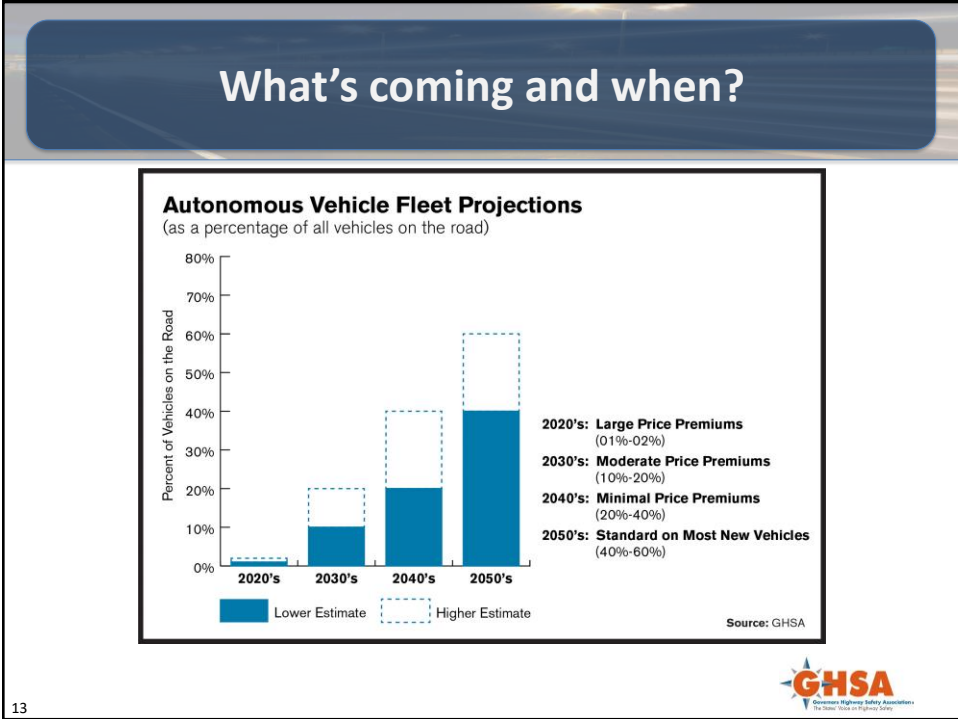
13

What does the public think about AVs?

- **Skeptical**
  - Prospect of wide use?   34% excited, 57% worried
  - Will AVs reduce crashes?   35% yes, 46% no
  - Would you ride in an AV today?   17% yes, 75% no
  - Would you buy an AV when available?   ≈ 20% yes, ≈ 50% no

- **Prefer AVs that allow drivers to take control**
  - Over 80% in two surveys

5 surveys (4 in 2016 and 1 in 2015), 4 in US and 1 in Canada

GHSA
Governors Highway Safety Association
The States' Voice on Highway Safety

14

The big takeaway

- **AVs and DVs (driver-controlled vehicles) will share the road for a long time – perhaps forever**

15

The hybrid fleet: AVs and DVs

- **The safety challenge: human behavior**
  - Drivers, of AVs and DVs
  - Other road users as they interact with AVs
- **A few examples**
  - Tesla fatality – Level 2 AV; driver had hands off steering wheel for more than 36 minutes out of 37; ignored warnings from car; ran into semi
  - Waymo (Google) car pulled into the left lane and ran into the side of a bus coming from the rear; Waymo car assumed the bus would yield
  - Uber car in leftmost of 3 lanes; traffic stopped in right 2 lanes. Driver in cross street was turning left in front of the 2 stopped lanes and didn't see Uber in third lane.
  - Kids running in front of AVs

16

The hybrid fleet: AVs and DVs

- **The institutional challenge: AVs are disruptive technology**
  - Hardware v software
  - Federal and state roles
    - Federal role: regulate vehicles
    - State roles: license vehicles and drivers, establish and enforce traffic laws, vehicle insurance and liability
  - Many new players: Waymo (Google), Uber and Lyft, …
  - Many issues: liability, data security, infrastructure needs, …
  - And it's all moving very quickly –
    How to prepare for technology that's developing rapidly

GHSA
Governors Highway Safety Association
The States' Voice on Highway Safety

17

What should states do?

- **AV testing**

- **AV operations**

GHSA
Governors Highway Safety Association
The States' Voice on Highway Safety

18

State AV policy issues - testing

Encourage AV testing while protecting public safety

- **Final testing is on public roads**
- **Some considerations**
  - Must testing organizations apply to the state
  - How and where will testing be conducted
  - Test driver selection and training
  - Test vehicle identification
  - Testing organization's safety culture and safety plan
  - Testing organization's insurance
  - Reporting: test trips, incidents, crashes, injuries

    Most topics are suggested in NHTSA's AV Policy

GHSA

19

State AV policy issues - operations

Encourage AV operations while protecting public safety

- **AV drivers**
  - Licensing and training for Level 3-4 AV drivers
- **Data systems**
  - Identify AVs in vehicle title and registration, driver licensing, crash reports
  - For Level 3-4 AVs, identify where AV can operate autonomously (Operational Design Domain)
  - Track software changes

GHSA

20

State AV policy issues - operations

Encourage AV operations while protecting public safety

- **Laws on AV operations**
  - Who's the driver
  - AVs and traffic laws – speed limits, following too closely
  - Distracted driving laws – hands on wheel, cell phones, …
  - DUI and DUID laws
- **Law enforcement**
  - How to identify AVs on the road: e.g., cell phone law enforcement
    Is it a Level 3? A Level 4 within its ODD?
  - Traffic stops; vehicle pursuit: how to flag down an AV
  - Road rage of human drivers interacting with AVs
  - AVs suspected of carrying contraband

GHSA

21

State AV policy issues - operations

Encourage AV operations while protecting public safety

- **Crash investigation**
  - How to identify AVs at a traffic stop or crash
  - Officer and emergency responder safety: can the AV start moving without a driver
- **Liability and insurance**
  - Who is liable – manufacturer, software provider, owner, operator
- **Coordination across states**

GHSA

22

What should states do?

- **Be informed; stay informed**
- **Be a player**
  - Join or start a state AV task force; include industry partners
  - Work with other states to develop consistent laws, policies, procedures
- **Consider AV laws and regulations carefully**
  - Encourage AVs while protecting public safety
- **Be flexible**
  - AVs are disruptive technology, developing very quickly

GHSA

23

What should national organizations do?

- **Develop model AV laws and regulations**
- **Document the traffic safety issues of AVs**
- **Develop model public education materials**
- **Establish an AV information clearinghouse**
- **Issue vehicle regulations and guidance promptly**
- **Establish regulations or guidelines to identify AVs easily**
- **Involve law enforcement, SHSOs, and DMVs in AV discussions**

GHSA

24

NHTSA Guidance

- **Released Sept. 12, 2017**
- **Guidance, not regulation**
  - "Encourage" rather than "require"
- **Framework, not detail**
  - Generic, not specific
  - What, not how
- **New acronym: ADS = Automated Driving System**

GHSA

25

Guidance for ADS developers

- **12 points**
  - Design for and validate overall system safety: "free of unreasonable risks"
  - Define the system's ODD = Operational Design Domain
  - Detect and respond to safety risks: objects, events
  - Identify and deal with system malfunctions
  - Testing and validation
  - Interaction with ADS drivers
  - Cybersecurity
  - Crashworthiness
  - Post-crash ADS behavior
  - Crash and event data recording
  - Consumer education and training
  - Federal, state, and local laws
  - Voluntary self-assessment of these points

GHSA

26

Guidance for states

- **Best practices - general**
  - Technology-neutral
  - Licensing and regulatory procedures
  - Reporting and communications
  - Traffic laws and regulations
- **Best practices – framework**
  - Administrative: ADS lead agency, technology committee
  - ADS testing: application, drivers, operations
  - Public safety official considerations
  - Liability and insurance

27

Last week's word

28

For more information

Jim Hedlund

Highway Safety North

jhedlund@sprynet.com

Download the report: www.GHSA.org

29