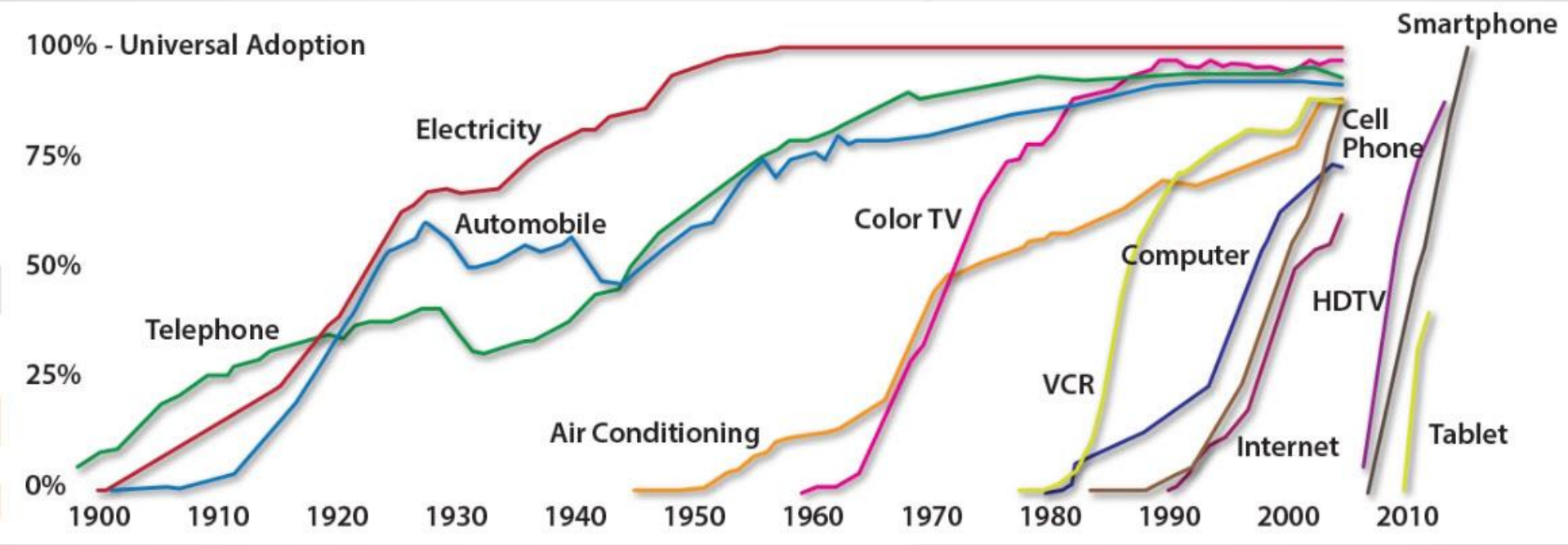
2016 Design Training Expo

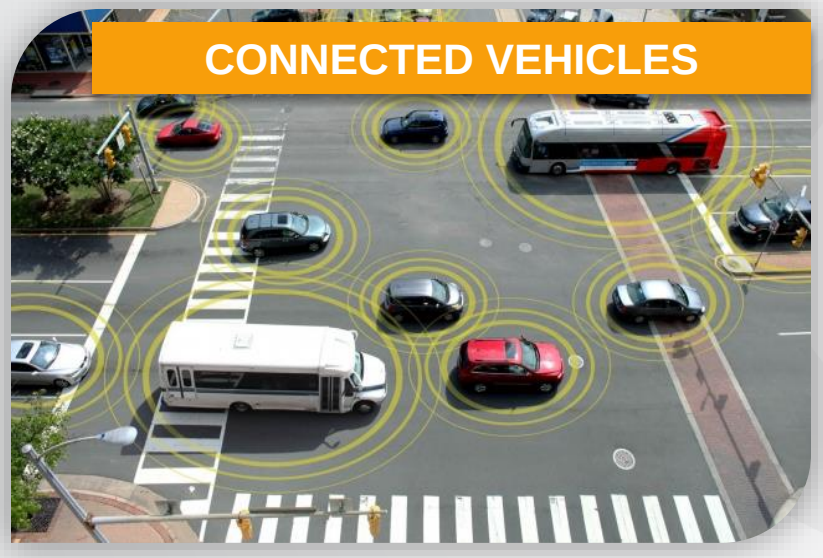
The Florida Automated Vehicles Initiative

Tuesday, June 14, 2016

Technology Adoption Rate



Automated Vehicles – An Umbrella Term



Automated Vehicles – Technologies Overview

FLORIDA AUTOMATED VEHICLES

CAMERAS
Stereo and infrared camera data helps avoid obstacles, identify road sign messages, and visualize lane markings.

SOFTWARE
On-board computers run advanced software to analyze data collected by sensors to make intelligent maneuvers and real-time route determination.

RADAR
Radar tracks nearby objects, which helps maintain the car's distance from vehicles ahead and detect blind spot obstacles.

LIDAR
Light detection and ranging system generates a point cloud that gives the car a 360-degree view.

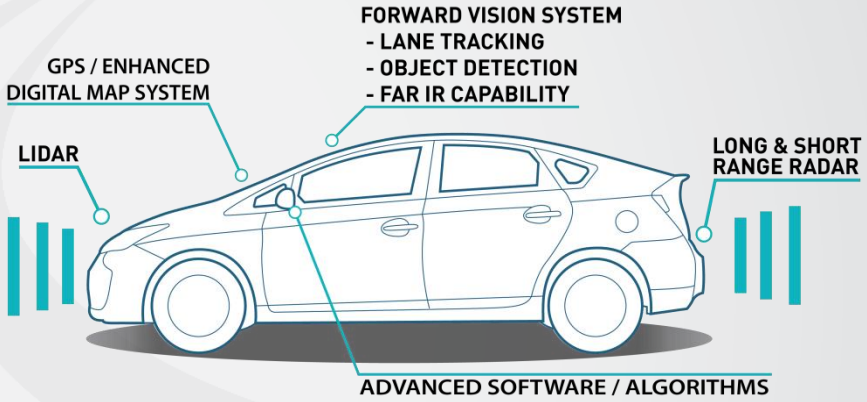
DEDICATED SHORT RANGE COMMUNICATION
Provides communication between vehicles (Vehicle to Vehicle - V2V) and between vehicles and the transportation infrastructure (Vehicle to Infrastructure – V2I). DSRC is expected to be utilized where existing Intelligent Transportation Systems (ITS) are already in place, such as urban areas, high volume limited access facilities, and managed lanes.

Autonomous Vehicles

FLORIDA AUTOMATED VEHICLES

Levels of Automation (as defined by NHTSA)

- **0 – No Automation**, but advanced collision warnings, blind spot monitoring, etc.
- **1 – Function Specific**, such as adaptive cruise control or active lane centering (but not at same time)
- **2 – Combined Function**, such as adaptive cruise control and active lane centering working at same time (must still be actively engaged in operation of vehicle)
- **3 – Limited Self-Driving**, Driver is not expected to monitor vehicle movements for limited time in limited situations (driver operates vehicle during part(s) of trip)
- **4 – Full Self-Driving**, No human operator expected to control safety-critical functions of the vehicle



Safety critical functions of the vehicle (steering/throttle) *are affected* without direct driver input

Connected Vehicles

FLORIDA AUTOMATED VEHICLES

Applications

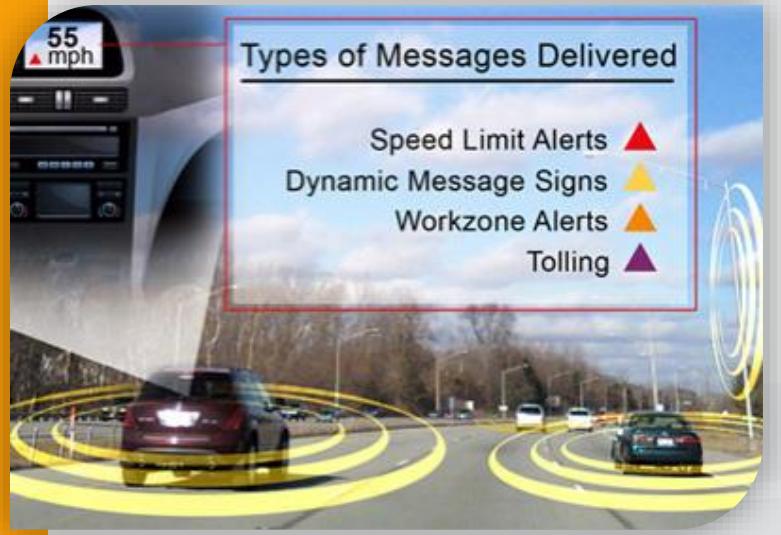
- Safety Critical Warnings
- Mobility Enhancements
- Environmental Benefits
- 55+ specific applications/uses defined by USDOT

Data Gathering/ Information Exchange

- Vehicle-to-Infrastructure (V2I)
- Vehicle-to-Vehicle (V2V)
- Vehicle-to-Bike/Ped/Other (V2X)

Safety critical functions of the vehicle (steering/throttle) ***not affected*** (operator is in control at all times)

Enhanced Situational Awareness



Connected Vehicles

Technology

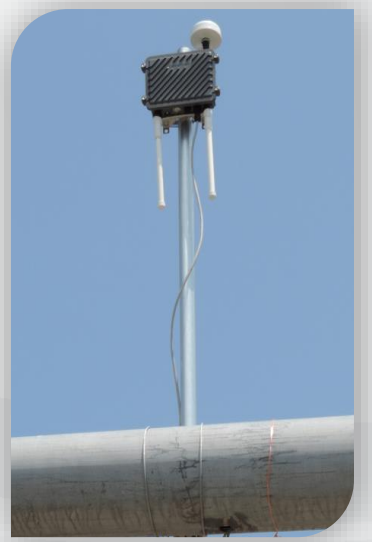
- Dedicated Short Range Communications (DSRC)
  - (5.9 GHz designated to transportation by FCC)
- Cellular network
- Satellite communications

Equipment

- All DSRC units are still in development (prototypes)
- Need to identify standards for product specifications
- Controllers are being upgraded to being ‘CV-ready’

On-Board Unit

Road-Side Unit



Connected Vehicles

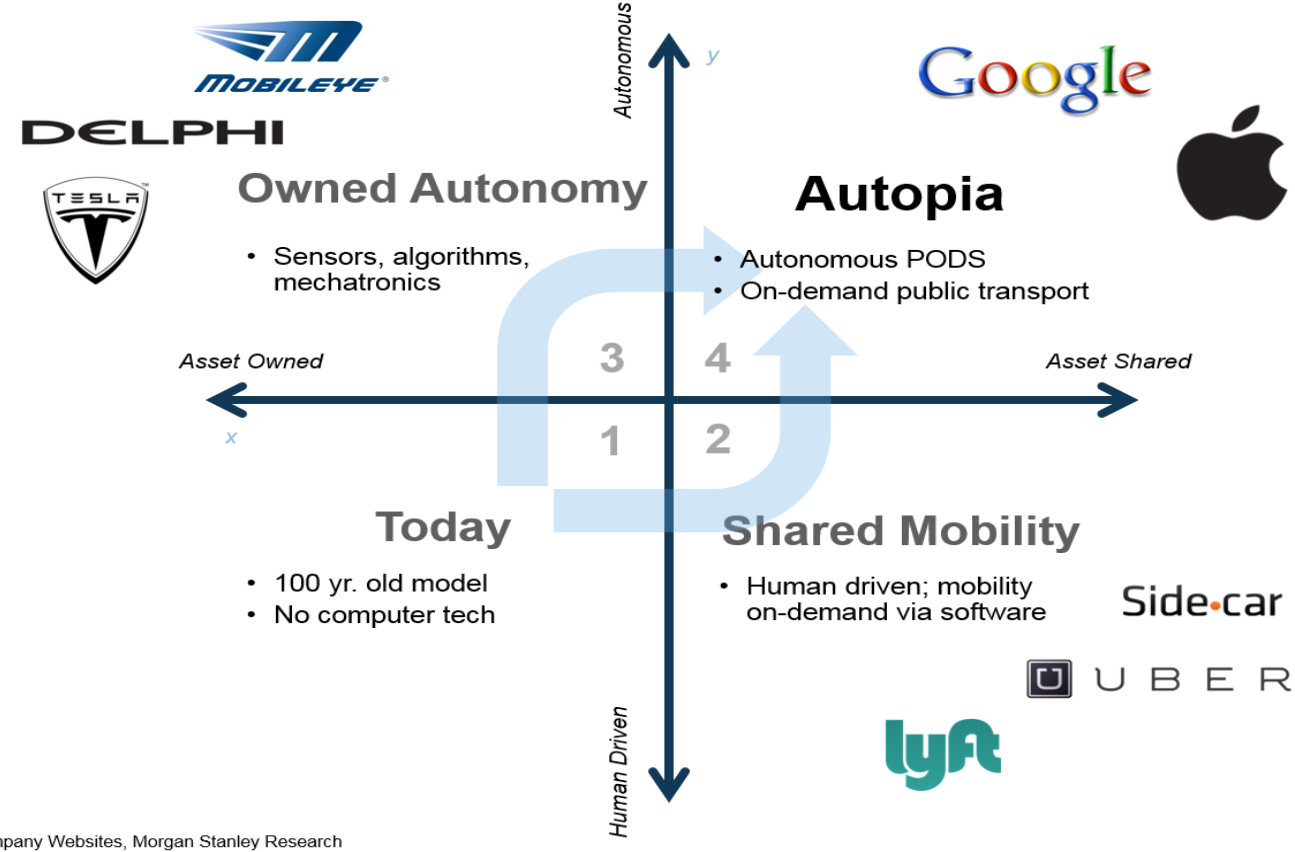
FLORIDA AUTOMATED VEHICLES

Specific Applications FDOT has Developed and/or Integrated from USDOT into SunGuide

- Wrong Way Driver Detection and Alert
- Over-height Detection and Alert
- Emergency Braking
- Emergency Vehicle Alert
- Red Light Violation Warning

Demonstration from 2014 FAV Summit

Morgan Stanley



Owned Autonomy

- Sensors, algorithms, mechatronics

Autopia

- Autonomous PODS
- On-demand public transport

Today

- 100 yr. old model
- No computer tech

Shared Mobility

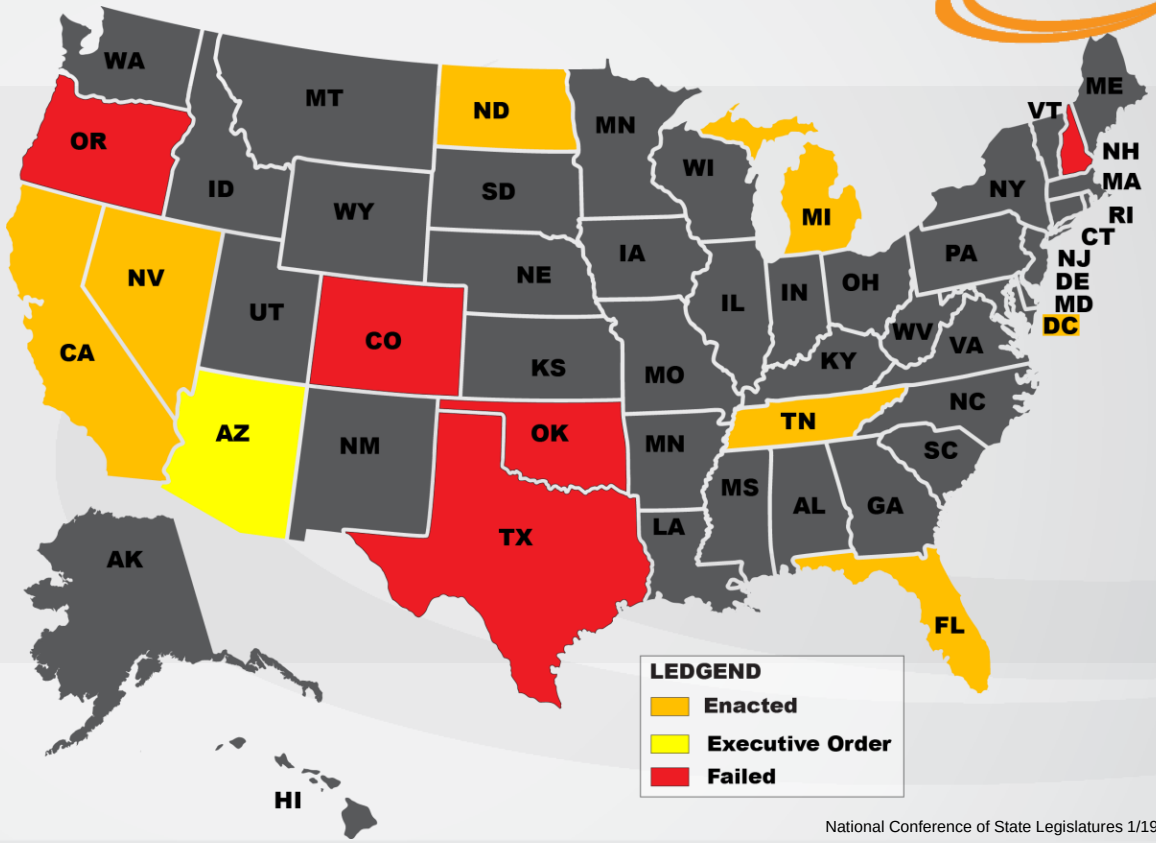
- Human driven; mobility on-demand via software

Company Websites, Morgan Stanley Research

AV Legislation

Thirteen states introduced legislation related to autonomous vehicles in 2015, up from 12 states in 2014, nine states and D.C. in 2013, and six states in 2012.

States with Enacted AV Legislation



National Conference of State Legislatures 1/19/2016

Florida Statutes – Autonomous Vehicles (2015)

F.S. 316.85 – Autonomous Vehicles; Operation

F.S. 316.86 – Operation of vehicles equipped with autonomous technology on roads for testing purposes; financial responsibility; exemption from liability for manufacturer when third party converts vehicle

F.S. 319.145 – Autonomous Vehicles (Title Certificates)

Florida Statutes – Autonomous Vehicles (2016)

HB 7027, signed April 4th 2016 – updates:

F.S. 316.86 – ~~Operation of vehicles equipped with autonomous technology on roads for testing purposes; financial responsibility~~; exemption from liability for manufacturer when third party converts vehicle

This amendment removed barriers to testing, including:
1) the term “closed course”,
2) requirement of a human operator to be present in the autonomous vehicle (for testing purposes), and
3) insurance requirements.

Florida Statutes – Autonomous Vehicles (2016)

F.S. 319.145 – Autonomous Vehicles (Title Certificates)

(1) An autonomous vehicle registered in this state must continue to meet applicable federal standards and regulations for such motor vehicle.

The vehicle must:

(a) Have a system to safely alert the operator if an autonomous technology failure is detected while the autonomous technology is engaged.

(b) When an alert is given, the system must:

1. Require the operator to take control of the autonomous vehicle; or
2. If the operator does not, or is not able to, take control of the autonomous vehicle, be capable of bringing the vehicle to a complete stop

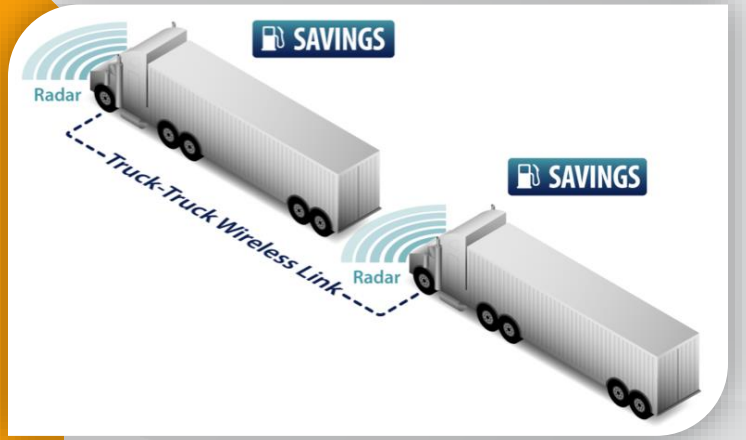
(b) Have a means, inside the vehicle, to visually indicate when the vehicle is operating in autonomous mode.

(c) Be capable of being operated in compliance with the applicable traffic and motor vehicle laws of this state.

Driver-Assistive Truck Platooning Study and Pilot Project

HB 7027 mandates:

“The Department of Transportation, in consultation with the Department of Highway Safety and Motor Vehicles, shall study the use and safe operation of driver-assistive truck platooning technology, as defined in s. 316.003, Florida Statutes, for the purpose of developing a pilot project to test vehicles that are equipped to operate using driver-assistive truck platooning technology.”



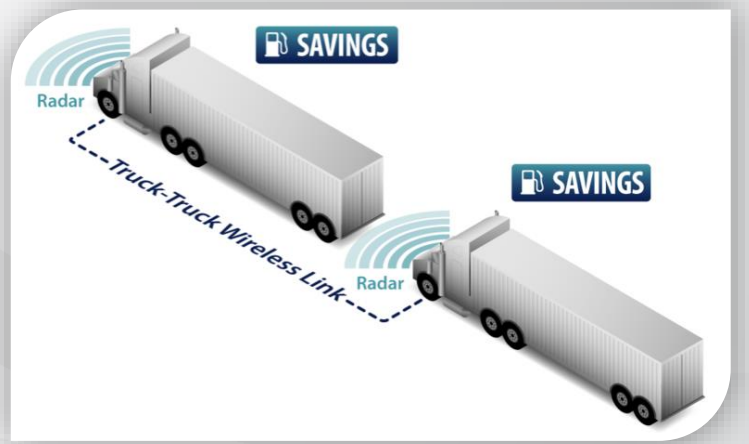
Driver-Assistive Truck Platooning Study and Pilot Project

1) Upon conclusion of the study, [DOT] may conduct a pilot project to test the use and safe operation of vehicles equipped with driver-assistive truck platooning technology.

2) Notwithstanding ss. 316.0895 and 316.303, Florida Statutes, [DOT] may conduct the pilot project in such a manner and at such locations as determined by the DOT based on the study.

3) Before the start of the pilot project, manufacturers of driver-assistive truck platooning technology being tested in the pilot project must submit to the DHSMV an instrument of insurance, a surety bond, or proof of self-insurance acceptable to the department in the amount of $5 million.

4) Upon conclusion of the pilot project, the DOT, in consultation with the DHSMV, shall submit the results of the study and any findings or recommendations from the pilot project to the Governor, the President of the Senate, and the Speaker of the House of Representatives.'



Implementation Challenges of Automated Vehicles

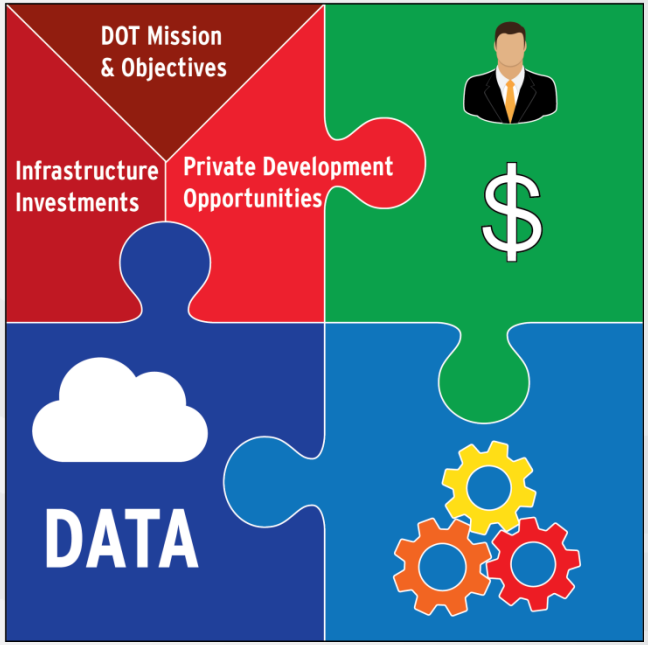
Rapidly Changing Business Models
- Requires new benefit/cost analysis to support deployment decisions
- Needs systematic & strategic approach

New Investments Needed
- Funding sources
- Infrastructure requirements
- Staffing needs

Data Issues
- Ownership
- Privacy/security
- Access & support

Interoperability
- Local, regional, national – multiple protocols
- Multi-jurisdictional testing and pilot agreements

Public Sector Perspective



Challenges Ahead for Transportation Professionals

Engineering Design Standards for AV

- Updates to the Florida Greenbook
- Potential changes to the Manual for Uniform Traffic Control Devices
- Adaptive/Flexible infrastructure
- Design for large structures (50+ year lifespan)

Increased Focus on ITS Support for CV

- Intelligent Transportation Systems
- New hardware and software skill sets
- Information Technology demands

Changes in Right-Of-Way Usage

- Potential requirements for access to dedicated AV facilities
- Additional facilities for non-traditional vehicles
- More efficient use of existing ROW

Potential Effects of AV on Design Criteria

Lane Width

- Potential less lane widths required for AV only lanes
- For long life span projects (bridges/urban facilities) - combine small increases in paving now with reduced AV-only lane footprint for an extra lane in the future
- Dedicated lanes for freight/transit

Criteria that may become less of an issue

- Sight distances
- Road signs

Materials

- Materials may need to be updated to prevent ‘rutting’ if cars drive within >10 cm of lane center
- Markings may need changes for improved machine-read as opposed to human read

Potential Effects of AV on Urban Planning

Parking Space Size

- Reduced width (doors don't need to open)
- Varied sizes to fit specific vehicle types

Parking Lot Location

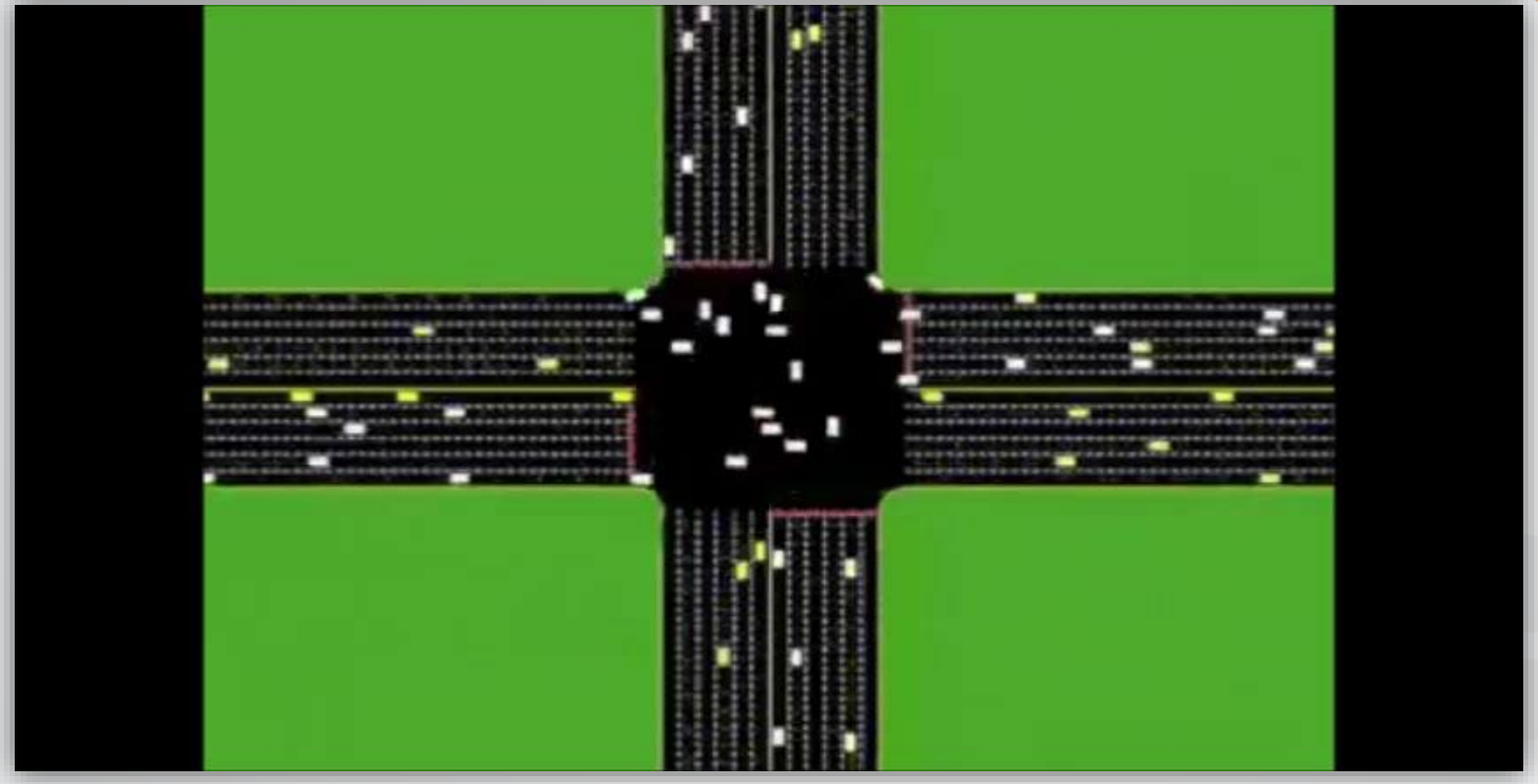
- No spaces within 300' of building entrances?
- On-street parking repurposed
- Passenger drop off/pick up lanes at building entrance (similar to airport design)
- Remote lots to make better use of urban land

Development Patterns

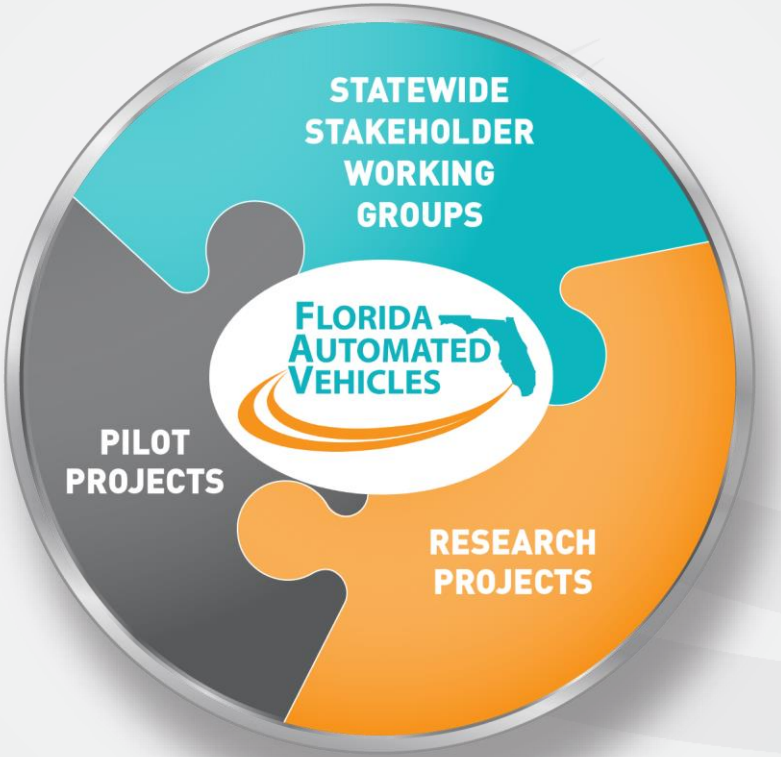
- Higher density requirements may be more attainable
- Driveway placement and design
- Building setbacks
- Greater focus on bike/ped improvements

Blue Polygons = Parking

Autonomous Intersection Management



FAV Initiative Activities



Stakeholder Working Groups

FLORIDA AUTOMATED VEHICLES

Policies & Legal Issues

Infrastructure/Technology

- Roadway improvements
- Engineering & design standards
- Infrastructure investment

Modal Applications

- Transit
- Freight
- Inspections

University Research Partnerships

FLORIDA AUTOMATED VEHICLES

Universities in Florida have been conducting research on AV/CV/ITS technologies for >10 years

- Policy Implications for AV Technology – MPO LRTPs (UF)
- Simulator for Connected Vehicle Messaging (UCF)
- Autonomous Technologies for Mobility Solutions for the Aging and Disabled Populations (FSU)
- Visioning Future Cities with AV Technologies (FSU)
- Unmanned Aerial Vehicles (FIT) and Unmanned Surface Vessels (FAU) for Bridge Inspections
- AV Requirements for Service Vehicles (ERAU)

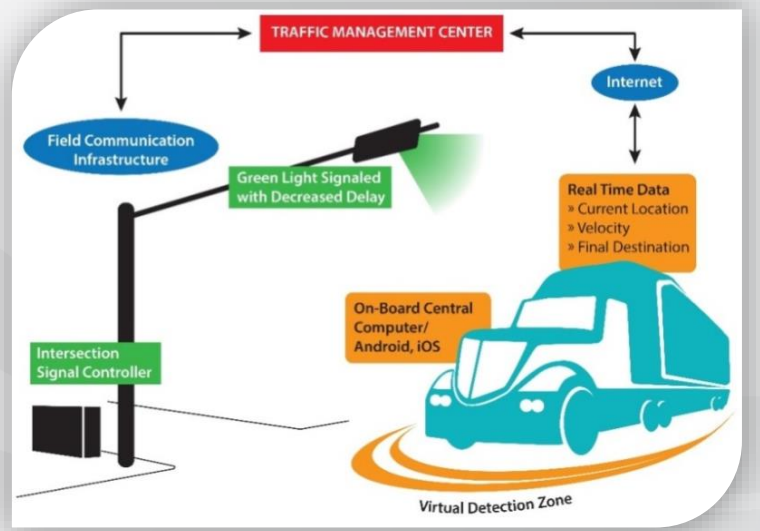
Connected Vehicles for Freight Mobility

Phase I (complete)

- Floral Industry – 86% of all flowers in US go through Miami
- MIA to Distribution Centers (3-6 mile trip)
- Stakeholder Engagement
- Measured pre-existing conditions
  - Delay analysis (travel time)
  - Fuel Savings analysis
  - Cost Benefit analysis
- Research in-cab devices and communications between vehicles and traffic management center

Phase II is currently under consideration

Improving Safety and Mobility



Assessing Advanced Driver Assistance Systems

District 7 – Tampa Bay Area

- Advanced Driver Assistance Systems (ADAS):
  - Forward Collision Warning (FCW),
  - Lane Departure Warning (LDW),
  - Bike/Ped Detection (BPD)
- Level 0 automation (as defined by NHTSA)
- 100 study vehicles equipped with GeoTab (telematics device)
  - 50 served as control group
  - 50 were equipped with Mobileye (ADAS)
- Performance Measures (quantitative analysis):
  - Driver behavior (reaction to ADAS alert)
    - Lane adherence
    - Following too closely
  - If incident occurred, did ADAS reduce severity?

Improving Situational Awareness & Driver Behavior

MOBILEYE

GEOTAB
management by measurement

FPTA Emerging Technologies Survey

Compelling Results

Familiarity with Advanced Driver Assistance Systems

Online real-time contactless ticketing and fare management solutions

Autonomous low-speed shuttles for first/last mile solutions and underutilized routes

Ride sourcing to supplement mass transit and para-transit operations

THEA - Connected Vehicle Pilot Deployment Program

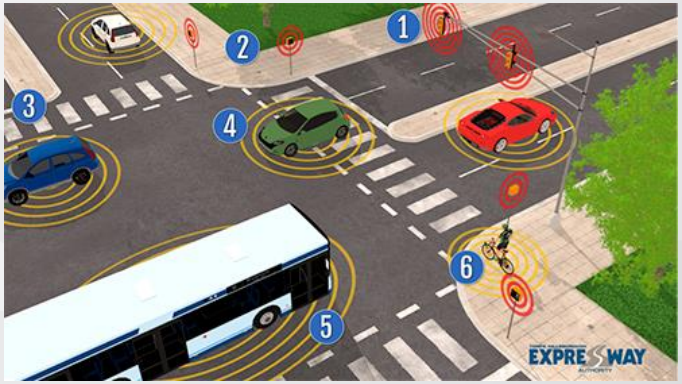
FLORIDA AUTOMATED VEHICLES

USDOT awarded Tampa Hillsborough Expressway Authority (THEA) a $17 million grant

- Focused on reducing the frequency and severity of crashes
- Increase bicycle/pedestrian (V2X) safety
- Enhance traffic flow and shrink the city's carbon footprint
- Data collection of real-world deployment of CV
- Understand limitations of CV systems to identify best practices that will be used to develop national standards
- New York City and State of Wyoming were also awarded

TAMPA HILLSBOROUGH EXPRESSWAY AUTHORITY

Driving Innovation and Opportunity



FDOT

Questions?

Email questions/comments to:
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www.AutomatedFL.com