Florida Clean Cities Coalitions

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Automated, Connected, Electric & Shared (ACES) Vehicles 101

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Clean Cities ACES Session

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7th Annual Florida Automated Vehicles (FAV) Summit

Clean Cities Program

Clean Cities

advances the energy, economic, and environmental security of the United States by supporting local actions to cut petroleum use in transportation.

- Reduced petroleum consumption
- Reduced greenhouse gas (GHG) emissions
- Reduced dependence on imported petroleum

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Elements of Clean Cities Program

Local & National Partnerships

Information & Education

Competitively Awarded Financial Assistance

Technical & Problem Solving Assistance

Clean Cities coalitions are locally based with the ability to tap national resources.

Clean Cities Connections

- National network of coordinators
- Peer-to-peer learning
- Problem solving
- Technical Response Service
- Tools, resources, publications

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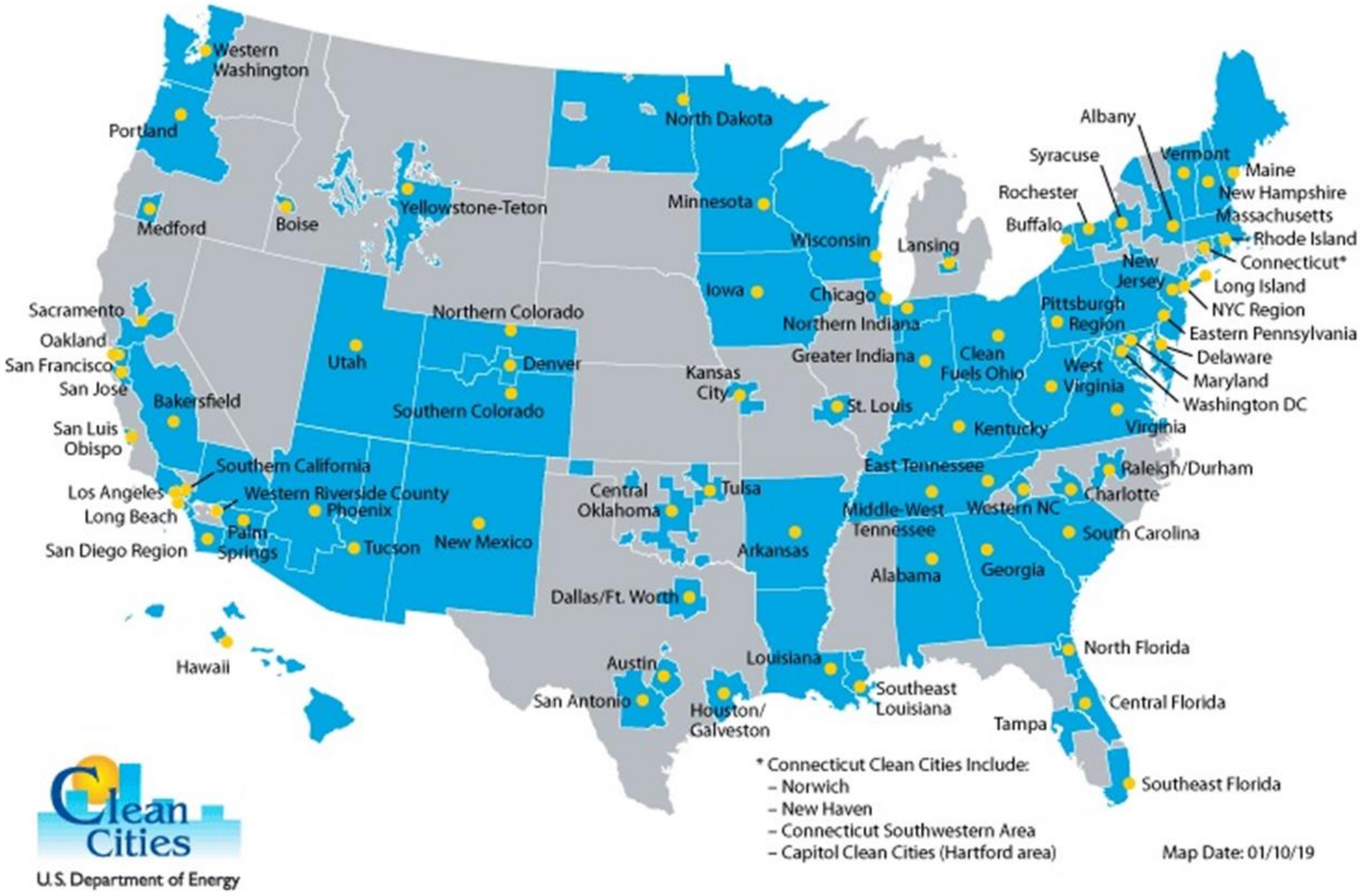
Florida Coalitions

Designated Florida Coalitions:

- Southeast Florida CCC
- Central Florida CCC
- Tampa Bay CCC
- North Florida Clean Fuels

Working on Designation:

- Northwest Florida CCC

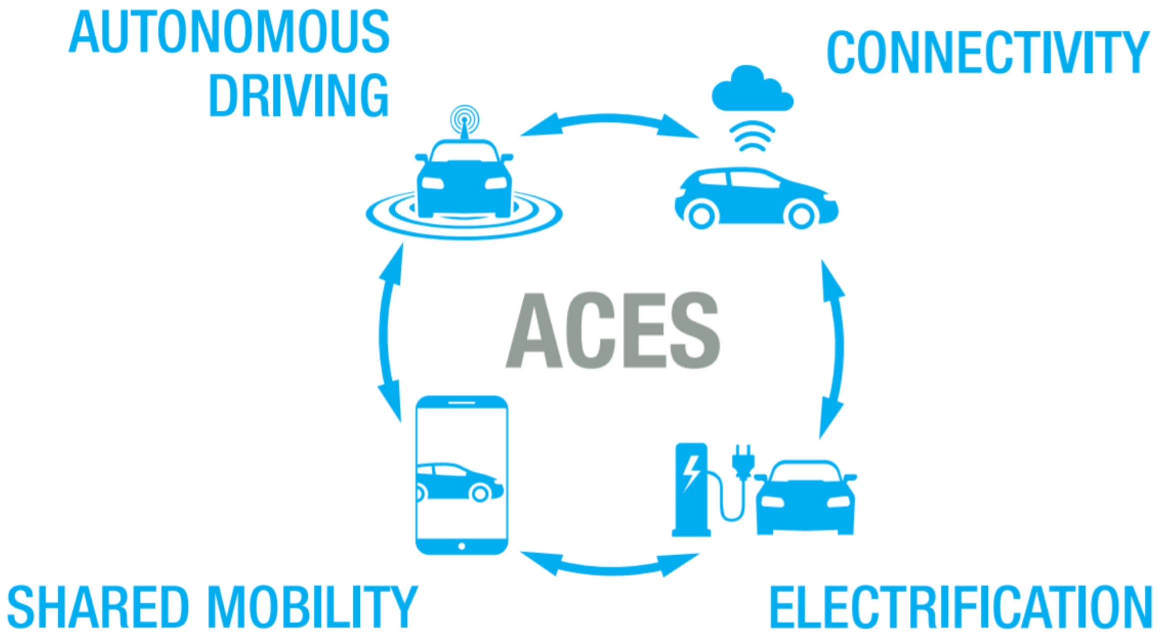


Activities of the Local Coalitions

- Data Reporting
  - Alternative fuel prices
  - Alternative fuel station opening/closing
  - Alternative fuel usage
- Outreach and Education
  - Educate the public and fleets about alternative fuels
  - Highlight alternative fuel successes
  - Connect fleets that are interested in alternative fuels
  - Heighten visibility of alternative fuels
- Technical Assistance to Fleets
  - Apply DOE tools and resources
- Identify Technology Gaps

What is ACES?

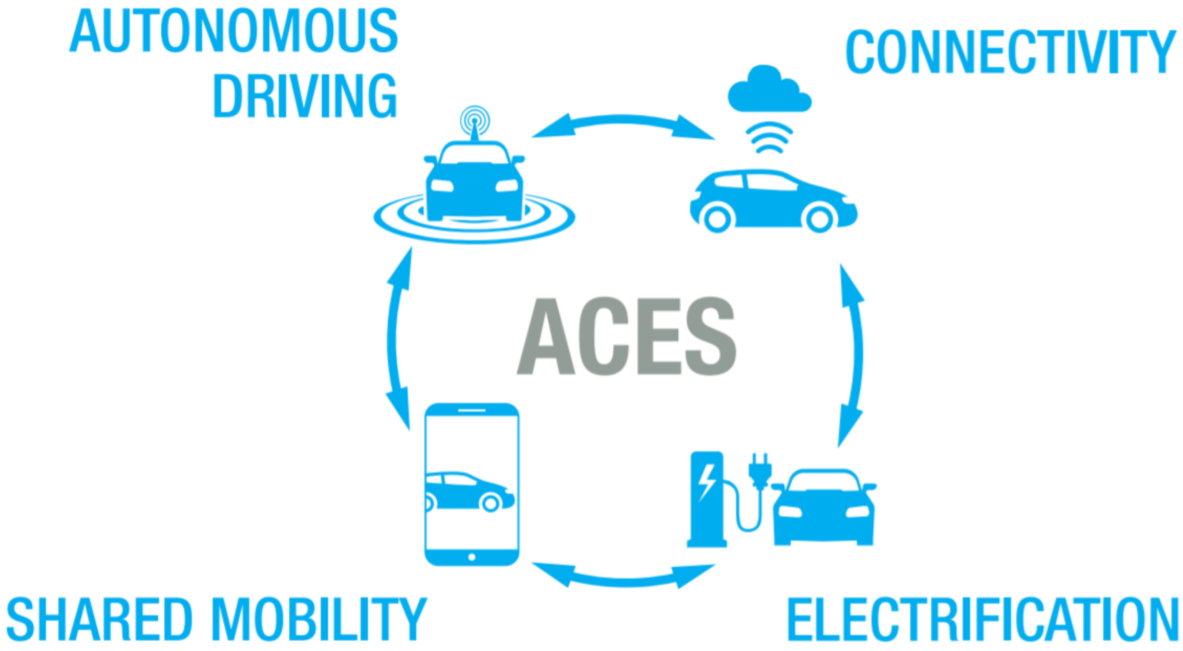
- **Automated**
  - Autonomous vehicle (AV), driverless vehicle
  - Ability to safely operate vehicle in unknown environment without the need for human intervention
  - Relies on sensors, cameras, radar, lidar, GPS, etc.
- **Connected**
  - Use wireless technologies to communicate with other cars (V2V) or roadside infrastructure (V2I)
  - Vehicle cooperation
  - Non necessarily synonymous with AV



Source: IEEE Young Professionals

What is ACES – Continued

- **Electric**
  - Battery-Electric Vehicle (BEV)
    - Use electric motor for propulsion
    - Charge battery by plugging into electric grid
    - Electric range: 80 – 300+ miles
  - Plug-in Hybrid Electric Vehicle (PHEV)
    - Electric motor and ICE
    - Small battery + conventional fuel
    - Electric range: 10-60 miles
- **Shared**
  - Short-term access to a network of vehicles within a certain area
  - Pay for time of use or distance
  - Alternative to traditional car rental and/or vehicle ownership



Source: IEEE Young Professionals

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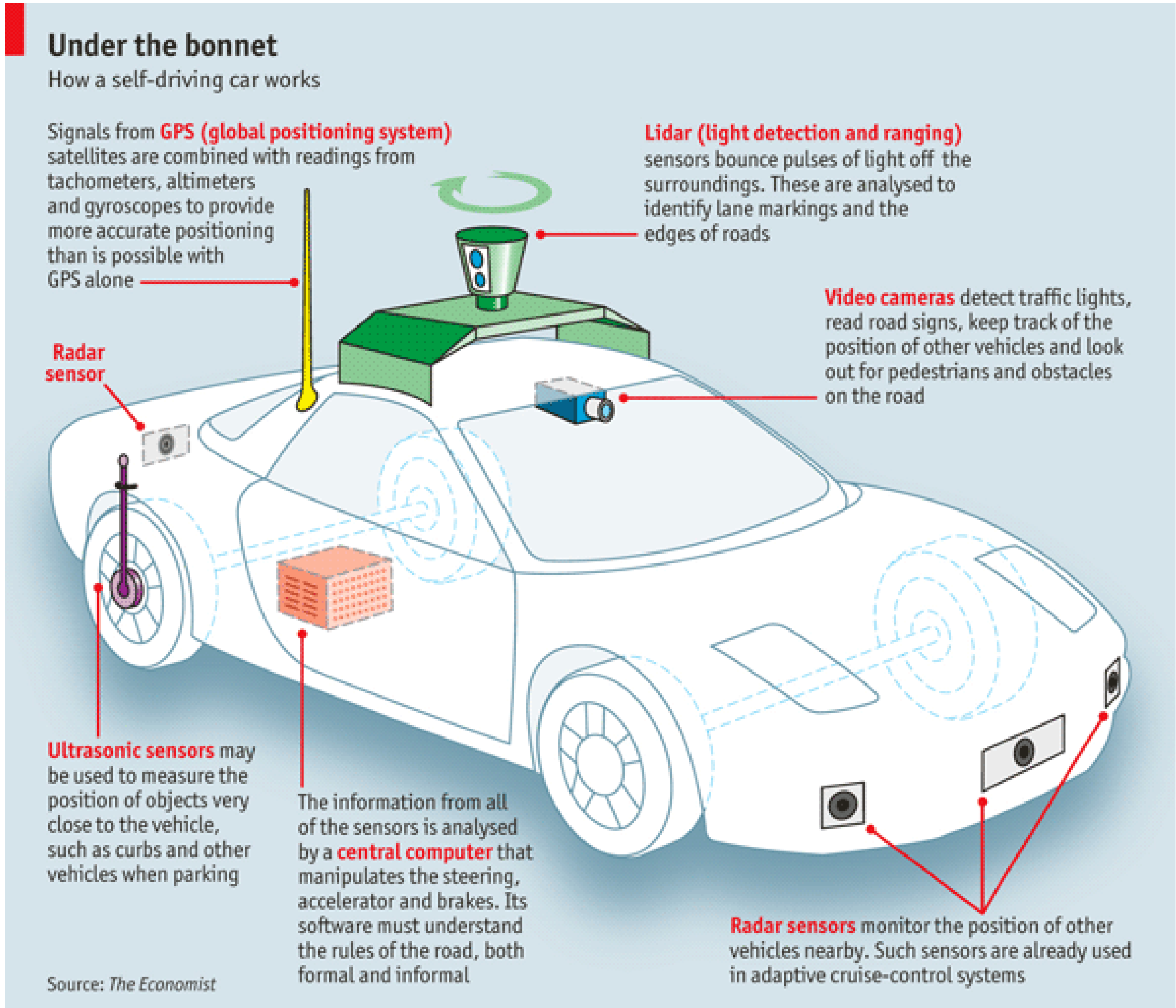
Automation – Vehicle Components

- Uses combination of technologies and sensors to sense roadway, vehicles, and objects
- Major players:
  - Google: driven over 2.5 billion simulated automated miles
  - Tesla: Over 1.2 billion miles driven with Autopilot
  - Audi, BMW, Daimler, GM, Nissan, Volvo, Bosch, Continental, Delphi Automotive, Mobileye, Valeo, Velodyne, Nvidia, Ford, other OEMs and tech companies



Source: The Economist

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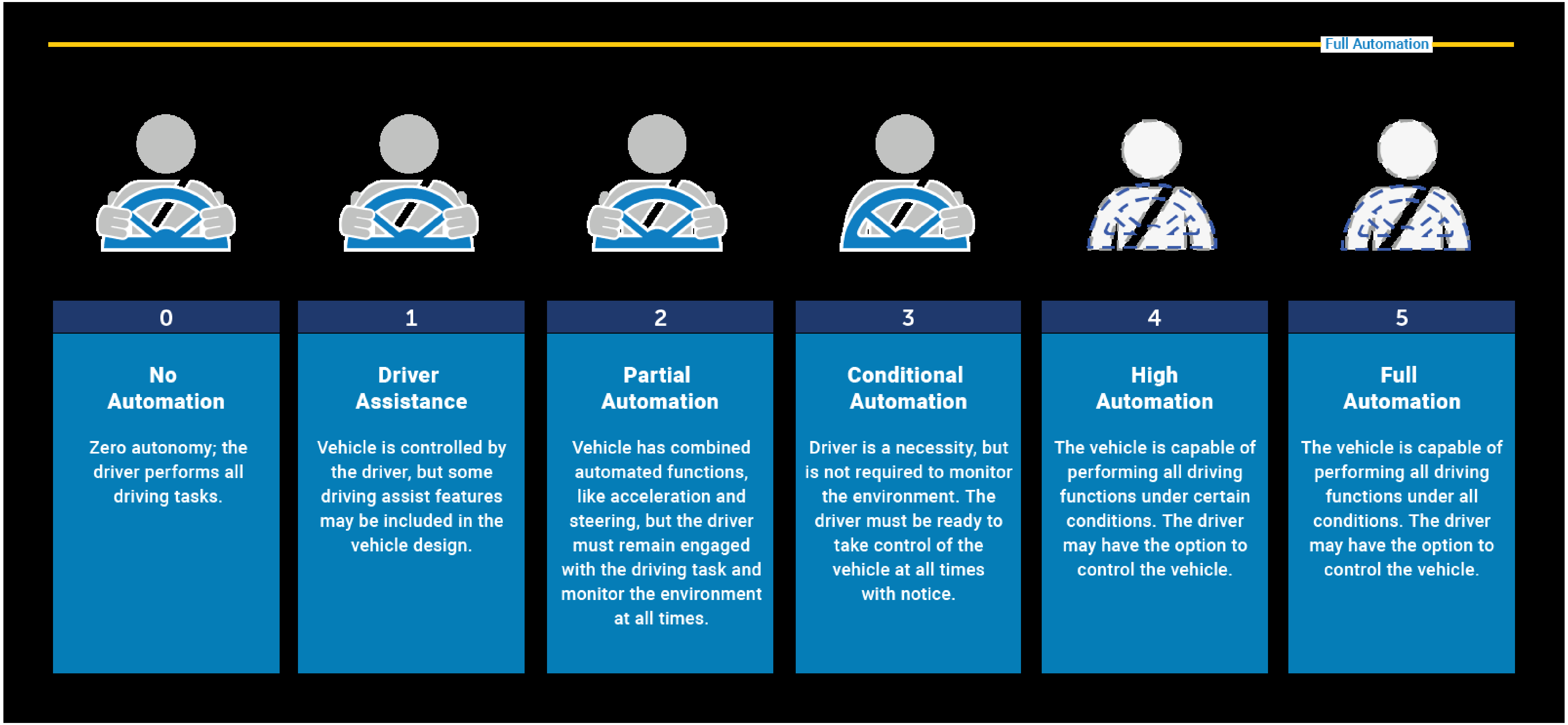
Automation - SAE Levels



Source: NHTSA

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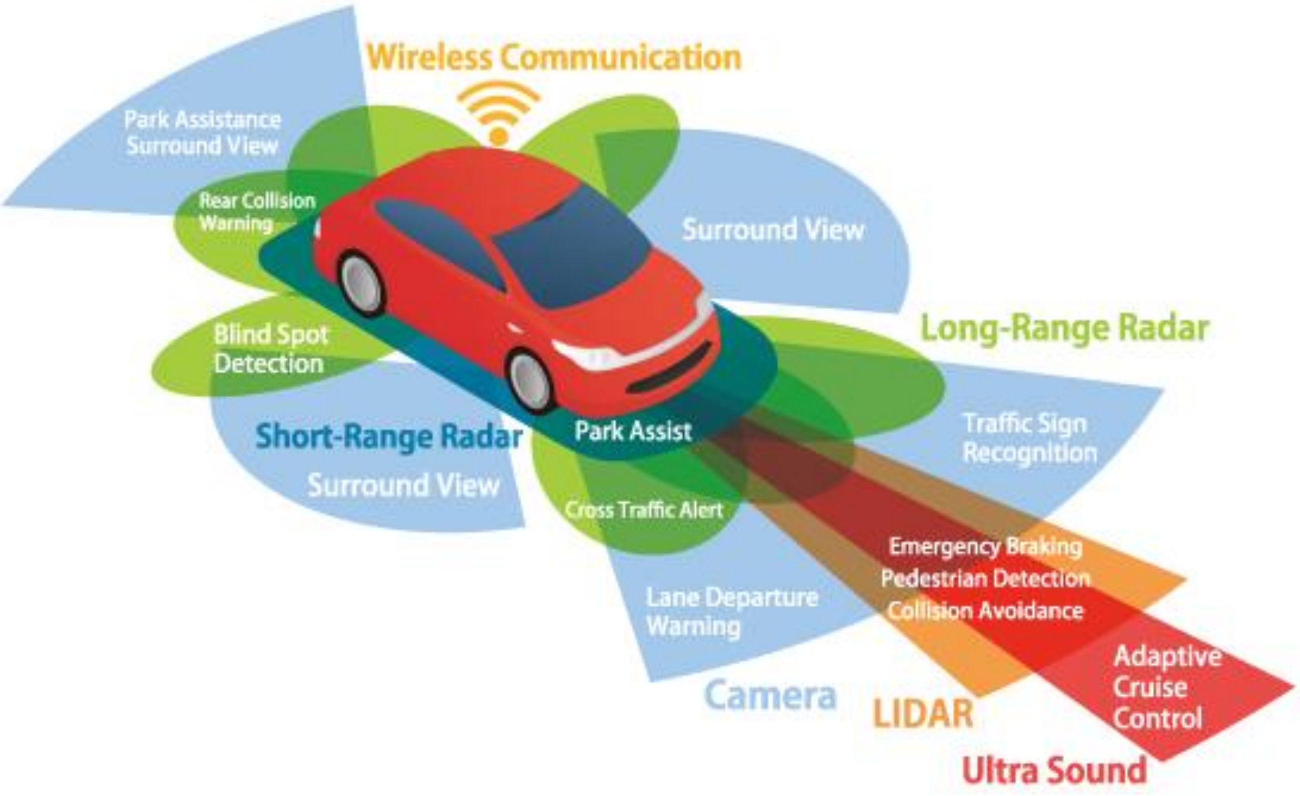
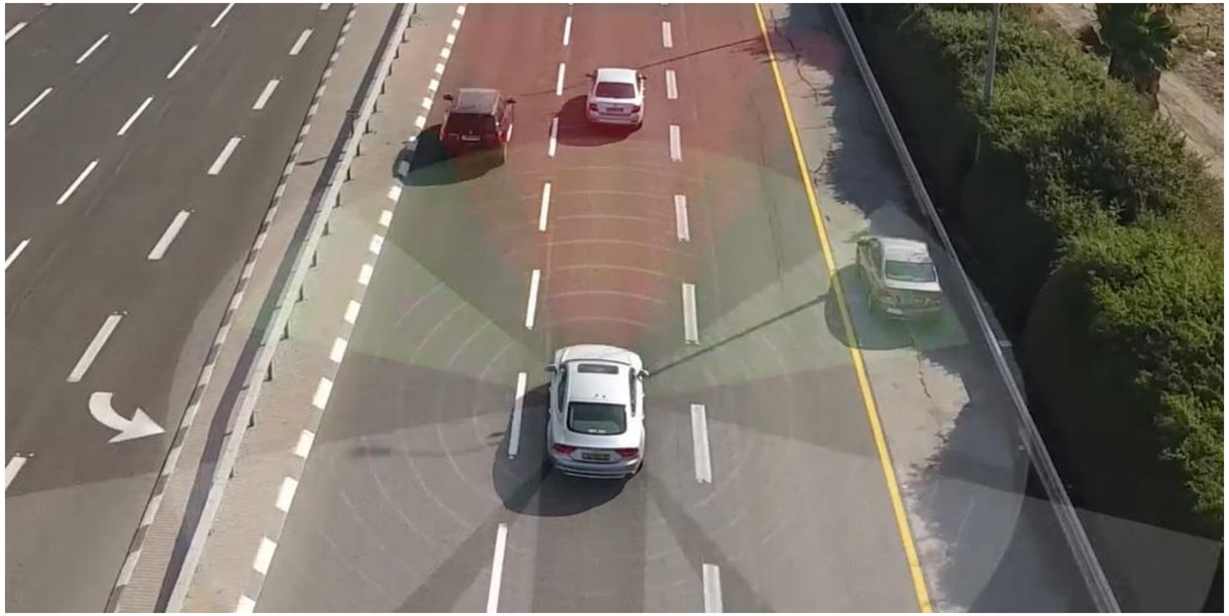
Potential Benefits of Vehicle Automation

- Safety: reduction in accidents
  - 94% of accidents are related to human error
- Reduce congestion
- Improve roadway capacity
  - Mainly through cooperative behavior of CV
  - Ability of vehicles to travel closer
- Reduce fuel consumption
  - Minimize hard acceleration and braking (speed harmonization)
  - Platooning



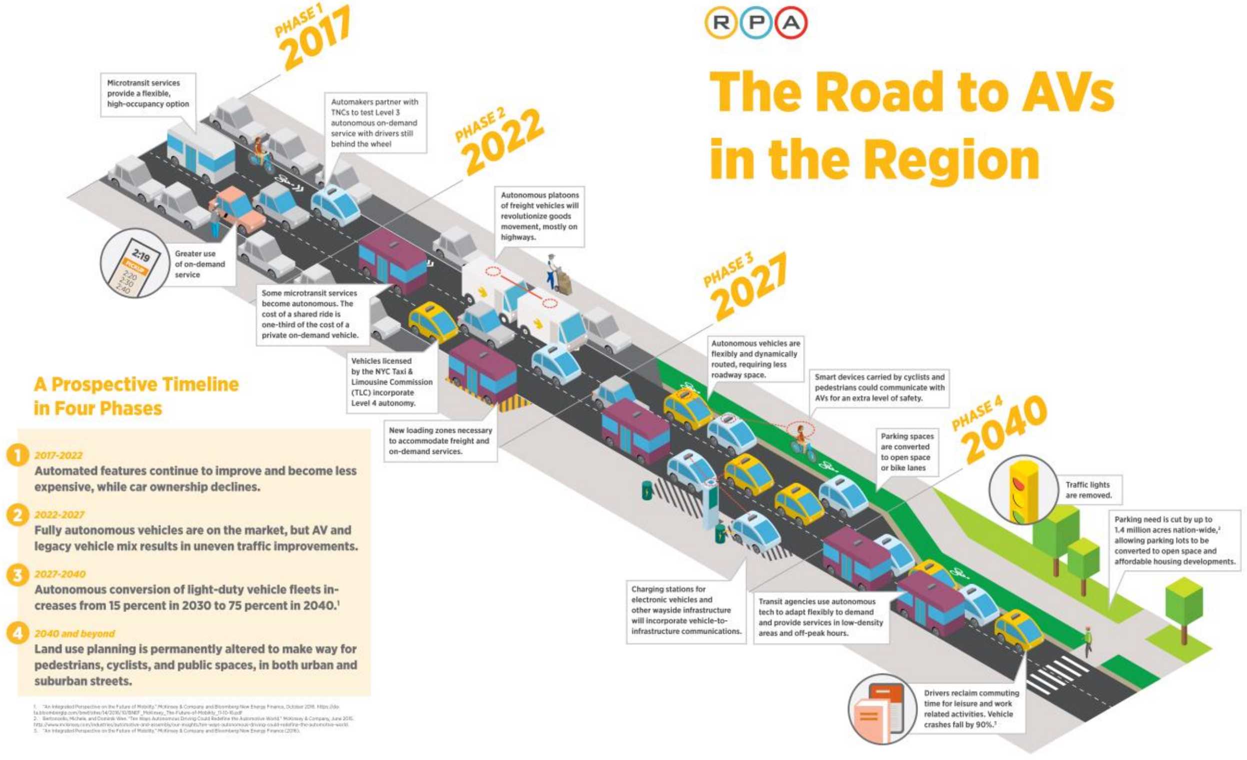
Vehicle Automation Challenges

- Technical
- AV technologies are still being tested
- Artificial intelligence is good at some functions (routine), but not very good at others (non-standard decisions, improvisation)
- Level 5 is not there yet
- Standardization
  - Security, safety, interoperability
  - System and performance requirements
  - Guidelines and best practices
  - Test and verification methods
- Government policy
  - States have different approaches
- Liability
  - Evaluating AV decisions/algorithms under different scenarios
  - Insurance
- Cyber-security



Vehicle Automation Uncertainties

- Behavioral changes
- Infrastructure needs
  - Improved Markings/Signage
  - Thicker pavement may be necessary
  - Higher pavement wear
  - Dedicated AV lanes
  - V2I equipment/devices
- Vehicle ownership patterns
- Land use
- Vehicle Miles Travelled
  - A wide range of predictions in different studies:
    - 60% reduction in VMT
      - ❑ more efficient use of vehicles
      - ❑ vehicle sharing
      - ❑ lower vehicle ownership, etc.
    - 200% increase in VMT
      - ❑ Decrease in disutility of travel
      - ❑ More productive in-vehicle time



Source: The Verge

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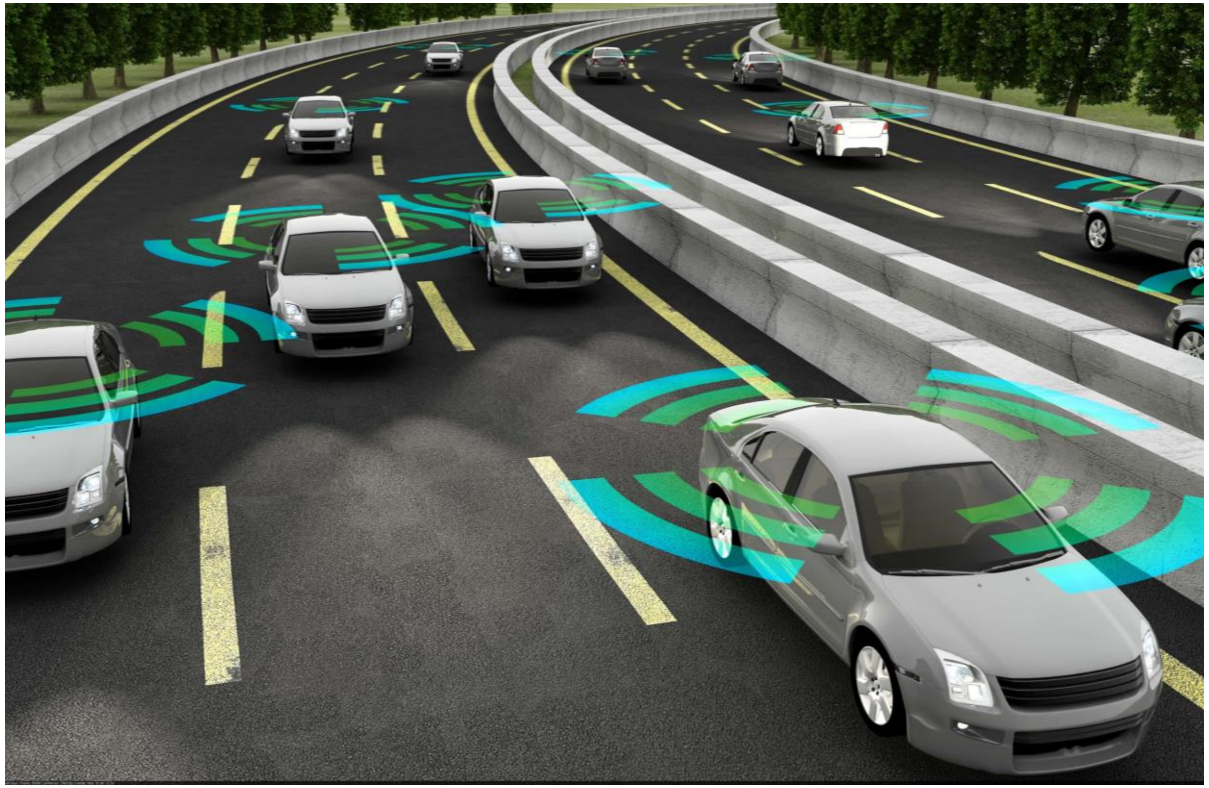
Connected

- Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I)
- Communication technologies:
  - LTE, DSRC, Satellite
- Potential benefits:
  - More accurate detection of nearby vehicles, pedestrians, objects
  - More accurate signal phase and timing (SPaT information from traffic signals)
  - Better cooperation between vehicles for improved traffic flow



Source: Medium

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Electric

- Electricity is the assumed platforms for AVs
  - Allows for simpler integration of autonomous capabilities
  - Advanced sensing and computing hardware on AVs require significant electric power (all-electric battery pack is more stable)
  - Electric vehicles also have lower latency and more consistent response
- Market drivers
  - Improvements and innovation in battery storage technology (reduce cost, improve range)
  - Expansion of charging infrastructure

Source: Intelligent Transport

Shared

- Shared mobility encompass variety of transportation services
- Ride sharing vs. ride-hailing vs. vehicle sharing
- Car sharing
  - Round-trip
  - Point-to-point or one-way
  - Peer-to-peer
- Potential benefits:
  - Reduce need for parking spaces
  - Congestion reduction

Source: Automotive IQ

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Adoption Timeframe

- Adoption rate impacted by availability, cost, socio-economic factors, consumer preferences, fleet, infrastructure, liability and other legal concerns, political factors
- National trends (multiple studies):
  - By 2035, AVs may make up approximately 35% of private-vehicle VMT and 11-14% of private vehicle fleet.
  - AV technologies are expected to be adopted in in luxury segment first
  - Level 4 may be available in medium, small, and lower priced vehicle categories in the mid-2020s to early-2030s.
  - Level 5 expected to have an impact in the mid- to late-2030s.
  - Market penetration rates in long-distance trucking can range from 15% to 90% by 2032.

- Florida – specific projections (2019 FDOT Study):
  - AV will double eVMT by 2048
  - Increased AV VMT fully absorbed by EV (eVMT)
  - Low penetration rate until 2030-2035
  - 25.4% of vehicles will be AV in 2035 (increase VMT by 3.8%)
  - 43% of vehicle fleet will be AV in 2048 (increase VMT by 14.6%)
  - eVMT is projected to account for 25.1% of total VMT in 2028

Snapshot of ACES Activities in Florida

- Tampa Hillsborough Expressway Authority (THEA) Connected Vehicle Pilot
- Florida Connected Vehicle Initiative
- FDOT ACES Transportation System Roadmap
- Florida EV Roadmap
- Alternative Fuel Corridors
- Central Florida Autonomous Vehicle Proving Ground
- Florida's Turnpike Enterprise (FTE) SunTrax
- JTA Ultimate Urban Circulator
- Gainesville Autobus

Source: THEA CV Pilot Program

FDOT Office of Policy Planning ACES Guidance Document

- Provides guidance to MPOs to address the increasing deployment of ACES and other emerging technologies
- Assist with accounting for ACES impact with long-range planning
- Considers how ACES deployment will impact communities
- Application for scenario development planning

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Thank You!

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