

A close-up, perspective view of a computer keyboard. The keys are arranged in a grid, receding into the distance. One key in the foreground is highlighted in a bright green color, while all other keys are a standard light gray. The lighting creates soft shadows on the keys and the surface below them.

IBTTA Annual Meeting  
September 13, 2016

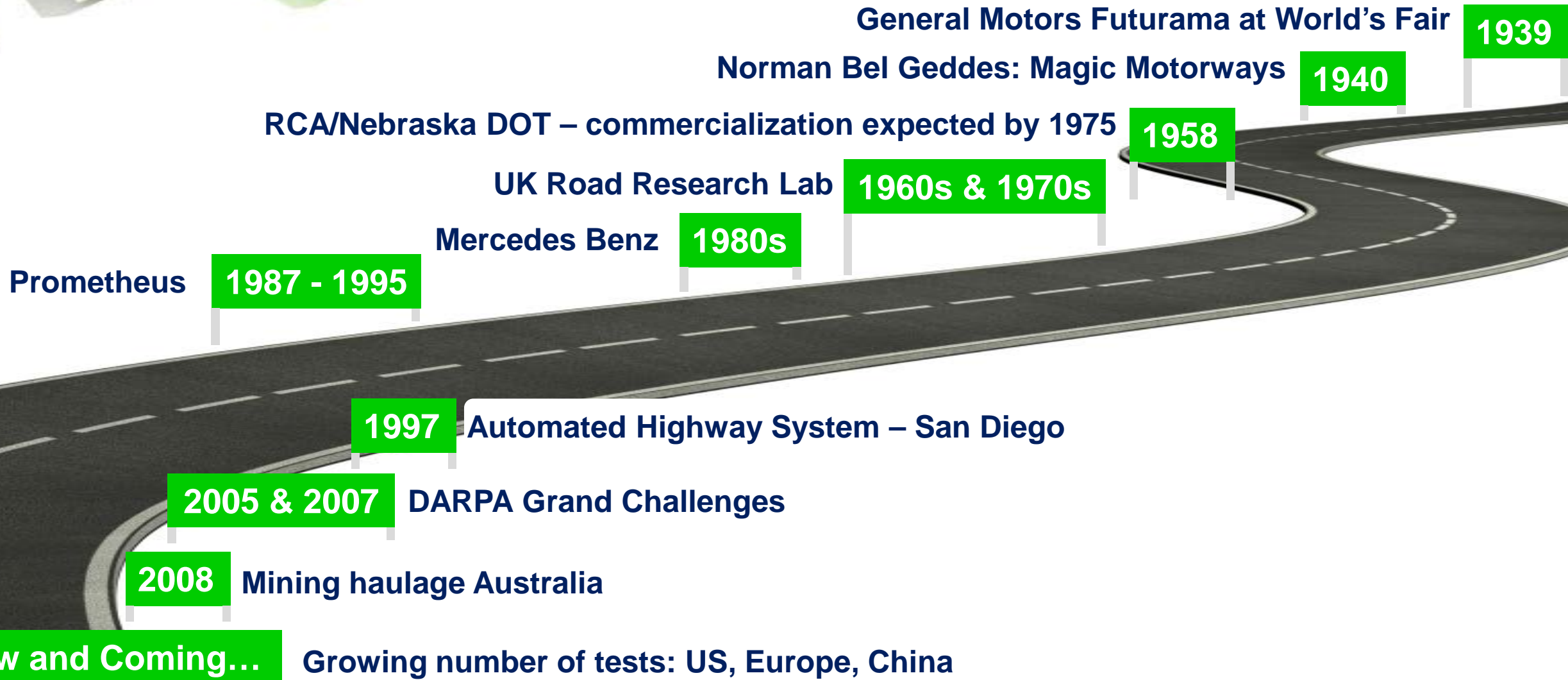
# **Chaos Unleashed: How Can the Toll Industry Take Advantage of Autonomous Vehicles?**

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# A Short History of Autonomous Vehicles





# Chaos in Transportation Market

- Old model: led by public investment in infrastructure
  - Toll roads and PPP as partial exception
- New model:
  - Private investment in vehicle technology shapes future quality and quantity of transportation
  - New players – not just auto OEMs
  - New services – shared mobility (Uber/Lyft just part of story)
  - Defacto deregulation of urban transportation and infrastructure
  - Real-time traffic information – and smart phones to communicate
  - New attitudes re auto ownership
- Same problems – safety, congestion, limited public funds



# Autonomous Vehicle Definitions

## Automated Vehicle

Operates independently of other vehicles and infrastructure (Google car?)

## Connected Vehicle

Shares information with other vehicles (V2V) or with infrastructure (V2I)  
Connected vehicle needed in order to improve capacity

## Autonomous Vehicle

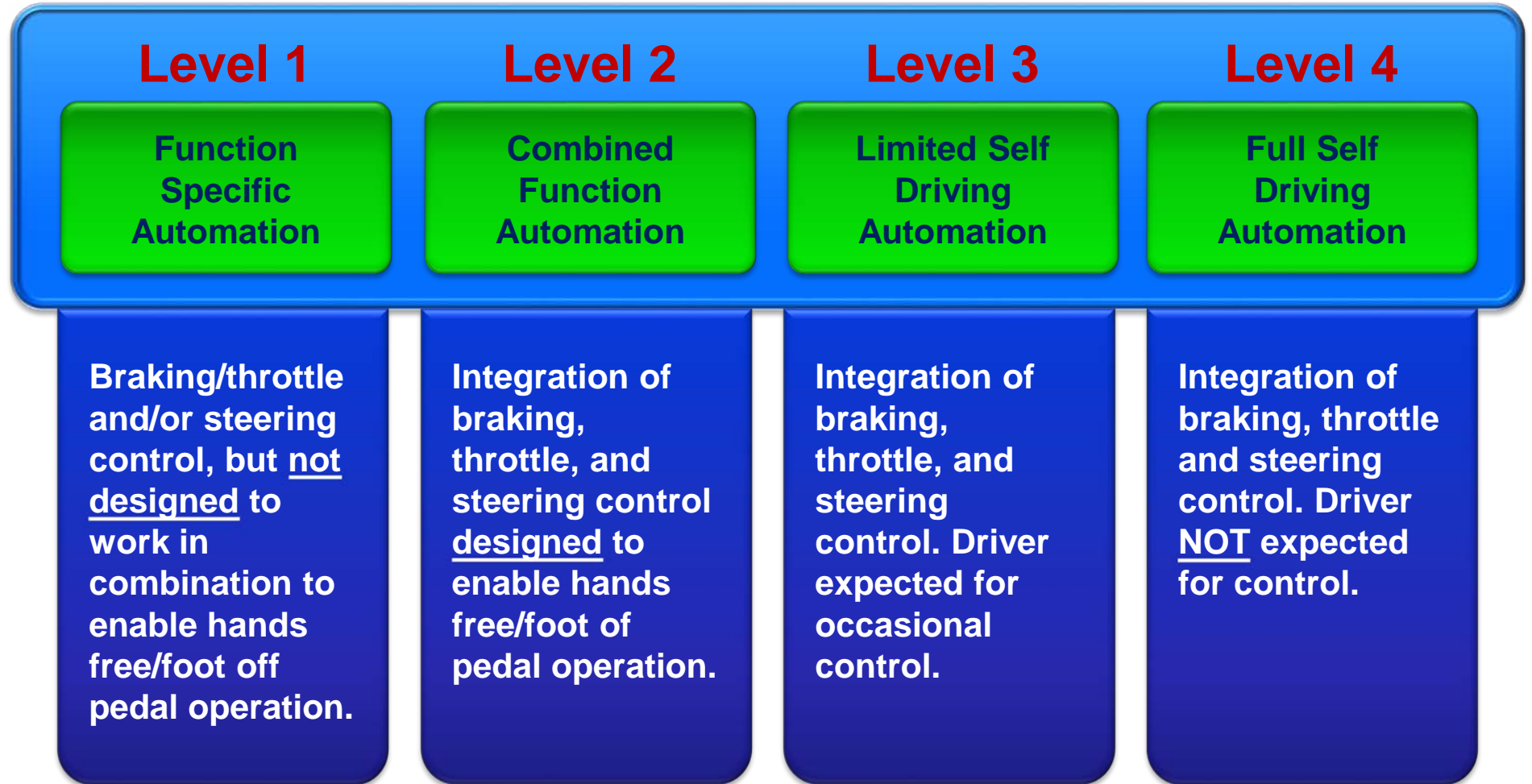
Both automated and connected

## DSRC

Method proposed by US DOT to communicate between vehicles  
Uses dedicated 5.9 GHz bandwidth – FCC may take this back



# NHTSA's Four Levels of Automation





# Different Flavors of Autonomous Vehicles

- Here now
  - Level 2 for good roads and good weather – major OEMs
  - Slow-speed shuttle buses and automated taxis for defined areas (Babcock Ranch model) – Level 4
  - Simple truck pelotons -- save energy
- Here soon
  - Ford, BMW, etc promise Level 4 vehicles by 2021
  - Use by Uber/Lyft etc.
  - Platoons
  - Public sector plans begin to reflect these changes



# General Implications

- Improve safety – driver error causes most crashes
- Improved roadway capacity
  - Some forecast 50-100 percent gains in capacity
  - Fewer crashes will reduce congestion
  - Reduced vehicle headways
- Increase VMT? Decrease auto ownership?
- Land use changes
  - good for urban or good for suburbs or both?
- More specialized vehicles?
- Specialized infrastructure?





# More Competition for Toll Roads

- De facto increase in roadway capacity will reduce congestion on all roads
  - Expressway gains the largest
  - But, could be less public investment in roads and transit
- Decrease value of travel time as drivers can do other things – read, e-mail, watch movie, sleep
- Higher quality of service from toll roads will have less advantage



# Increased Demand for Toll Roads

- Increased demand for travel due to reduced cost of travel
  - Drivers can carry out other activity while in car – work, phone, entertainment, even sleep
  - Improves access to jobs and markets in general
- Stimulates more travel by car
  - Attractive option versus short-haul aviation or rail
  - Encourage more “road trips”
- Savings from truck platoons may shift more freight to roads



# Toll Roads as Market Leaders

- Chance to lead deployment
  - AV only lanes – to take advantage of safety and capacity benefits
  - Truck platoons – but may need space for them to group and de-group – NY Thruway model
- New capacity built around high-speed lanes
  - High-speed buses as cost-effective option for high speed rail
  - 120 MPH lanes for private vehicles
  - Opens new market and higher rates
  - Work with shared mobility firms





# Conclusions

- Scale of changes in transportation remarkable.
- New technology is only part of story – new services; new players; new actions by traditional actors.
- Questions remain about the pace of market penetration and the impacts on transport services and on travel behavior
- These changes generate opportunities for the toll industry – but no clear road map.

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