

# Current State of Truck Automation

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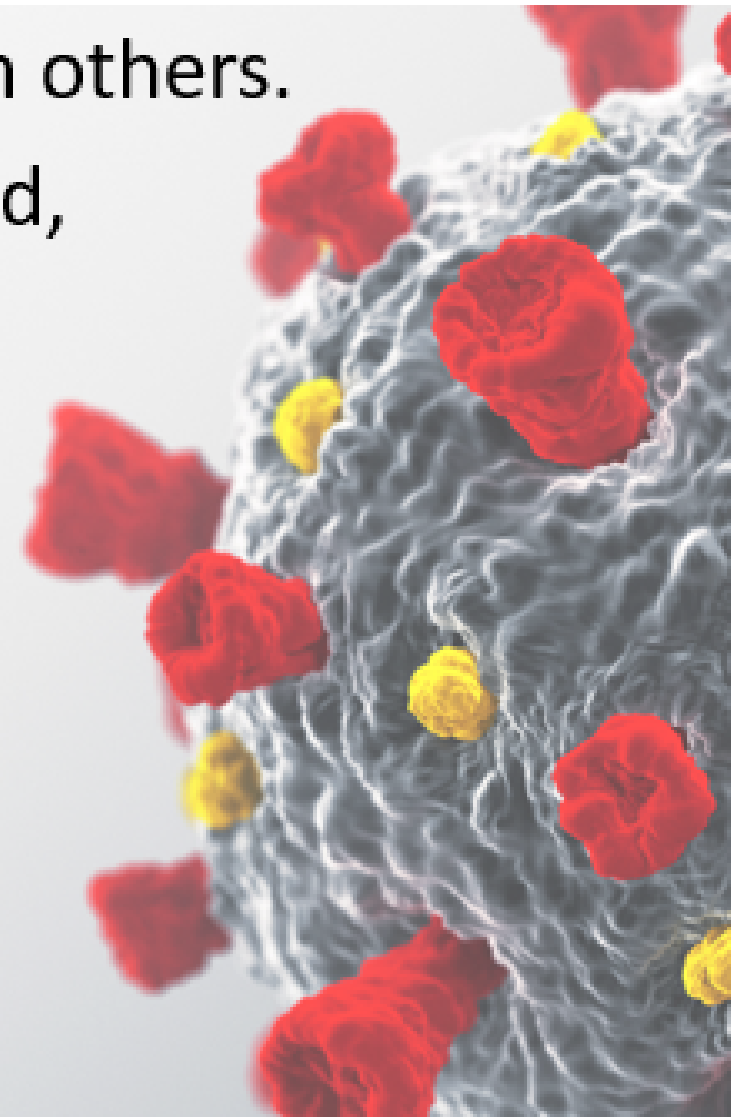
FHWA Talking Freight Seminar Series

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# Pandemic Effects: A Mixed Bag

- Pandemic affected some companies more than others.
- Most (but not all) end users (fleets) re-trenched, deferring innovation.
- Effects on startups depended on where they were in their funding cycle.
  - Product introductions in this climate challenging.
- System development hampered.  
Testing possible in a limited set of states, depending on COVID protocol.



# 2020 Macro Trends

- Auto OEMs developing autonomy for private vehicles
  - will offer at their own pace
- Fleet operations are “where the action is.”
  - robo-taxi, robo-delivery, robo-truck
  - “driverless robo-taxi” launched!
- Strong momentum in driverless goods movement.

# Fleets First!

## Robo-delivery, Robo-taxis, Robo-trucks

- Operations area selected for best fit with tech capability.
- Cost pressure much less than retail model: all about Return on Investment!
- Hands-on, skilled staff: software upgrades, system safety certification, maintenance, etc.





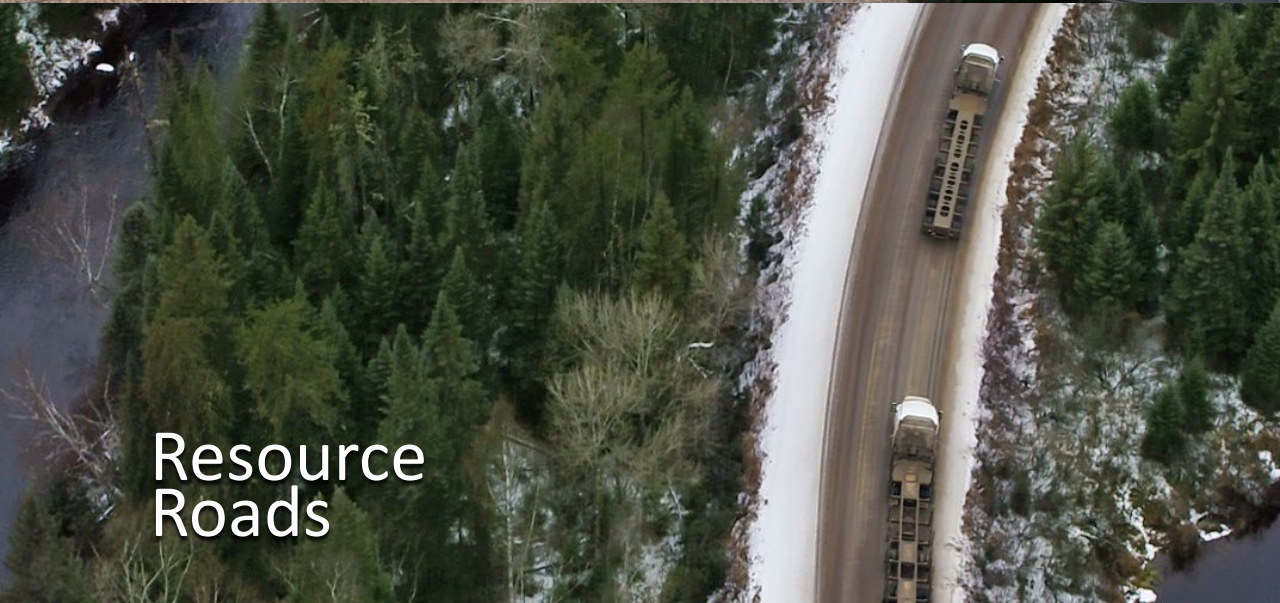
# Goods Movement



Controlled  
Environments



Streets



Resource  
Roads



Highway





# Streets

- Complex environment
- Low speed
- Customer-facing
- Strong market, growing

# Streets: Parcel Delivery Business-to-Business



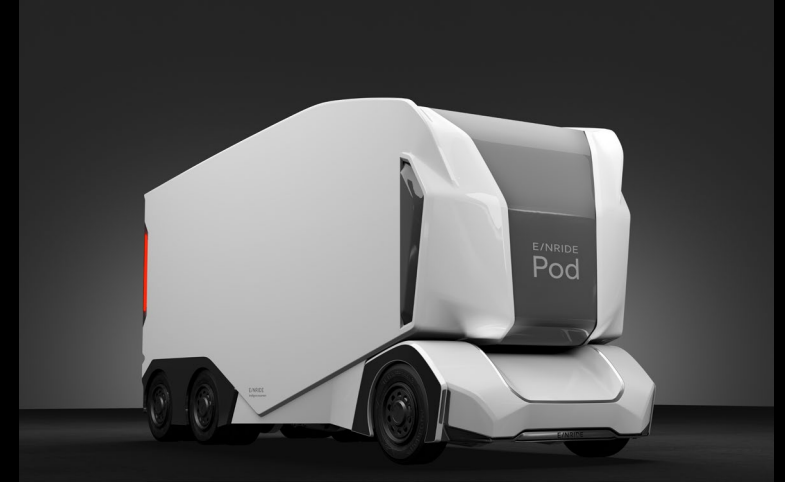
## Waymo

- Announced customers:
  - UPS



## Gatik

- Announced customers:
  - Walmart
  - Loblaw
- 2021: fully driverless operations in Arkansas
- \$25M in new funding



## Einride

- Announced customers:
  - Oatly
  - Lidl
  - Coca-Cola
- \$10M in new funding



# Streets: Parcel Delivery Business-to-Consumer



## NURO

- Announced customers:
  - Fry's Food
  - Kroger
  - CVS
- \$500M new funding





# Controlled Environments

Logistics Yards

Semi-controlled  
Industrial roads

- Low speeds; dirty, dusty
- Specialized, high user need
- Small market

# Controlled Environments



## Outrider

- Announced customers:
  - Georgia Pacific
- \$65M in new funding



# Outrider.ai: Distribution Yards



- Distribution yard ideal for automation:
  - well-defined environments
  - complexity constrained
  - discrete repetitive tasks
- Automates all aspects of the yard *including connecting and disconnecting the brake lines to the trailers.*



Outrider





# Resource Roads

- Unpaved roads
- Remote areas
- Medium speed
- Modest market

# Resource Roads



- A major Canadian not-for-profit research center.
- Driver shortage is a key pain point! **Automated Follower platooning of interest.**
- Launching project in 2021 to adapt commercial systems for rural public roads.





# Highway

- Well ordered environment
- High speed
- Huge market
- Operational Modes
  - Platooning L1 / L4
  - Solo driverless

# Platooning: Two Generations

## 1<sup>st</sup> Generation

### Level 1 Platooning

- front driver drives normally
- rear driver(s) steer, monitor the road, respond to traffic

## 2<sup>nd</sup> Generation

### Level 4 Following

- front driver drives normally
- no driver in follower truck(s)



# Truck Platooning Players



LOCOMOTION



TRATON  
GROUP



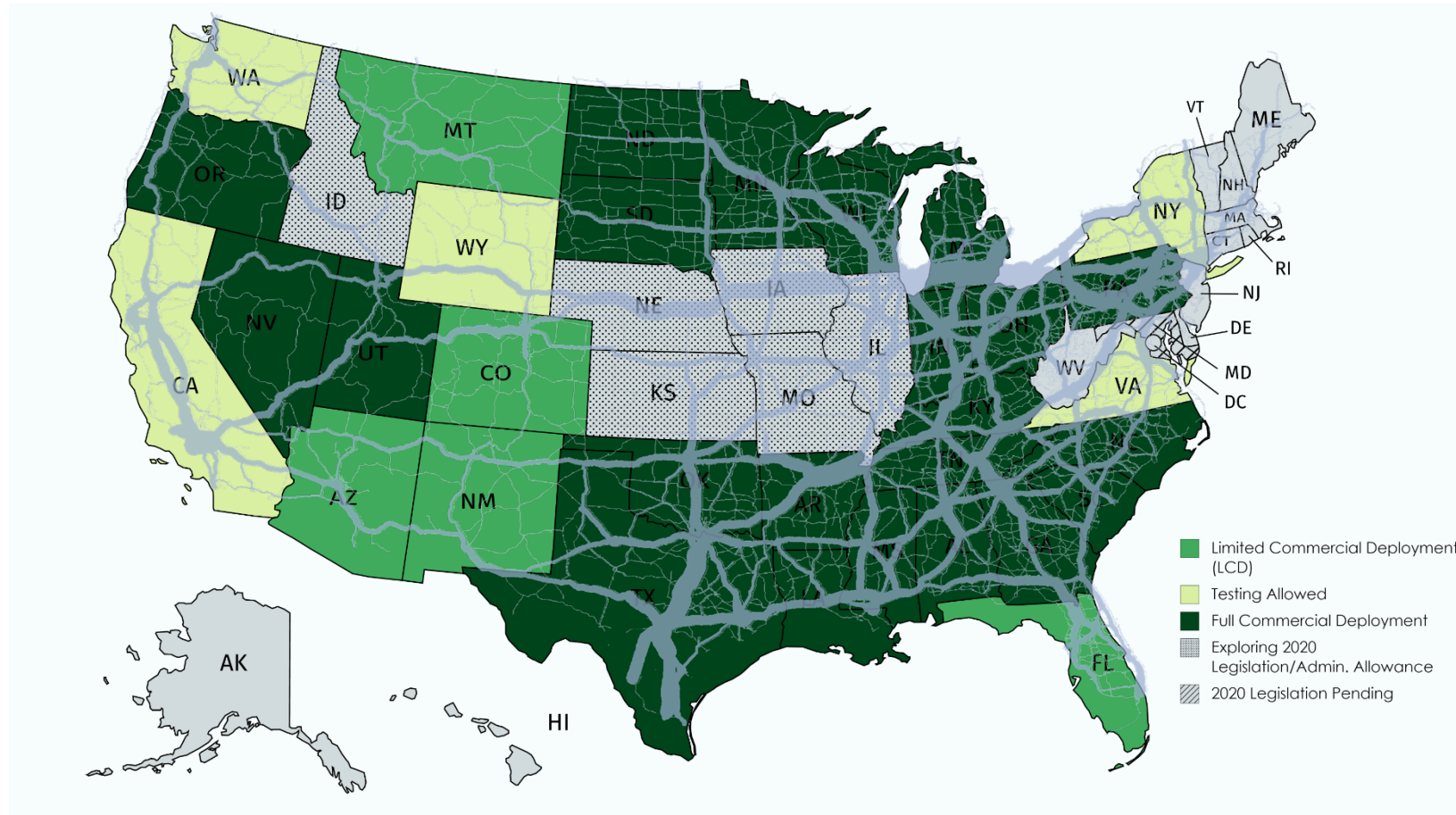
DAIMLER TRUCKS

# Truck Platooning Basics

- Close Drafting done safely, reducing fuel use
  - 4% for leader, 10% for follower at 60 ft at 60 mph
- Close Following via “connected braking” between trucks, using low-latency vehicle-to-vehicle communications (DSRC)
- Commercial systems focus on multi-lane, divided, limited access highways
- Properly handling cut-in’s by other vehicles a key part of safety case.



# U.S. State Allowance for Truck Platooning



# Commercial deployment now widely allowed

- Level 1 Commercial Deployment now allowed in 27 States
- Approved States now encompass over 80% of annual US Freight Truck Traffic
- AutoFollow allowed in Arizona, Texas, Utah thus far

# Locomotion



- Testing with Wilson Logistics last summer, carrying freight between Oregon and Idaho.
- Wilson Logistics agreed to equip 1,120 of their trucks with Locomotion's platooning technology; initial deliveries in 2022.



# U.S. Army Developing “Leader-Follower” Kits



- Different functional specification
  - short to long gaps
  - Level 1 and Level 4
- 100 systems being evaluated at an Army base.
- Army RFP for thousands of systems expected in 2021.

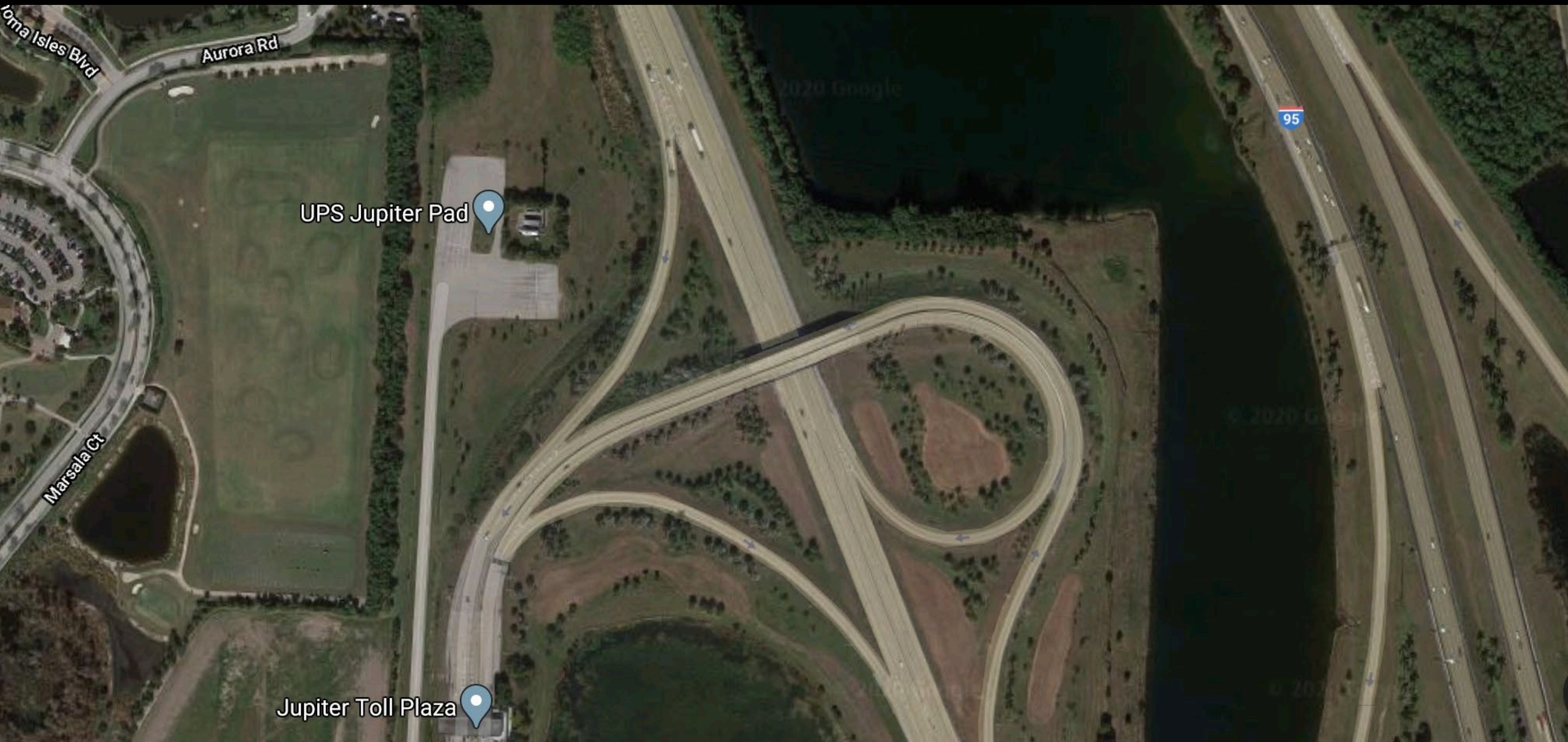


# Solo Driverless Players





# Solo Driverless: Ramp-to-Ramp





# Solo Driverless: Dock-to-Dock





# Solo Driverless Trucking: Industry Activity

- Truck ADS startups are operating L4-intent systems on public roads, backed up by safety drivers.
- Kodiak: hundreds of commercial deliveries on regular 200-mile Dallas-Houston freight run
  - just announced 800 miles of continuous disengagement-free driving over multiple runs
- TuSimple: running 3 to 5 commercialized trips per day.
  - 2021: first driver-out operations (retrofitted trucks)
  - 2024: factory-built Level 4 trucks, nationwide L4 commercial operations
- Waymo: highly active program, sourcing L4-ready trucks from Daimler.

# Solo Driverless Trucking: Industry Activity

- Plus
  - Pilots ongoing with large Fortune 500 private fleets.
  - Safety testing program across 17 states includes winter testing on MnROAD.
  - Ohio's Transportation Research Center contracted to provide independent track-based validation.
  - October 2020: Voluntary Safety Self-Assessment Report provided to NHTSA.
- *Several developers note significant fuel savings from automated driving.*

# Solo Driverless Trucking: Truck Manufacturers

- Daimler Trucks: large internal program.
- Volvo Trucks: large internal program.
- Traton partnering with TuSimple.



# Plus: A Unique Statistical Validation Approach



- “Billions of real-road miles are needed to statistically prove the safety of the system before making fully driverless trucks commercially available.”

# Plus: A Unique Statistical Validation Approach



- 2021 product introduction: intelligent trucks powered by Plus's self-driving system
- Jointly developed with the world's and China's largest heavy-duty truck maker (FAW).
- Initial driver-in product (2021)...
- ... incrementally validate and transition to full driverless / driver-out product.



# Plus: A Unique Statistical Validation Approach



- FAW J7+ models average 100,000 miles per year or more.
- Only 5000 trucks running for two years = 1B miles.
- L4 deployment expected ~2024 as truck OEMs bring L4-ready tractors to market.



# Deployment Geography



USA top ten fleets comprise ~160,000 trucks.



EU exemption process allows for limited deployment now.

# What Does Automated Freight Mean to Sustainable Supply Chains?



- Plus teamed with Land O'Lakes for the “Butter Run” December 2019
- 2,800 miles cross-country in only three days
- More sustainable shipping:
  - 15-20% fuel savings compared to average truck driver
  - Less time running trailer refrigeration unit
  - Can driverless trucks become a new alternative mode to air freight, for time-sensitive shipments?









# Thank You

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