

# Runway to Autonomy

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# History of Autonomous Vehicles



**EESI**

Environmental and Energy  
Study Institute

## THE ROAD TO FULL AUTOMATION

### HISTORY OF AUTONOMOUS VEHICLES (AV) IN THE U.S.

**1958**

First car with  
cruise control is  
introduced

**2004**

DARPA Challenges are  
created to incentivize  
American autonomous  
vehicle development

**2014**

Google creates first  
AV prototype

**2016**

First known fatal accident  
involving a Tesla in  
autopilot mode. Other  
accidents followed.

**2021**

Ford and GM invest  
billions of dollars in  
AV technology and  
testing

**1995**

Carnegie Mellon University  
Navlab project completes  
cross-country trip with  
"semi-autonomous" vehicle

**2009**

Google begins Self-  
Driving Car Project

**2015**

Tesla introduces  
autopilot software;  
University of Michigan's  
MCity AV Lab is launched

**2018-20**

AV mass transit programs  
debut in numerous states;  
NHTSA releases  
new AV guidance

Graphic by: Sydney O'Shaughnessy  
Source: [Wikipedia](#), [Reuters](#), [The Verge](#)



# Autonomous Operation Today



- Autonomous goods movement is already here.
  - Rotterdam largest autonomous port in world
    - Autonomous cranes
    - Smart Container
    - Autonomous trucks and ships
  - Major companies like FedEx, Amazon, Purolator etc have high levels of autonomy in warehouses.
  - Controlled Environments, limited decision making required from operational standpoint.



Image Courtesy Shutterstock

# Navigation versus Operation



## ➤ Navigation

- Relatively well understood for controlled access areas.
- Leverage \$B's in investments by automakers, long haul trucking and agriculture
- Couples navigation sensor suite with high resolution mapping
- Large data basis in existence for neural networks



Image courtesy Trucis.com

## ➤ Operation

- Decision making based on dynamic changes in real time.
- For GSE operation data is limited

# Bringing Autonomy to the Runway



- Advantages of Airport versus Roadway
  - Geo-fenced
  - Access well controlled
  - No pedestrians to deal with
  - Well understood changes to airport grounds when maintenance is required.



# Bringing Autonomy to the Runway

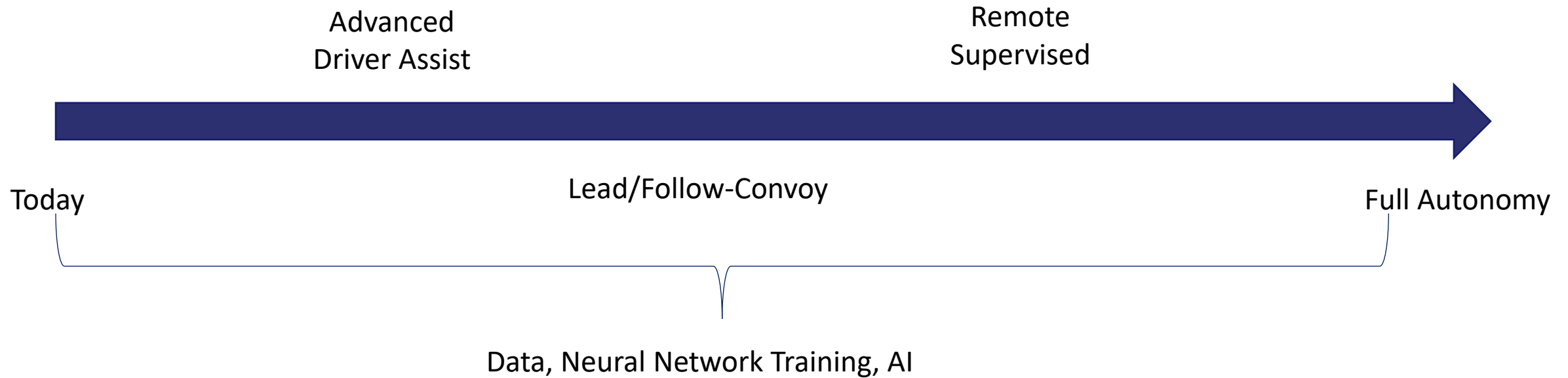


- Where challenges are much more complex
  - Weather becomes a much more significant issue
    - Neural networks for decision making much more complex because of all the variability in external environment.
  - Snow planning
  - Dynamic - Real time interactions between operation of multiple pieces of **operating** equipment
  - Limited training data available.





# Roadmap to GSE Full Autonomy



# Key Enablers

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## ➤ Data

- Reliable Communications/Sensors for all weather
- Cybersecurity & Regulatory framework
- Training through Machine Learning (Supervised/Unsupervised)
- AI Algorithm Development

## ➤ PARTNERSHIPS





# The Opportunity

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- Operational Efficiency
- Operational Reliability
- Enhanced Safety (AI does not get tired)
- Fully Integrated part of Airport Collaborative Decision Making





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