

# Autonomous Cooperative Control of Emergent Systems of Systems (ACCESS) Laboratory

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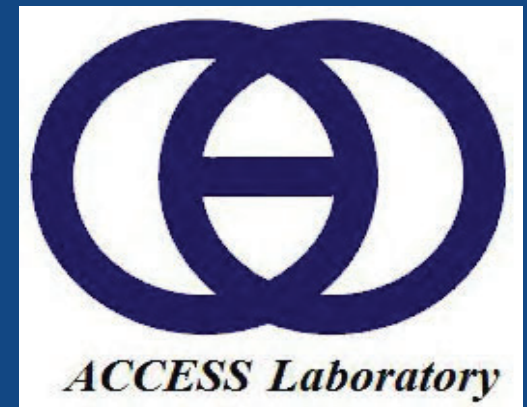
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<http://www.accesslab.net>



## Autonomous Cooperative control of Emergent Systems of Systems (ACCESS) Laboratory

### Research Focus:

- Control and Robotics
- Human-machine Interactions
- Cyber-physical systems
- Multi-agent Systems
- Artificial Intelligence
- Reliability and Security

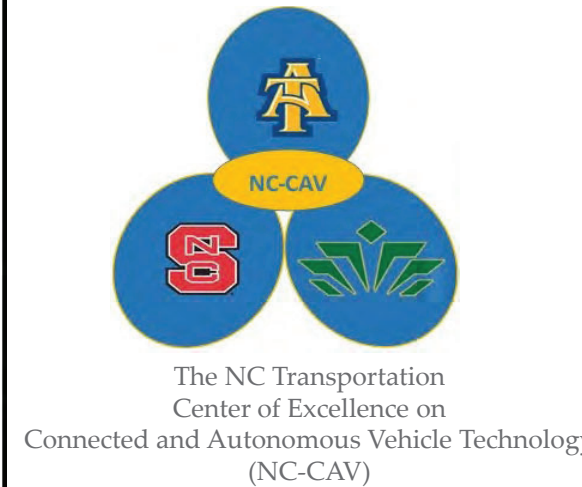
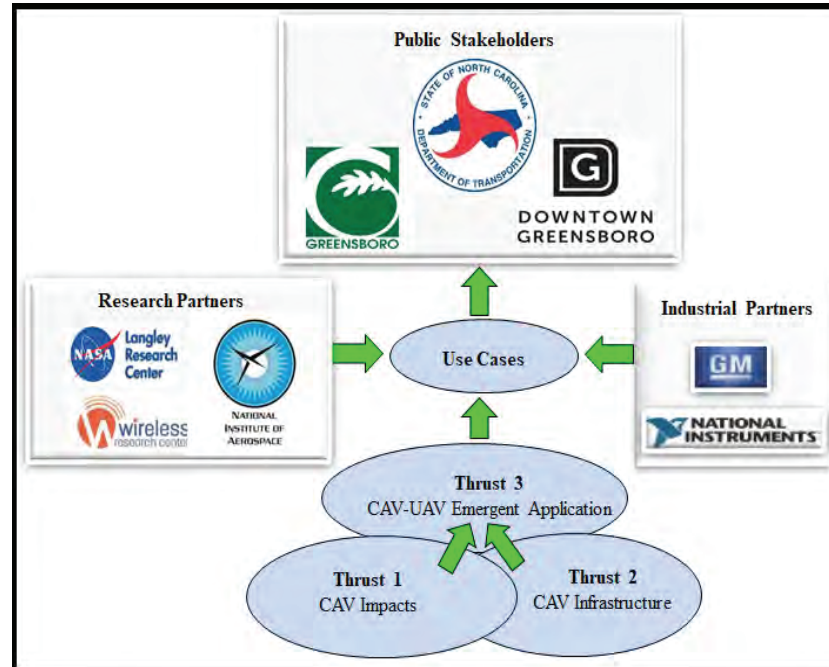
### Applications of Interest:

- Smart Transportation
- Self-driving cars
- Human-Autonomy
- Connected Vehicles
- Battlefield management
- Smart Agriculture



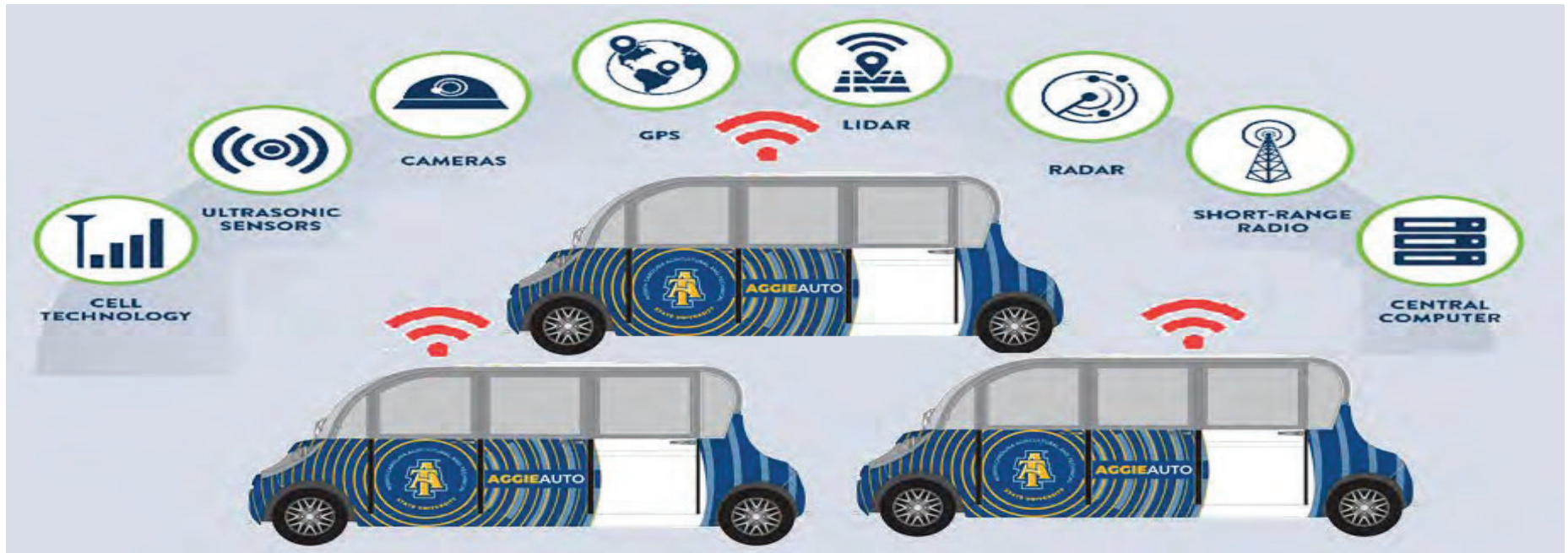
“NC-CAV Center of Excellence on Advanced Transportation Technology,” Sponsor: North Carolina Department of Transportation (NCDOT), 2020-2025.

- **Thrust 1 (CAV Impacts)** investigates the impact of Connected and Autonomous Vehicle’s (CAV) on North Carolina’s transportation system and associated revenue.
- **Thrust 2 (CAV Infrastructure)** assesses North Carolina’s readiness for CAVs in traditional and emerging transportation infrastructure.
- **Thrust 3 (CAV Applications)** explores emerging applications of CAVs and develops CAVs and Unmanned Aerial Vehicles (UAVs) for advancing transportation systems.





*“Developing and Operationalizing a Testbed of Connected Self-driving Shuttles to Test and Develop CAV Applications in North Carolina,”* Sponsor: North Carolina Department of Transportation (NCDOT), 2021-2023.







Center for Regional and Rural Connected Communities (CR<sup>2</sup>C<sup>2</sup>) was initially funded by Department of Transportation in 2023 for \$15M for 5 years. The consortium members will contribute \$15 million in matching funds, making the total investment in this project \$30 million.

The CR<sup>2</sup>C<sup>2</sup> will serve as the Region 4 (Southeast) University Transportation Center (UTC) charged with addressing transportation challenges within the southeastern region of the United States.



The first university research testbed of connected and autonomous self-driving shuttles!





North Carolina A&T  
State University

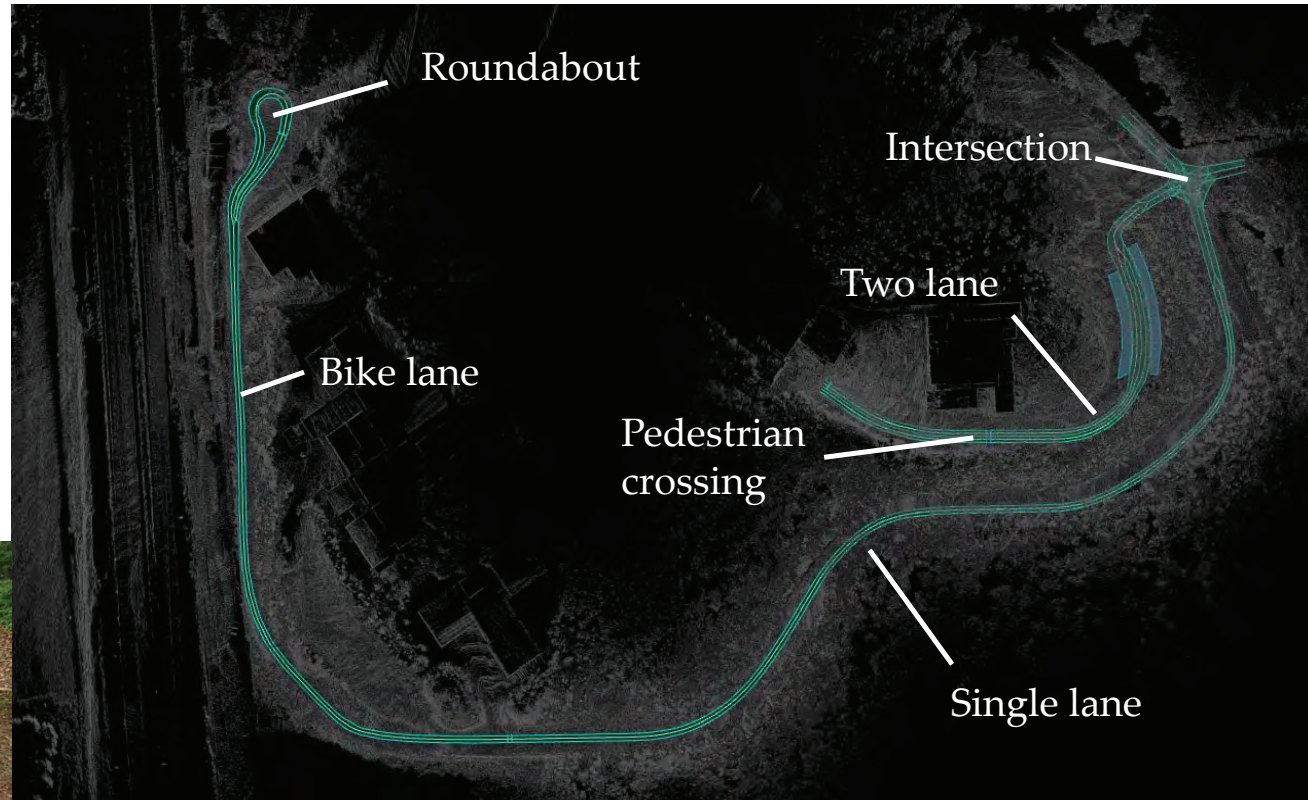
**Gateway University Research Park - North Campus  
Autonomous Vehicle Test Track**

5900 Summit Ave.  
Browns Summit, NC 27214





- Narrow road
- Steep Hills
- Forest environment
- Solid /Dash line
- Pedestrian Cross
- Roundabout
- Intersection
- Regulatory/Warning Signs
- Bicycle lane
- Bus stop
- Pedestrian crossing



One of the first nation's AV rural test track.



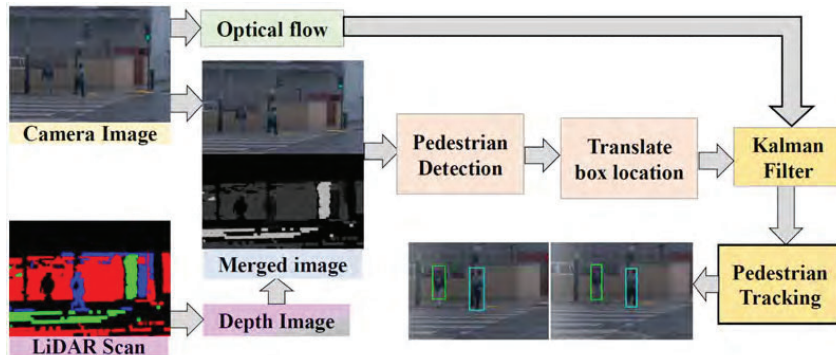


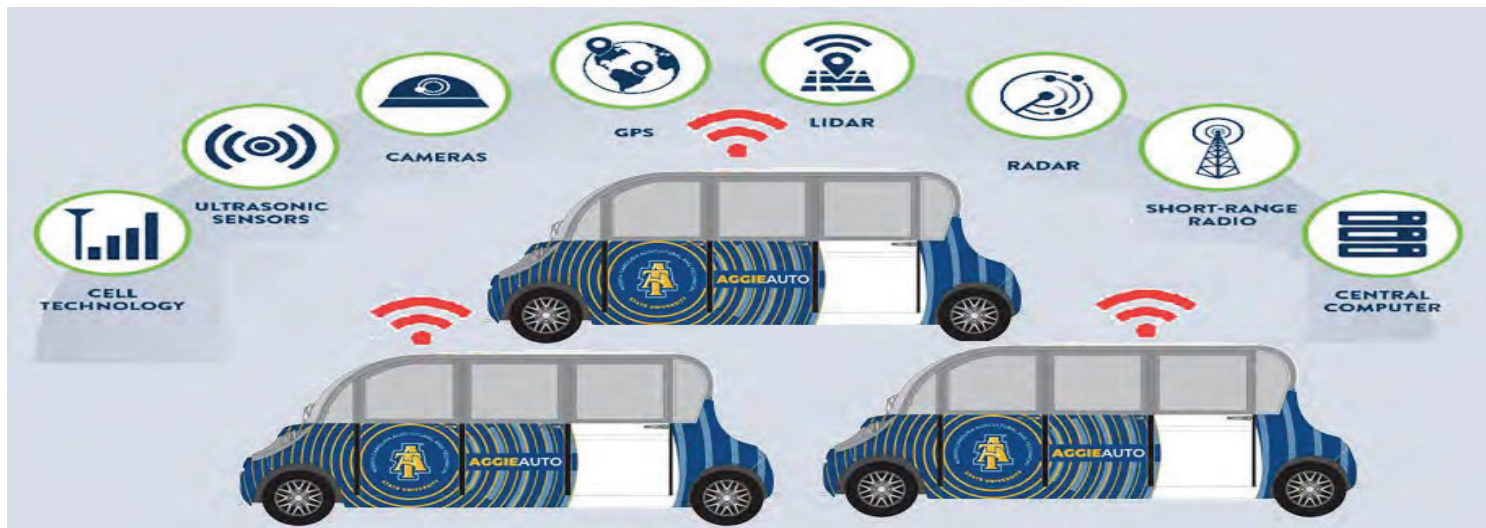
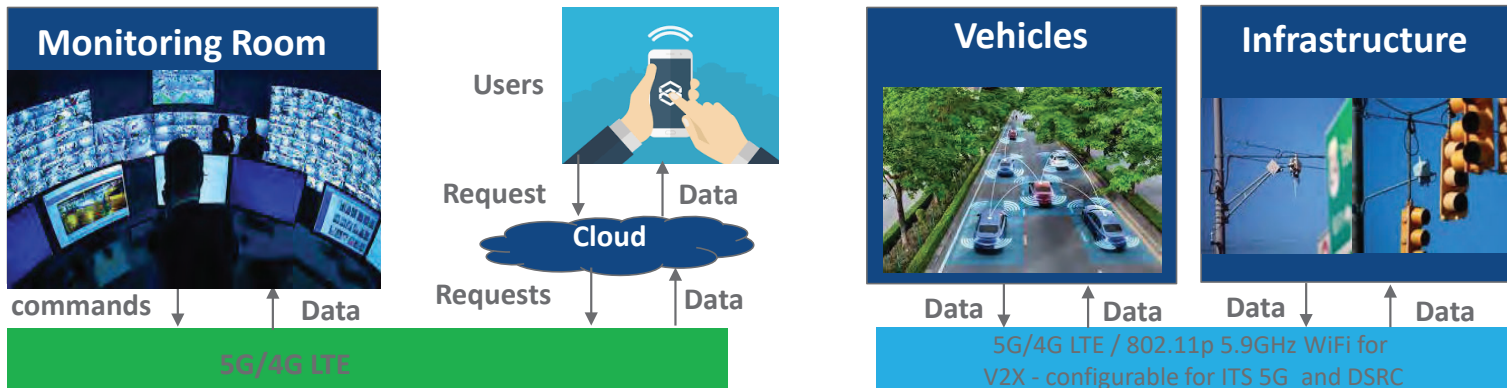


*“Enhancing Autonomous Vehicle Traffic Safety through Pedestrian Detection, Classification and Communication,” Ford, 2021-2023.*

**Objective 1:** Network fusion: We explore fusing different networks and inferences with manageable runtime overhead through parallel fusion mechanisms.

**Objective 2:** Edge acceleration: We explore the implementation of the developed networks on the RPI4B+, NVIDIA Jetson by achieving an optimized speed in network communication using edge computing, while maintaining IoT devices.







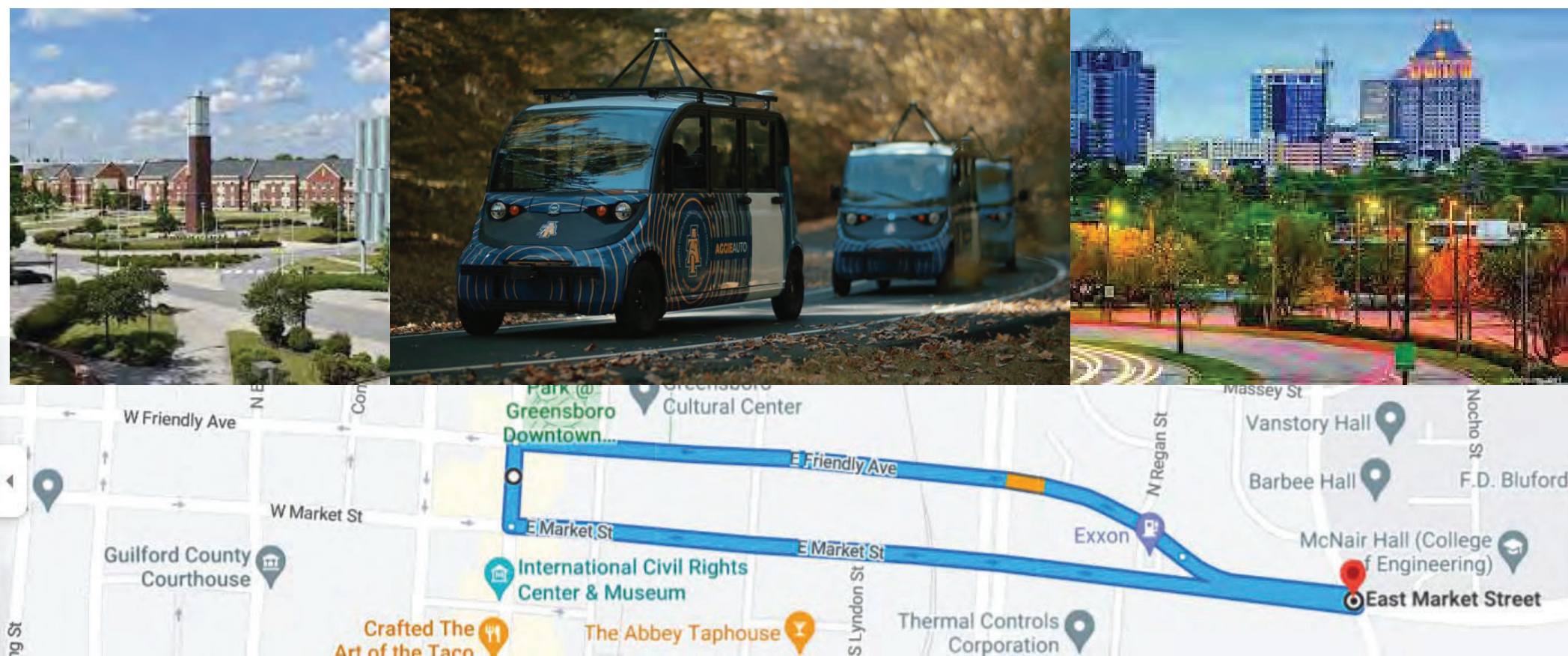


**NORTH CAROLINA AGRICULTURAL  
AND TECHNICAL STATE UNIVERSITY**

*We Continue to Serve the Local Community!*  
*Connecting disconnected underserved communities*

“Technology Transfer (T<sup>2</sup>): Microtransit Pilot Project in Greensboro, NC,” Sponsor: NCDOT, April 15, 2023- May 15, 2024.

Public Deployment Pilot Program: Sep 18-Oct 13; 11 AM to 1:00 PM







**NORTH CAROLINA AGRICULTURAL  
AND TECHNICAL STATE UNIVERSITY**

*Thank You!*





# forward thinking

Jeremiah Mancini | EVP | Head of Global Sales





**FORWARD THINKING**  
*Stay ahead of the other guys.*

## Forward Thinking Systems®

- Founded in 2005
- Headquartered in Jericho, NY
- Released ADAS & DMS Commercially in 2015
- Multiple Patents Awarded
- International Presence & Global Pioneer

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SALES & PARTNER SUPPORT



**KRAKÓW, POLAND**  
CENTRAL EUROPE HQ





# Product Portfolio

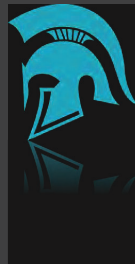
End to end fleet solution



IntelliHub

Your fleet in a browser.

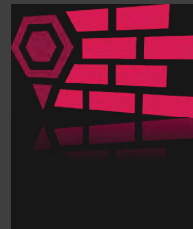
Track, manage, and execute all fleet operations from a seamless single-pane solution.



Field Warrior

The app for your mobile workforce.

ELD, Commercial nav, forms, signatures, DVIR and more.



Route Matrix

More stops in less time.

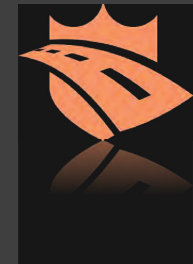
Automatically optimize your stops into the most efficient order saving time and fuel.



FleetCam

Award-winning AI camera solution.

AI driven All-In-One fleet camera system designed to save lives.



DriveShield

Empower your drivers.

Monitor on-road behavior, view historical events, and self coach inn in one easy to use score card system.



# Using Ai to drive Transformation



Maintenance



Fuel Efficiency



Productivity



Service  
Verification



Reducing Vehicle Wear



Safety



Fleet Utilization



Route Optimization



Compliance



Automation is driving much of this transformation...



# Autonomous vehicle technology

## LEVELS OF AUTONOMY

Society for Automotive Engineers (SAE) outlined 6 levels of automation for automakers, suppliers, and policymakers to use to classify a system's sophistication



# Mixed fleets

1

Pre ADAS & DMS

2

Embedded ADAS & DMS

3

Connected ADAS & DMS

4

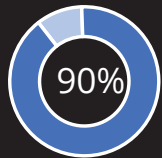
Autonomous + Connected

Regardless of what's in your fleet, the stats need to be addressed.



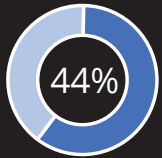
# The stats on Safety & Efficiency

## Accident Statistics



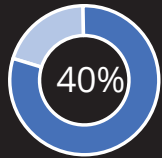
of rear end accidents can be prevented with 1.5 seconds of advance warning.

[1] National Transportation Safety Board



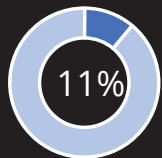
of non-performance driver-related crashes are due to falling asleep while driving.

[2] National Highway Traffic Safety Administration



of all driver-related crashes are due to driver inattention.

[2] National Highway Traffic Safety Administration



reduction in crashes when the vehicle has a lane departure warning system installed.

[3] Insurance Institute for Highway Safety

## Fuel Efficiency Statistics

25%

lower gas mileage due to harsh acceleration on average

[1] US Department of Energy

17%

average reduction in gas mileage due to speeding 5-10mph above limits

[2] Virginia Tech Transportation Institute

66%

of all fleets suffer from excessive idling issues.

[3] National Truck Equipment Association

12%

average fuel savings with a properly deployed telematics system

[4] Insurance Institute for Highway Safety

How do you address a mixed fleet?



# Mixed fleets

1

Pre ADAS & DMS

2

Embedded ADAS & DMS

3

Connected ADAS & DMS

4

Autonomous + Connected

# Ai Event Detection



DMS (Driver Monitoring System)

ADAS (Advanced Driver Assistance System)

Harsh Driving Events

## ADAS



### Follow Distance Warning

Driving too closely to the vehicle ahead



### Forward Collision Warning

Accelerating too quickly relative to the vehicle ahead



### Lane Departure

Vehicle changed lanes without signaling



### Rolling Stop Sign

Vehicle didn't come to a complete stop



### Pedestrian Warning

Pedestrian detected in front of vehicle



### Driver Distracted

Driver's eyes are not sufficiently focused on the road



### Driver Falling Asleep

Falling asleep or strong fatigue



### Driver Smoking

Driver smoking a cigarette detected



### Driver Using Cellphone

Driver holding cellphone to their ear



### No Seat Belt

Driving without seat belt detected



### Harsh Cornering

Vehicle turned a corner too harshly



### Harsh Accelerating

Vehicle accelerated too harshly



### Harsh braking

Vehicle decelerated too harshly

## Other



### No Driver Detected

Driver facing camera can't see the driver



### SOS / PTO Event

Custom power take-off event (SOS button or other)



### Camera Covered

Camera's view is completely obscured

## System Events



### Low Voltage

Vehicle-battery voltage dropped below threshold



### Memory Error

An error occurred in the camera's storage system



### Video Loss

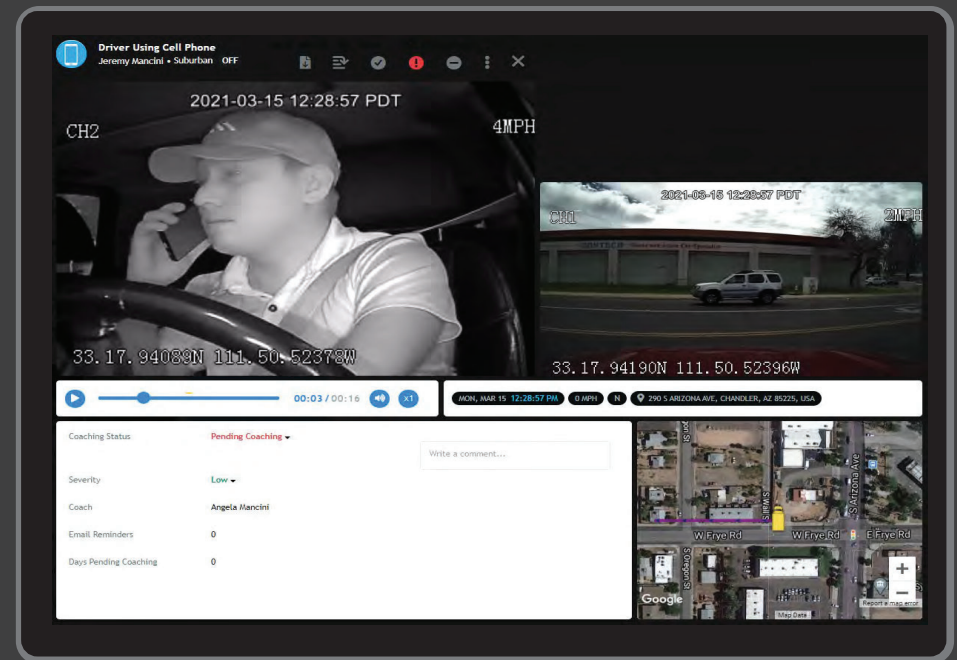
A camera is not providing video (malfunction or unplugged cable)



# In-Vehicle Experience



# Administrative Experience



# How to effectively implement

## Understand your fleet

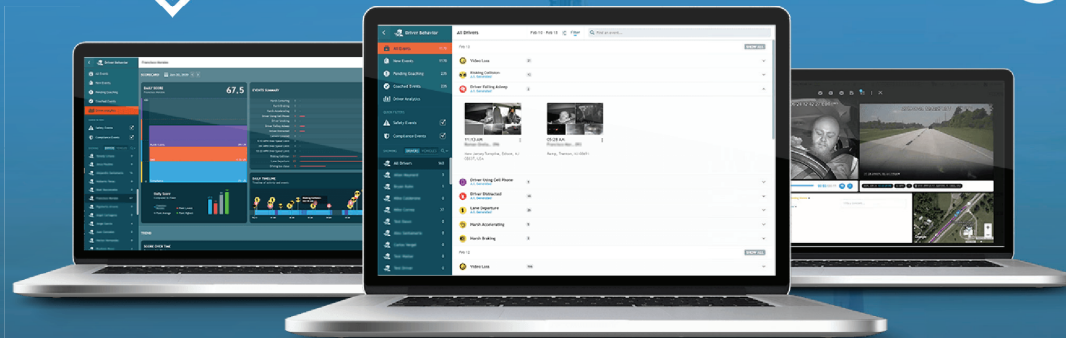
- Current technologies
- Future vision
- Vehicle & Equipment Types

## Develop a strategy

- Deployment plan
- Driver training
- Reporting & Analytics
- Automation
- Regular Reviews

## Allow drivers to self-improve

- In-cab feedback systems
- Automated coaching
- Incentives
- Proper follow-up when necessary



Solutions | Ideas | Helpful Resources

[www.ftsgps.com](http://www.ftsgps.com) | 1-516-336-7826

Jeremiah Mancini | EVP | Head of Global Sales





# AUTOMATED BUS RAPID TRANSIT

Sustainable Fleet Technology Conference  
New Horizons: AI and Autonomous Vehicles

Jeff Barghout  
Founder & CEO

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August 15, 2023

# ABOUT ROBOCIST

**Established in 2015**, our seasoned team brings decades of experience in transportation, engineering, artificial intelligence, and machine vision.

**We believe** the current era calls for a transformative approach to transportation, vehicles, infrastructure, and the strategies to maintain and upgrade our roadway network.

**Our goal** is to redefine and revolutionize these elements, paving the way for a more efficient and sustainable future in transport.

## **Consulting:**

- Technology scouting
- Technology evaluation, planning & implementation
- Strategic Support

## **Data as a Service (DaaS)**

- Roadway asset cataloging & assessments (pavement, road markings, signs, etc.)

## **Focus Areas:**

- Electric vehicles
- Autonomous vehicles
- Supporting infrastructure

# AUTOMATED BUS RAPID TRANSIT (ABRT)

A New Mode for High Quality, High-Capacity Transit Corridors

- Public focus on autonomous cars, trucks, and drones
- Buses represent a new opportunity
- Practical ways to apply current automated technology to transit
- Deployment is already underway globally
- Catalyst to reimagine the future of transport





# COMPARING LIGHT RAIL AND BUS RAPID TRANSIT

## Accessibility Features (Both)

- Low floors in most LRT and BRT vehicles
- Level boarding for LRT and some BRT systems
- Compliance with Americans with Disabilities Act

## Features of Bus Rapid Transit (BRT)

- Operate on both dedicated and shared roadways
- Typically faster than traditional bus transit
- Traffic signal priority/preemption
- Short headway bidirectional services

## Characteristics of Light Rail Transit (LRT)

- Single or short train operation on fixed rails
- Power from overhead electric line
- Greater passenger capacity per operator
- Inflexible routes due to infrastructure requirements



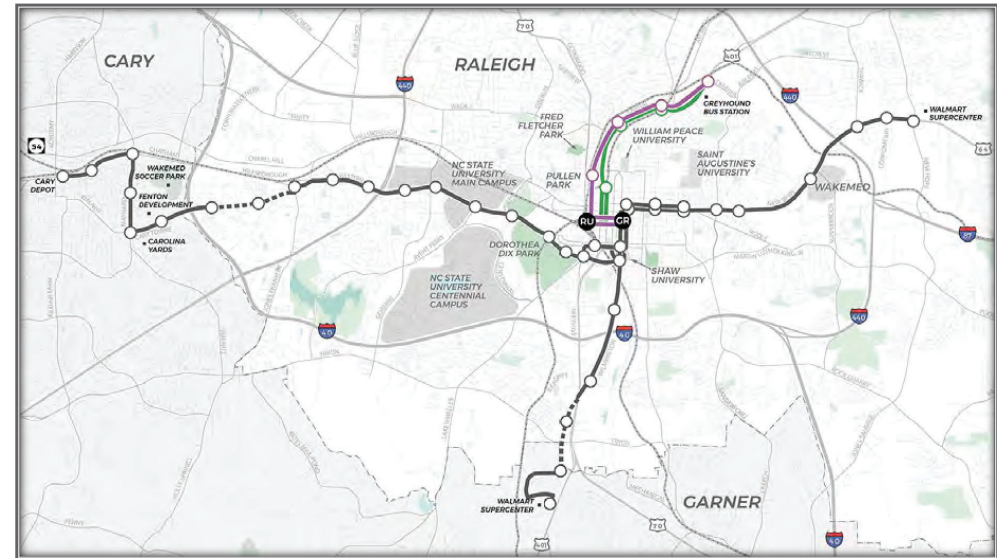
# COMPARING LRT AND BRT (CONTINUED)

## Comparison of LRT and BRT

- LRT - higher passenger capacity, higher infrastructure costs
- BRT - lower passenger capacity, lower infrastructure costs, and greater route/service flexibility

## Infrastructure Considerations

- LRT – Require expensive trackwork and signals
- BRT - Use of conventional traffic signals, roundabouts, and intersections



**Wake BRT:** 20 miles of transit lanes along 4 BRT corridors in Wake County

# EXPLORING AUTOMATED BUS RAPID TRANSIT (ABRT)

Leveraging autonomous vehicle technology to enhance BRT, making it competitive with LRT and improving traditional bus transit quality

## BRT Enhancements:

- **Safety:** automated collision avoidance and emergency braking
- **Precision Driving:** automated lane-keeping for narrow rights-of-way and sharp turns
- **ADA Compliance:** automated precision docking for ADA-compliant gap and reduced bus and platform damage
- **Ride Quality:** automated smooth acceleration, deceleration, and speed control
- **Adaptability:** “platooning” to create electronically linked train of buses controlled by a single driver in the lead bus





# USING AUTOMATION TO ASSIST, NOT REPLACE, DRIVERS

Federal Transit Administration (FTA)

*Strategic Transit Automation Research (STAR) Plan*

> “BRT service without a driver on board the vehicle”

Practical vision for Automated BRT:

- Support, not remove the drivers
  - Better, easier vehicle operation and flexibility
- Enable transit authorities to:
  - Transport more passengers
  - Increased safety
  - Improved comfort
  - Simplified accessibility for mobility impaired

We will be posting ABRT whitepapers under

“Resources” on our website shortly: [www.Robocist.com](http://www.Robocist.com)



Kansas City Area Transportation Authority  
Prospect MAX BRT

# AUTOMATED PRECISION DOCKING

## Better Positioning at Elevated Bus Stops

- Level boarding at all doors
- Reduce the gap between platform and bus
- Improved accessibility and service for mobility impaired community
- Fewer boarding and aligning incidents
- Reduce damage to buses and platforms compared to manual docking
- Supports bus yard automation
- Reduces driver stress
- Saves agency resources



KCATA: Kansas City, MO

# AUTOMATED COLLISION AVOIDANCE & EMERGENCY BRAKING

## Fewer Collisions

- Save lives
- Less injuries
- Reduces collision damage repairs
- Reduces insurance claims and premium
- Reduces driver stress
- Reduce spare bus ratio requirements
- Saves agency resources

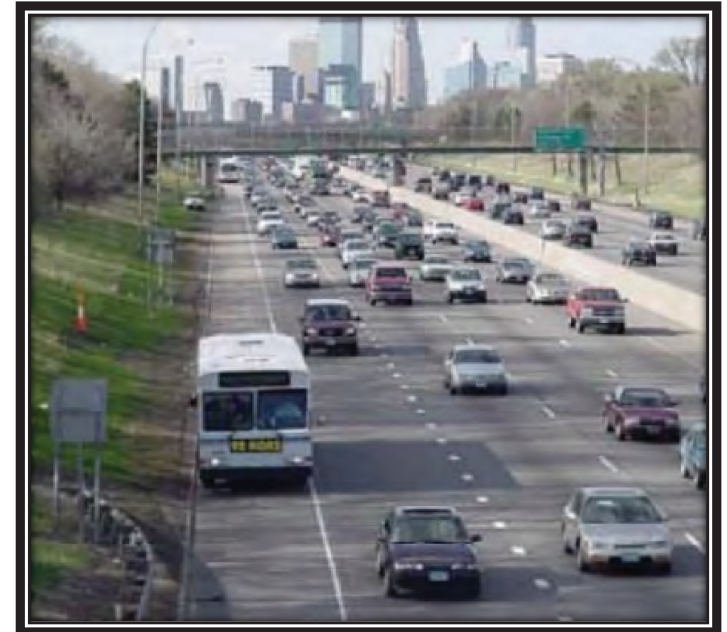


Pierce Transit CAWS/AEB  
FTA Safety Research and Demonstration Project

# AUTOMATED LANE KEEPING

## Increase Roadway Useability

- Utilize narrower busways
- Use of shoulders for buses
- New ABRT corridors can be narrower with sharper curves
- Lower right-of-way acquisition and infrastructure cost
- Fewer sideswipe collisions
- Fewer mirror replacements



Automated Bus on Shoulder  
Minneapolis, MN



# AUTOMATED BUS PLATOONING / LEADER-FOLLOWER

## Force Multiplier

- Increased passenger capacity on high volume routes
- Increased flexibility to adjust passenger capacity based on demand forecasting
- Increase bus capacity without increasing operators
- Improved fleet optimization
- Improve passenger to driver ratio

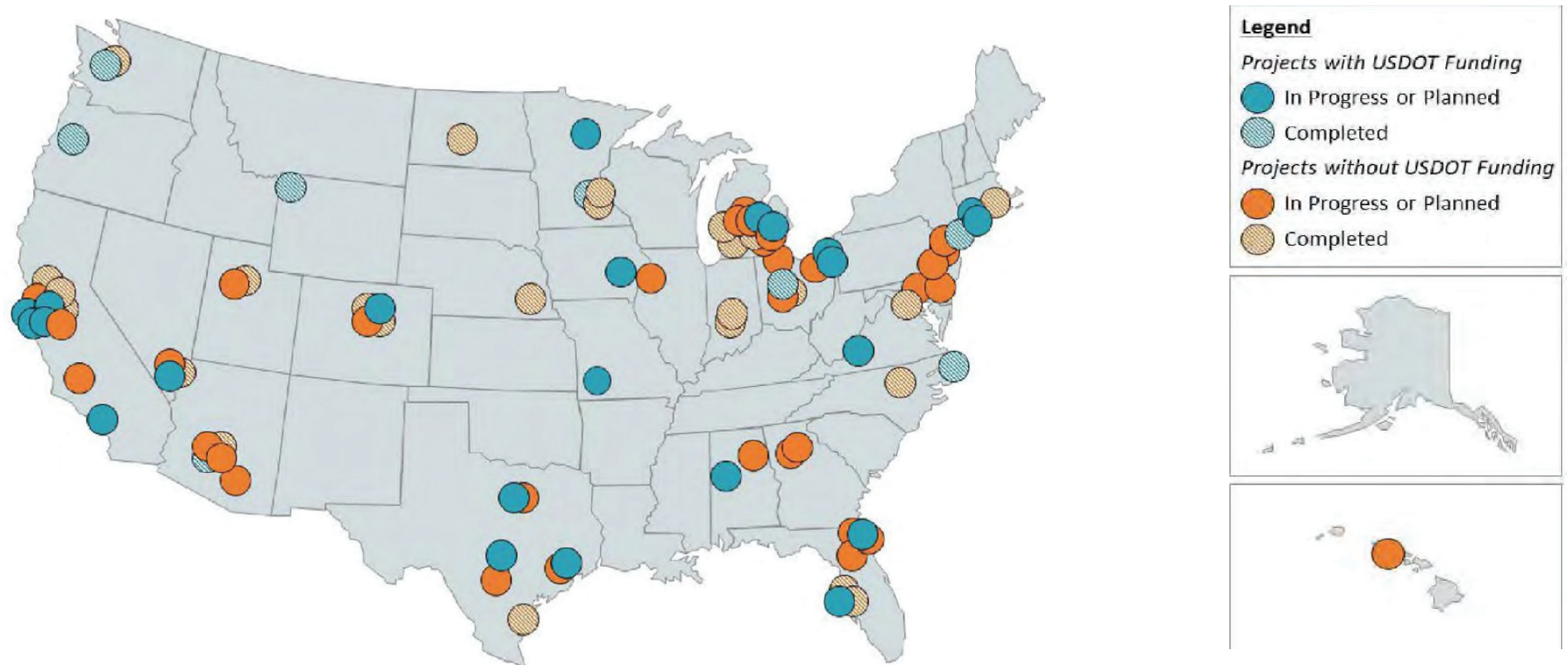


PANYNJ Exclusive Bus Lane  
Weehawken, NJ

# U.S. TRANSIT BUS AUTOMATION TESTING ACTIVITIES

## Federal Transit Administration (FTA) Transit Bus Automation Quarterly Update (Q2 2023)

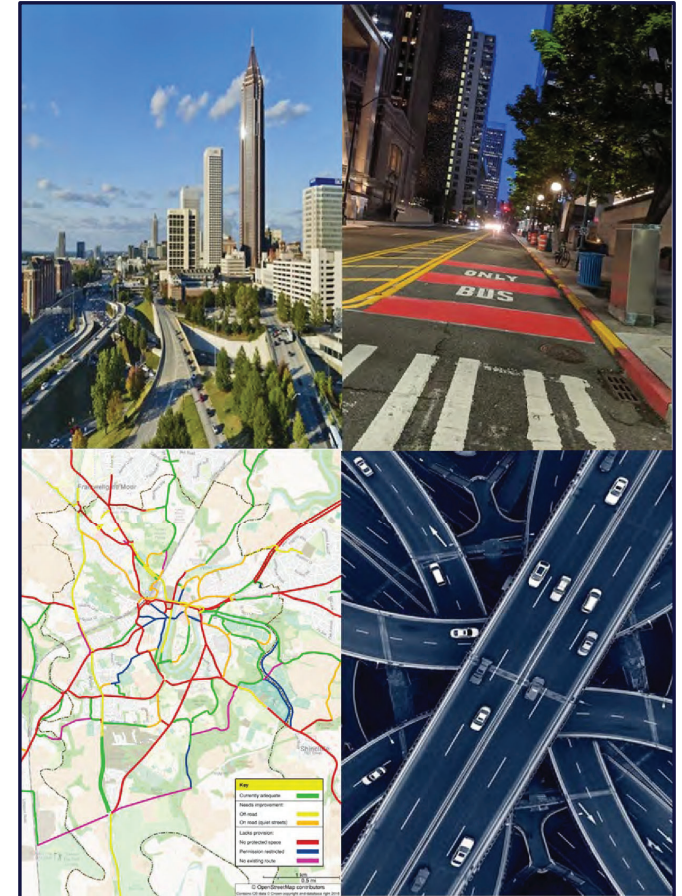
<https://www.transit.dot.gov/research-innovation/transit-bus-automation-quarterly-update-q2-2023>



# INCORPORATING ABRT INTO THE PLANNING PROCESS

## BRT Deployment – Great First Step

- Explore utilizing LRT corridors for ABRT implementation
- Plan for high performance, high-capacity transit corridors
- Comparison of costs, service, and environmental impacts for alternative modes: Bus, BRT, ABRT, LRT
- Development of ABRT costs and benefits plans
- Consider long range impact of ABRT adoption as a catalyst for a new business ecosystem
- Work with technology agnostic experts for early adoption



# MY CRYSTAL BALL: A VISION FOR 2030 AND BEYOND

- Centralized dedicated AV arteries / highways
- First mile / last mile
  - Local lead vehicle pick-up
  - Robotaxis (San Francisco, CA: Cruise & Waymo)
  - Mobility impaired and senior support
- Off-peak vehicle applications: goods transport and delivery services
- Disaster response: evacuation, power redistribution, supply transport
- Calling all entrepreneurs - New market platform comparable to apps on phones:
  - Thriving entrepreneurial ecosystem
  - Telehealth, telelearning, remote work, immersive VR shopping, entertainment







# ROBOCIST

Transforming the Driven Environment

# Thank You

Jeff Barghout

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[www.Robocist.com](http://www.Robocist.com)

Content Contributors: Dick Mudge & Jerry Lutin

# ABOUT JEFF BARGHOUT

For 30 years, Jeff Barghout has been a dynamic force in business strategy, technology development and evaluation, and entrepreneurship. As CEO of Robocist, he is at the forefront of **emerging transportation technologies, pushing boundaries with connected, autonomous, and electric vehicles, and leveraging AI to quantify the driven environment.** With a keen ability to identify market needs and trends, coupled with a track record in artificial intelligence, computer vision, and machine learning projects, Jeff is at the forefront of the evolving technology landscape.

Jeff has worn many hats throughout his professional journey including roles as an engineer and strategic planner at Chrysler, conducting technology commercialization for NASA, directing EPA's GHG Technology Center evaluating energy and mobility innovation, and serving as VP of Transportation Initiatives at a prestigious research and consulting firm. A serial entrepreneur, he's launched businesses across sectors, and serves on boards like E4 Carolinas.

His expertise lies in navigating the complex intersection of technology, market forces, regulation, and stakeholder needs, making him a national “go-to” expert. Each day, Jeff continues to push boundaries and create impactful innovations, embodying the spirit of entrepreneurship and technological advancement.

