

Texas State University  
CIEDAR Smart Mobility Lab  
March 25, 2021



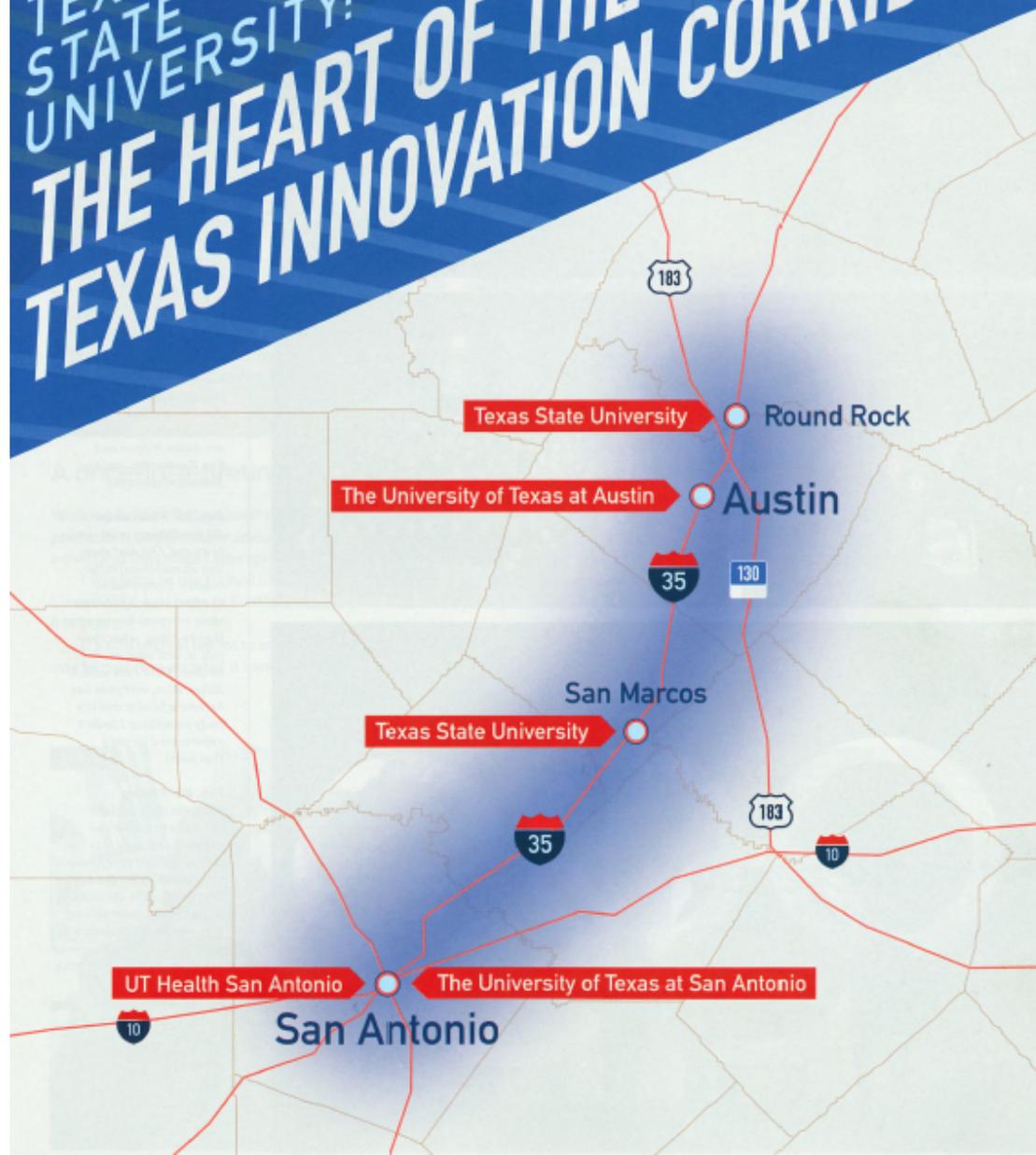
*The rising STAR of Texas*

# Texas State University

- 7th largest university in Texas, ~39,000 students, 90% of graduates stay in Texas.
- 50% of our students are ethnic minorities;
  - Official Hispanic Serving Institution (HSI), 35% Hispanic population.
- Carnegie Classified Research University (R2).
- Top quartile nationally in R&D expenditures



# TEXAS STATE UNIVERSITY: THE HEART OF THE TEXAS INNOVATION CORRIDOR



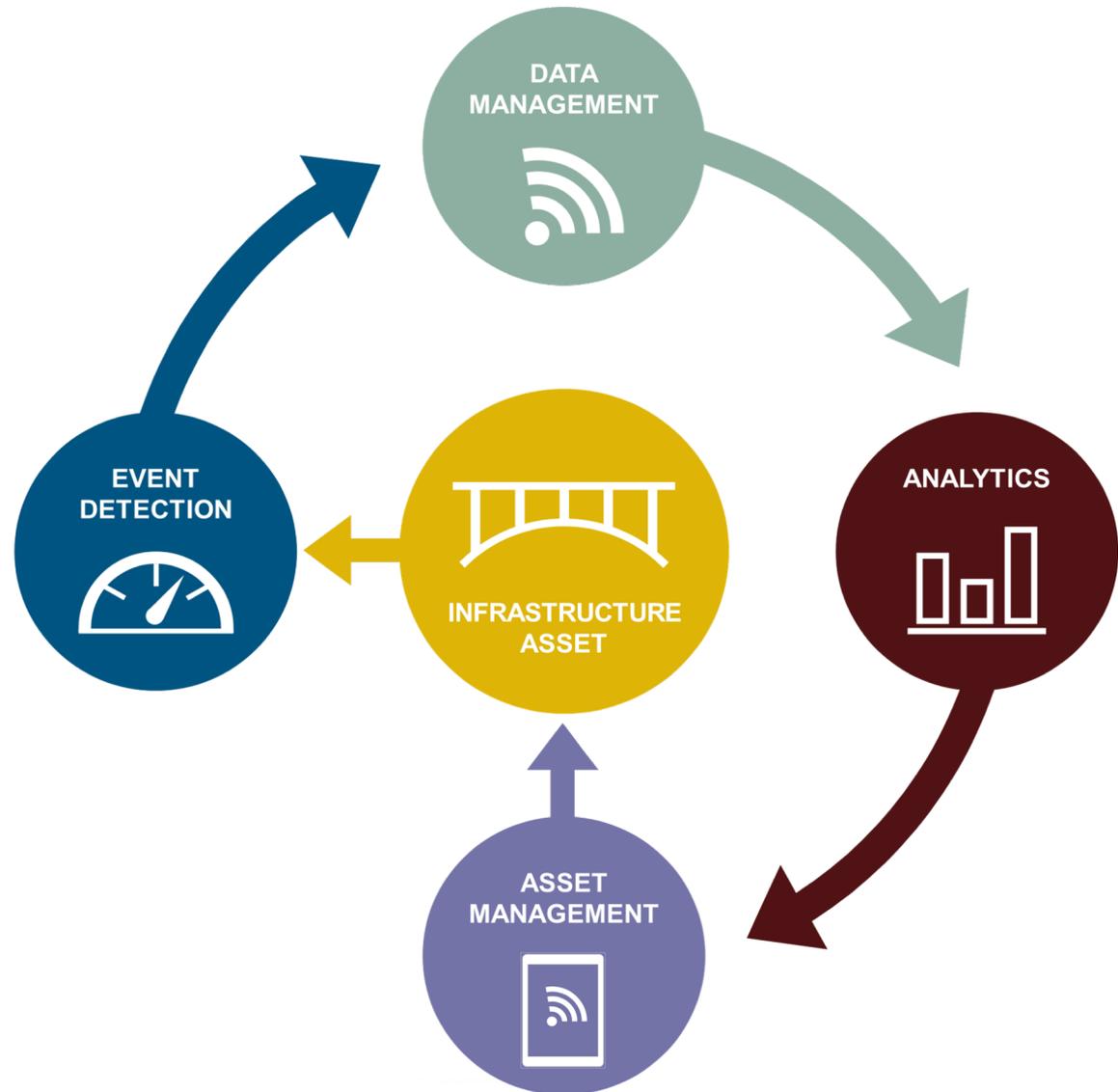
TEXAS  
STATE  
UNIVERSITY

*The rising STAR of Texas*

## CIEDAR Vision

- Connected Infrastructure for Education, Demonstration, and Applied Research (CIEDAR).
- The creation of multiple living labs within a smart neighborhood in partnership with industry to accelerate digitalization, decentralization, and decarbonization of industry via our own Technology Enhanced Infrastructure vision.

# Technology Enhanced Infrastructure



# CIEDAR Mission

- The study of all technologies with application to the lifecycle monitoring of infrastructure assets.
  - Validation of existing technologies
  - Evaluation of emerging technologies
  - Development of new technologies
- The transdisciplinary study of technologies with application to infrastructure.
  - project teams may include faculty and students from civil engineering, electrical engineering, mechanical engineering, industrial engineering, manufacturing engineering, geography, mathematics, physics, chemistry, computer science, design, business, communications and others.

# CIEDAR Consortium Opportunity

- CIEDAR is exploring partnerships with industry to develop the following 9 living labs populated by its expert faculty and students:

## Connected Infrastructure, Education, Demonstration, and Applied Research

### Smart Utilities

(Grid management, full monitoring, control and management of all assets)

### Smart Buildings

(positive energy buildings, embedded sensors throughout, BIM, BAS, BAM)

### Smart Energy

(energy storage & batteries, electric vehicles, microgrids, micro generation)

### Smart Water/Wastewater

(water & waste treatment, recycling, desalinization, conservation, safety)

### Smart Cities

(streetlights, traffic lights, public safety, parking, recycling, etc.)

### Smart Mobility

(roads, bridges, tunnels, connected vehicles, autonomous vehicles)

**Networks** (5G, 4G , PLTE, IoT, LPWA, LoRaWAN, LoRA, 6lowPAN, Extended Wi-Fi)

**Sensors** (wearables, printable, embedded, nano, micro, waterproof, ingestible, others)

**Data / Software** (AI / ML, Blockchain, Databases, Cloud, Cybersecurity, Autonomous X)

## **CIEDAR Locations**

- Round Rock Campus – 100 acres
- San Marcos Campus – 500 acres
- STAR Park – 100 acres
- Freeman Ranch – 4,100 acres
- Muller Ranch – 160 acres
- ALERRT Center – 20 acres

# CIEDAR Smart Mobility Vision



Mobility-as-a-Service enables multimodal mobility by providing user-centric information and travel services (navigation, location, booking, payment, ...) hence allowing mobility as a seamless service across all transport modes.

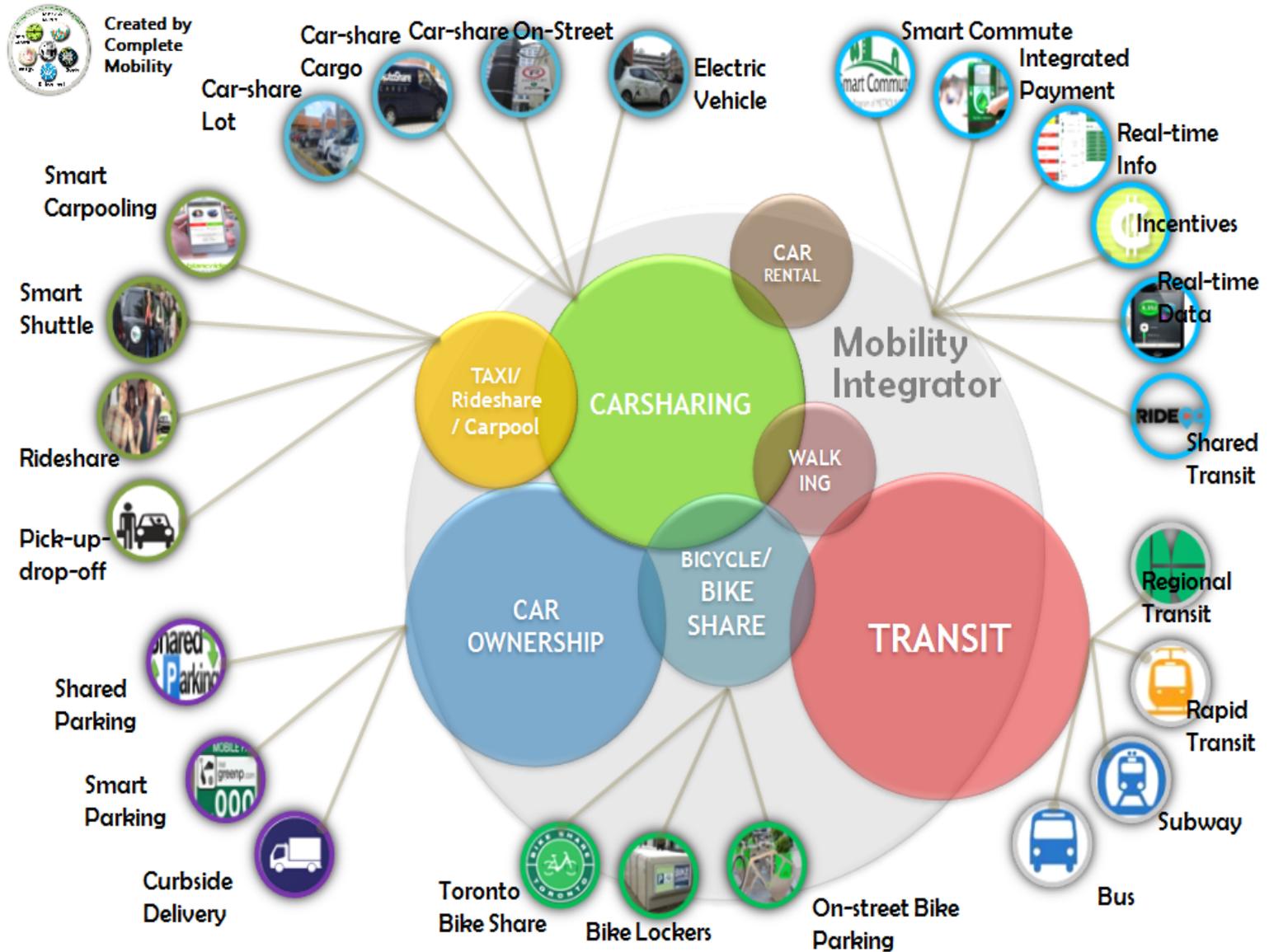
Mobility on Demand also don't require ownership of private automobiles and gives convenient access to a range of travel modes while socializing the high initial costs of switching to electric-vehicle based mobility.

Integrated mobility on demand services can contribute to modal shift to public transport and also addresses spatial inefficiencies of private transport.

# CIEDAR Smart Mobility Focus

- Infrastructure
  - Active Roads, Sidewalks, Highways, Airfield Runways, Bridges, Tunnels, and Overpasses.
  - Street Signage, Mapping Technologies, Voice Control, GIS, Location Services, Written Equations, Applied AI/ML, Smart Street Lights (AMI), Smart Traffic Lights (AMI), Smart Parking Meters
- Intelligent Systems
  - Robotic Systems, Flying Systems, Driving Systems, Sailing Systems, Boating Systems, Transportation NOC Systems, Ticketing and Payments Systems ,and Security Systems, Automated Pavement Condition Data Collection.
  - Connected Vehicles, Electric Vehicles, Charging Stations, Autonomous Vehicles, Control Software, Safety Systems
- Vehicle Types – Taxis, Ride-sharing, Commercial, Private, and Self-driving, Planes, Drones, Buses and Trains, Car and Bike sharing.
- Enabling Technologies
- Software (AI / ML, Blockchain, Databases, Cloud, Cybersecurity, Autonomous X, others).
- Sensors (Wearables, Embedded, Nano, Micro, Water Proof, Printable, others).
- Networks (GPS, Private LTE, 5G, and 6G, Wi-Fi6, others).

# CIEDAR Smart Mobility Use Cases



# CIEDAR Key Smart Mobility Projects

- STAR Park campus test track (30 acres)
- Freeman Ranch test track (100 acres)
- Round Rock to San Marcos test track (50 miles)
- Power Lines and Towers Drone testing track
- Commercial Package Delivery Drone test track
- Human Delivery Drone test track
- Cargo Mass Transit Network using aerial or boring or tunneling technologies test track
- Large scale EV battery forecast modeling
- Hybrid EV charging technologies
- EV to Grid discharging
- Automated Highway and Airport Runway Pavement
  - 2D and 3D camera and laser sensor technologies
  - 3D reconstruction with photometric stereo methods
  - Highway speed vehicle-based pavement survey system architecture
  - Image processing algorithms and methods
  - Quality assurance of automated pavement condition data

# Contacts

## **Andres Carvalho**

Co-Director, CIEDAR

Professor of Innovation, College of Science and Engineering  
Fellow, Materials Applications Research Center

**Phone:** 512-968-8108

**Email:** [andres.carvalho@txstate.edu](mailto:andres.carvalho@txstate.edu)

## **Stan McClellan**

Co-Director, CIEDAR

Professor of Electrical and Computer Engineering  
Ingram School of Engineering

**Phone:** 512-245-4125

**Email:** [stan.mcclellan@txstate.edu](mailto:stan.mcclellan@txstate.edu)