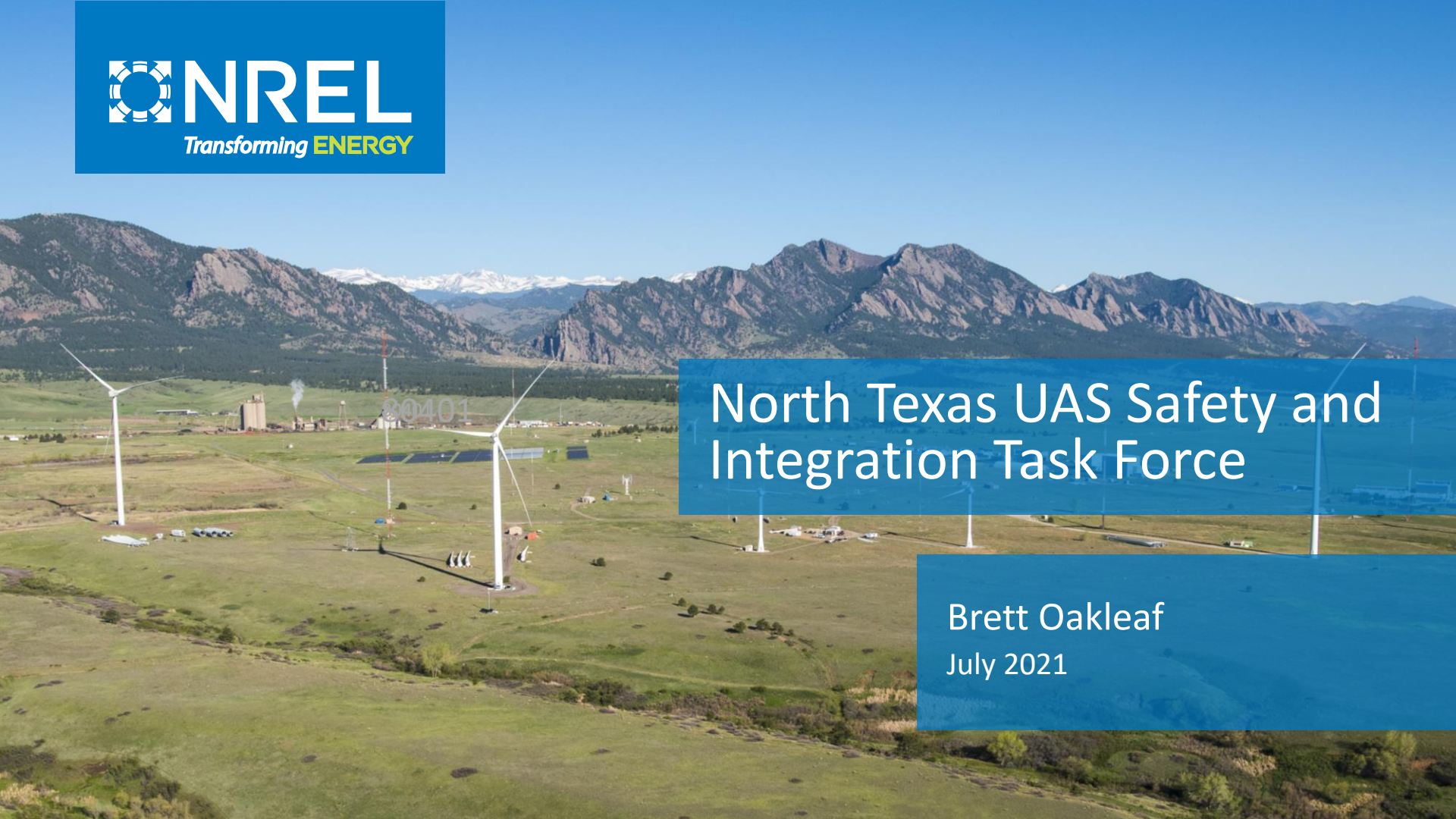


North Texas UAS Safety and Integration Task Force

Brett Oakleaf

July 2021

NREL Overview


Pacific Northwest
NATIONAL LABORATORY
INL
Idaho National Laboratory
NREL
The Ames Laboratory
Fermilab
Argonne
NATIONAL LABORATORY
BROOKHAVEN
NATIONAL LABORATORY
NETL
BERKELEY LAB
SLAC
PPPL
PRINCETON PLASMA PHYSICS LABORATORY
Jefferson Lab
Thomas Jefferson National Accelerator Facility
Lawrence Livermore
National Laboratory
Sandia
National
Laboratories
Los Alamos
NATIONAL LABORATORY
EST. 1943
SRNL
OAK RIDGE
National Laboratory

NREL at a Glance

1,998

Employees,
Plus more than
600
early-career researchers and visiting scientists

World-Class
facilities, renowned technology experts

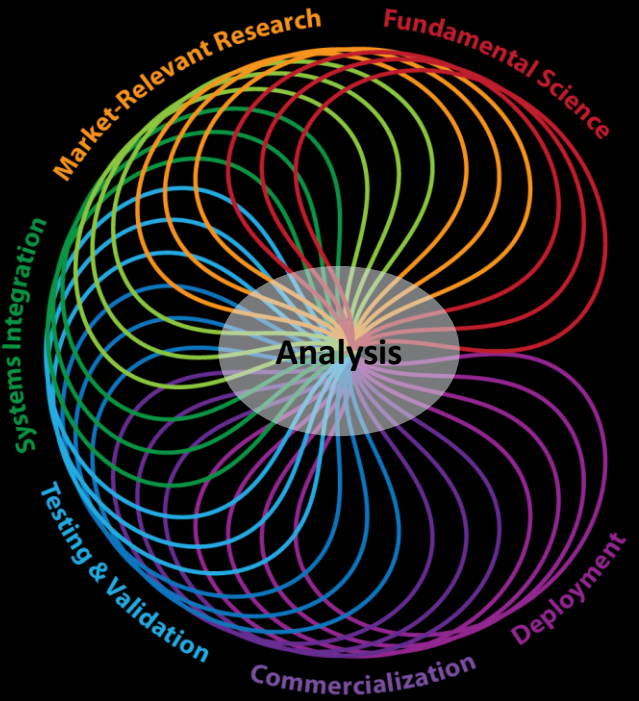
nearly 820

Partnerships
with industry, academia, and government

Campus
operates as a living laboratory

$1.1B annually

National Economic Impact



Spectrum of Energy Innovation

From Science through Deployment

- Comprehensive approach to innovation
- Collaboration with private industry
- Connect science to the marketplace
- Deliver market-relevant technologies and competitive clean-energy products
- Guide with leading analysis

NREL Science Drives Innovation

Renewable Power

Solar

Wind

Water

Geothermal

Sustainable Transportation

Bioenergy

Vehicle Technologies

Hydrogen

Energy Efficiency

Buildings

Advanced Manufacturing

Government Energy Management

Energy Systems Integration

High-Performance Computing

Data and Visualizations

NREL Core Capabilities: Foundation for Innovation

Analysis and System Integration

Decision Science and Analysis

Systems Engineering and Integration

Policy and Markets

Innovation and Application

Biological and Bioprocess Engineering

Chemical Engineering

Mechanical Design and Engineering

Power Systems and Electrical Engineering

Foundational Knowledge

Applied Materials Science and Engineering

Biological Systems Science

Chemical and Molecular Science

Crosscutting

Advanced Computer Science, Visualization, and Data

Large-Scale User Facilities

Answering **crucial questions** about:

Technologies

What electric technologies are available now, and how might they **advance**?

Consumption

How might electrification impact electricity **demand** and **use patterns**?

System Change

How would the electricity system need to **transform** to meet changes in demand?

Flexibility

What role might **demand-side flexibility** play to support reliable operations?

Impacts

What are the potential **costs, benefits, and impacts** of widespread electrification?

Need for Decarbonization

Transportation Megatrends

Seven key megatrends are poised to **transform our transportation system**.

These trends have begun to affect our mobility behaviors, and impact how we, and the goods we need, will travel sustainably in the coming decades.

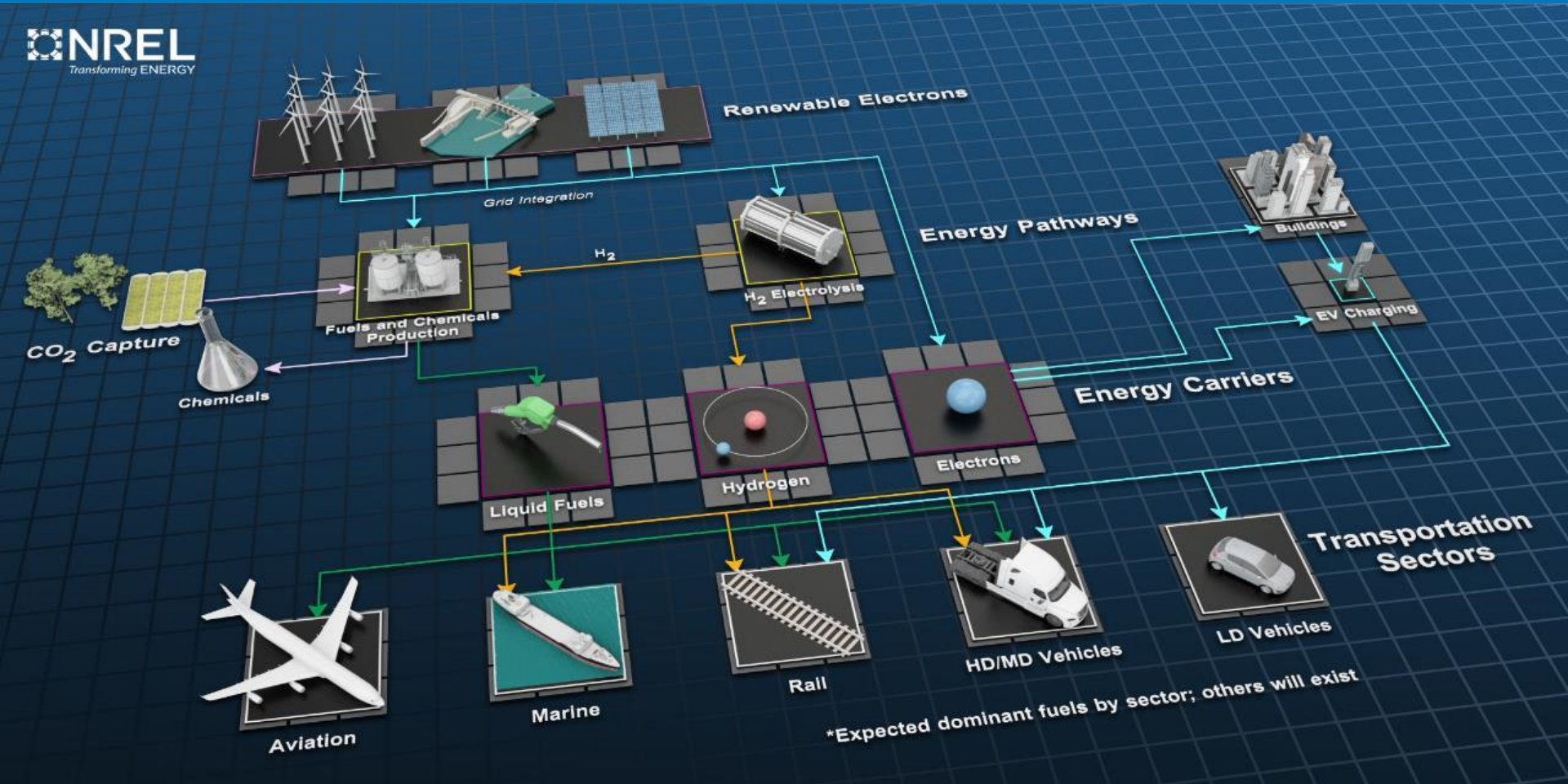
1. Rapid technology change
2. Customer demand
3. Live, work, and study anywhere
4. Environmental sustainability and energy security
5. International trade
6. Our growing and aging population
7. The need for healthier lifestyles

Implications for Research Needs

- **Rapid changes in vehicle technologies** – electrification (batteries and fuel cells), connectivity, automation
- **Global drive for increased transportation efficiency** – reducing emissions and decarbonizing transport across the light-, medium-, and heavy-duty vehicle, rail, aviation, and marine sectors
- **Maximizing future use of renewable electrons through time and sector shifting** – storing as H_2, liquid fuels, chemicals (long-term storage)
- **Realizing the system-wide benefits** of optimally integrating transportation with buildings, grid, renewables.

NREL | 11

NREL's Vision for Decarbonizing the Transportation Sector



Aviation Revolution

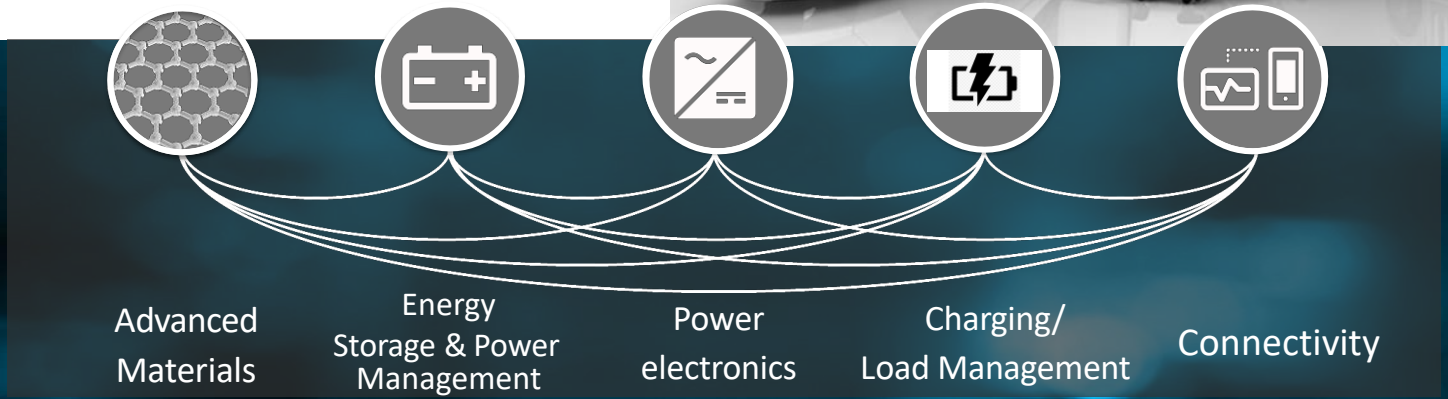
An Aviation Revolution is underway

An Aviation Revolution - Background

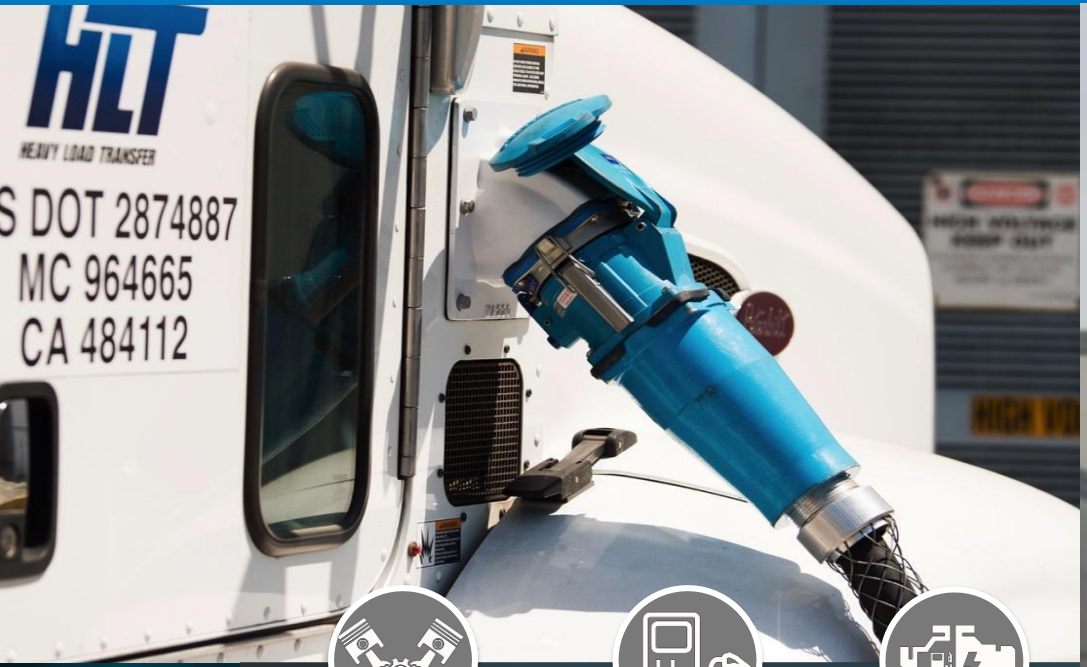
- 2018: 4.8 **Billion** passengers & 58 **Million** tons of freight
  - Both could more than double by 2035
  - **US –** Passenger aircraft energy usage: 89GW of equivalent energy
- Market for Advanced Air Mobility (e.g. flying taxis, drones, etc) should continue to mature during this decade, growing to $1.5 trillion globally by 2040
- Driving this trend: fully autonomous vehicles, more efficient batteries and advanced manufacturing techniques.
- Driving forces: FAA, NASA, Numerous private companies

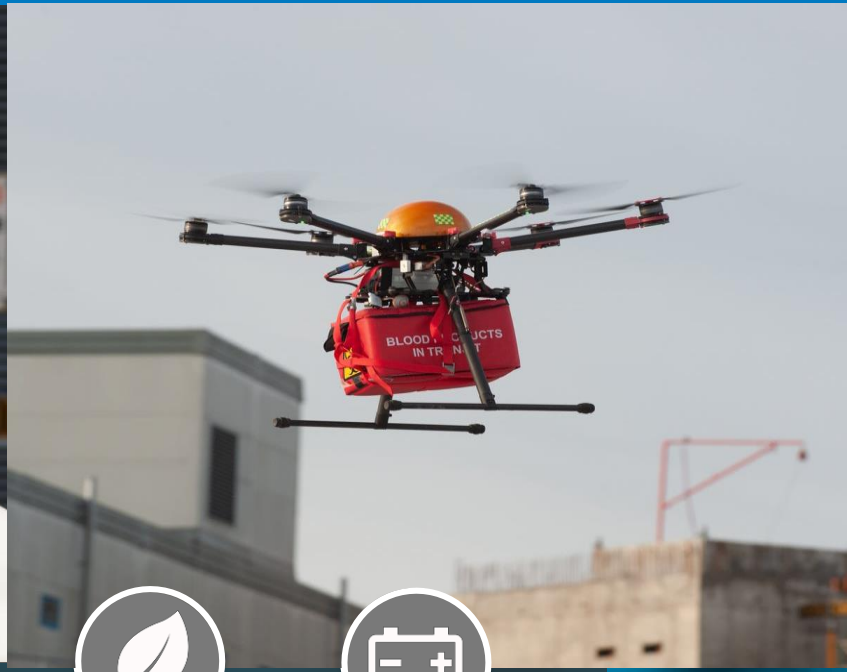
Four Elements of Sustainable Mobility

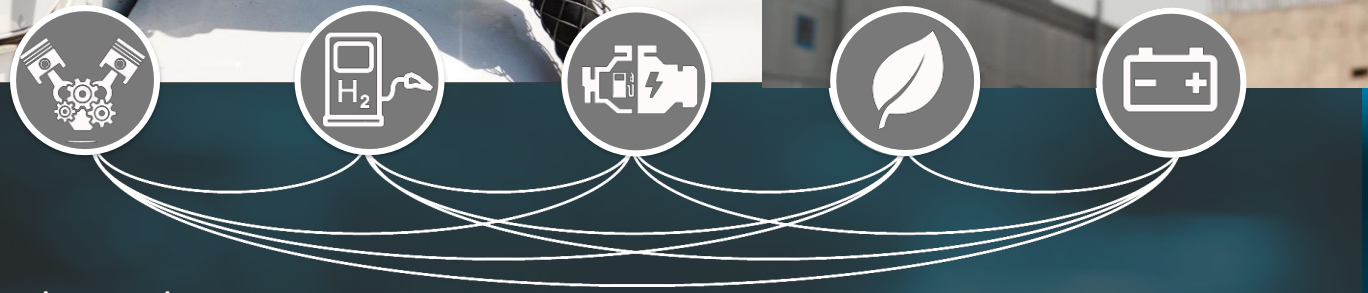
Moving people



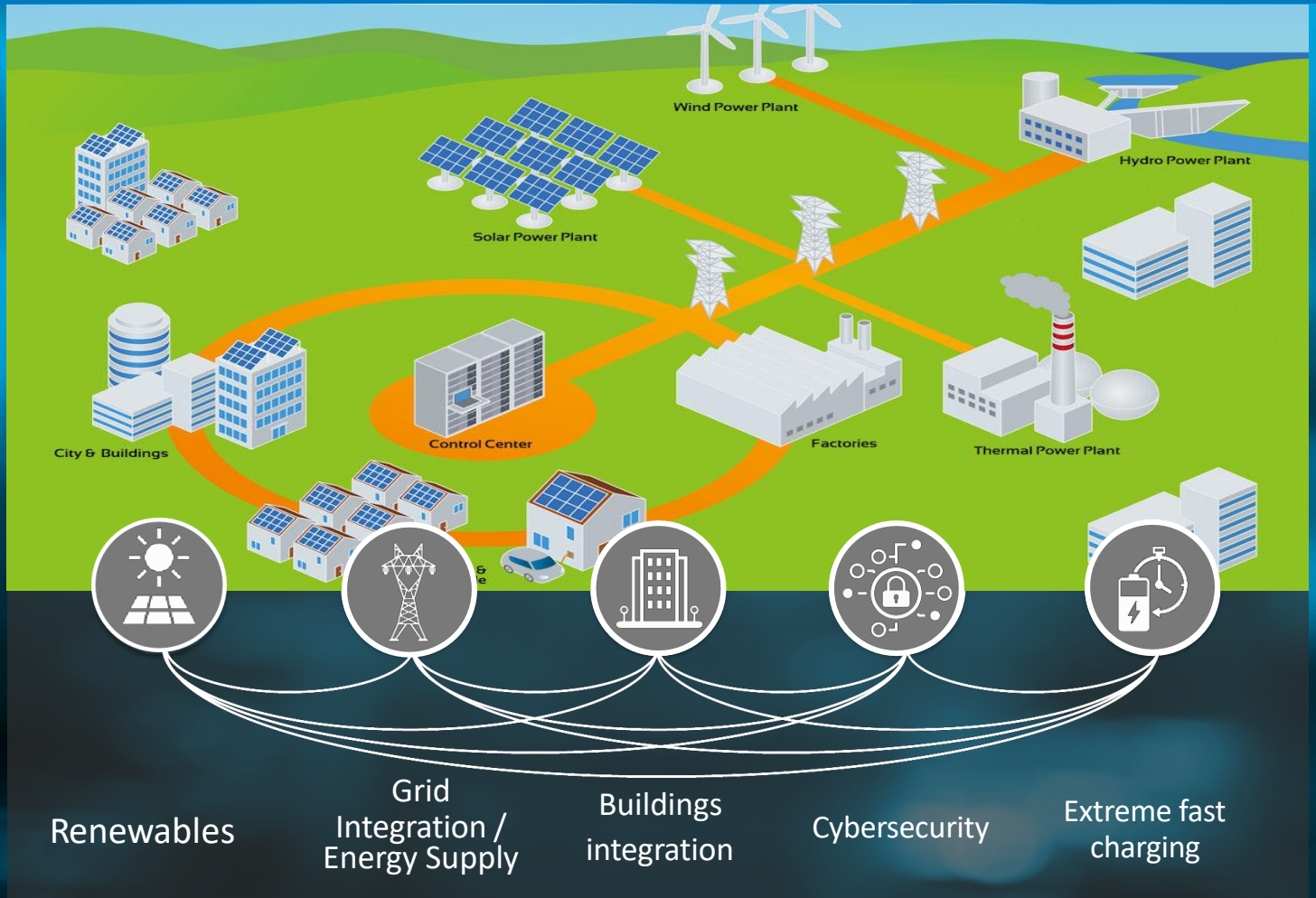
Moving goods







Powering mobility



Transformative technologies

Automation

PHIL - Testing

Wireless charging

Big data/ analytics

Deep learning

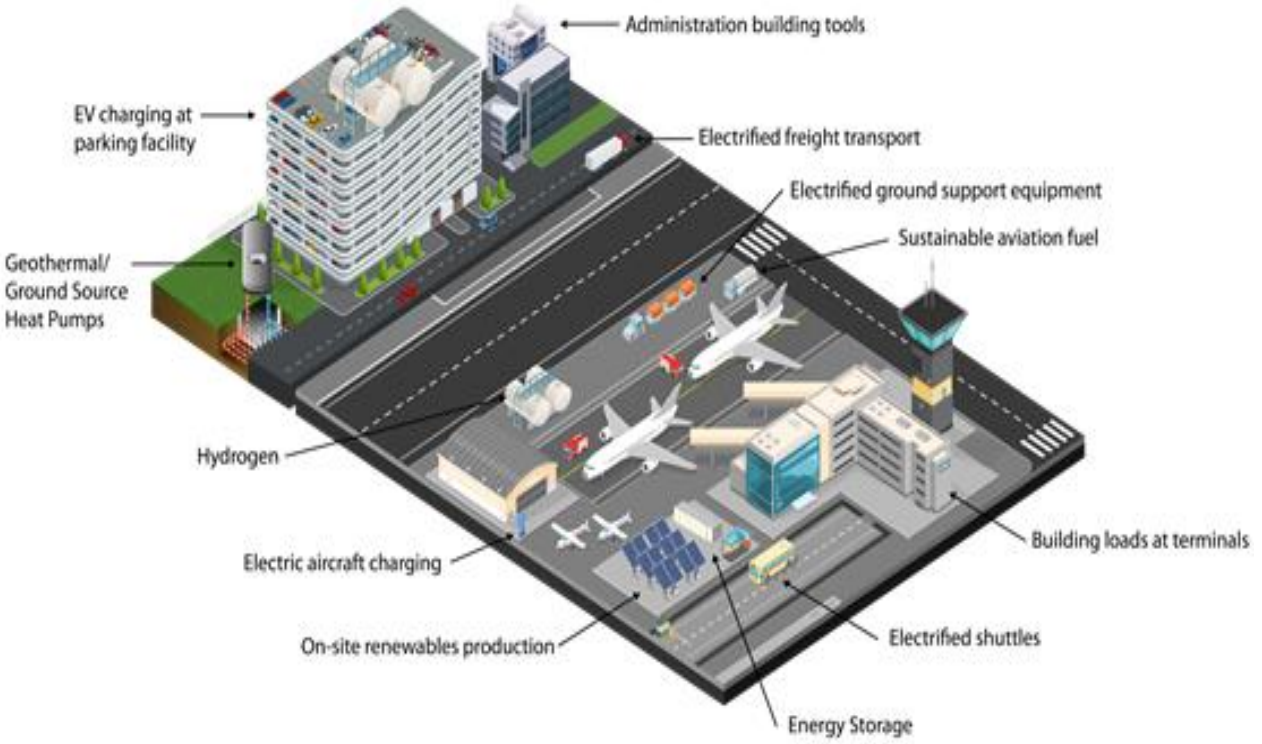
The Challenge

The challenge:

Airports/Airlines are under transformational pressures on emissions and electrified aviation

Cities are searching for clean energy and advanced mobility options

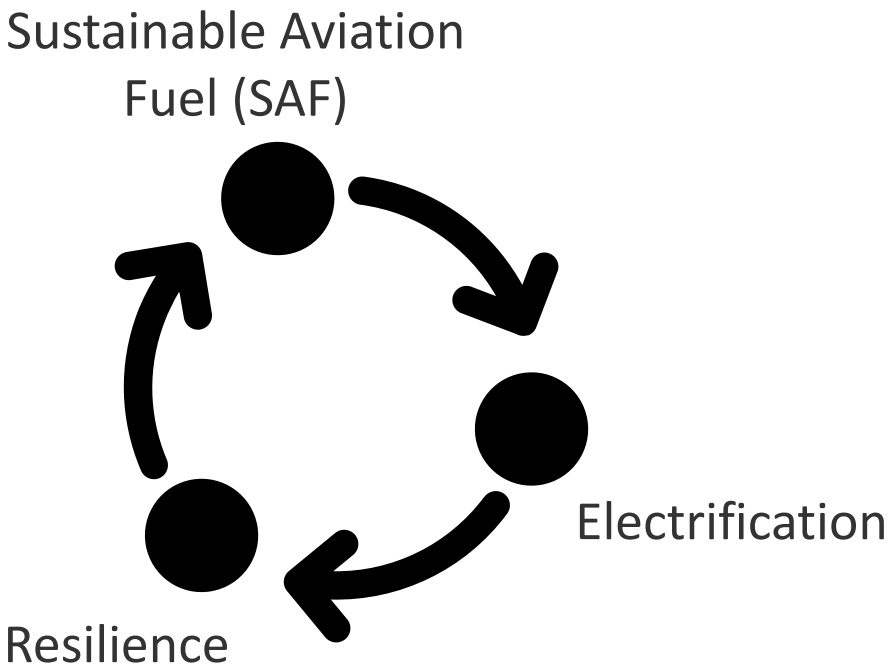
Rural communities are in need of mobility, commerce, and energy resilience opportunities



Sustainable Aviation (SA) will bring together NREL's experience, expertise, and capabilities to codevelop and help implement options that address stakeholders' unique energy-mobility goals and diverse priorities.

Sustainable Aviation

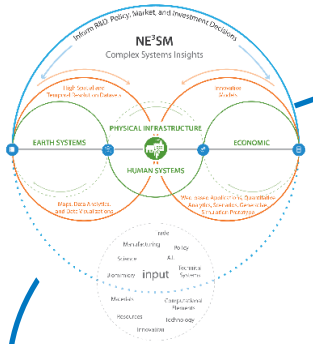
- Multiple pathways to carbon neutrality
- SAF easiest pathway utilizing existing infrastructure and long-haul flight viability
- Electrification applicable to Urban Air Mobility, Drone, short haul (<500 miles), and ground support vehicle use cases
- With growing electrification, the need for vastly improved electrical resilience need for continuity of operations

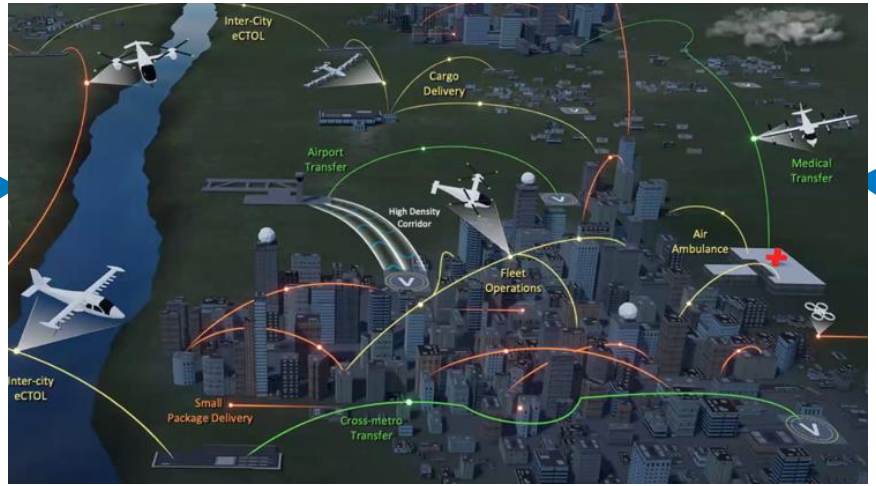


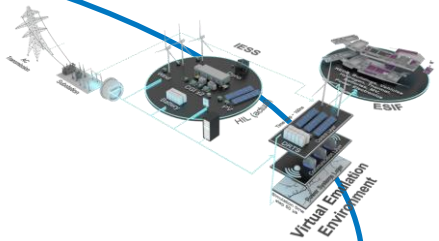
Initiative Summary

- Influence a generational shift that will affect mobility, energy, climate, commerce
- Transitioning the aviation industry's energy needs towards a cleaner and lower cost future
- Utilization of existing industry infrastructure to advance deployment and lower cost (SAF)
- Utilization of unique NREL capabilities around Sustainable Aviation Fuel (SAF) and Electrified Aviation (e.g., generation, delivery, storage, usage)
- Alignment of: Biden Administration; Public (DOE, DOT, USDA); Govt Agency (FAA, NASA, AFWERX) and Private (Airport Consortium) strategic goals

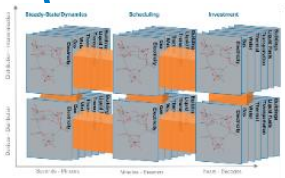
Electrified Aviation vision

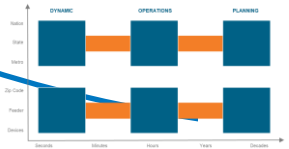


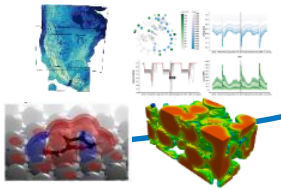


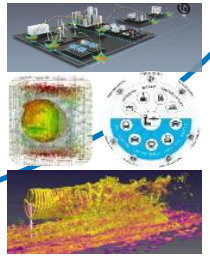


Accelerate transformation of the Advanced Air Mobility through integrated analytics and physical/virtual testing.









Integrated Analytics at Scale

Advanced Computational Science

Sustainable Aviation Partnerships

NREL already has partnership with many of these key stakeholders (FAA, NASA, AFWERX, and Multiple Airports/Airport Consortium) in/nearly in place, and now we need bring in DoD, EPA, FEMA, DOT, and USDA to support larger vision

- **ASTM:** To expedite SAF approval process
- **FAA**: Task 1 (underway now) Electrified Aviation Energy and Infrastructure analysis. Task 2 (proposing) Energy Self Sufficient Airports
- **NASA**: Task 1 (working towards IAA) Energy supply and infrastructure analysis for electrified aviation – regional and airport level. Task 2 (proposing) Integrating ARIES capabilities virtually into NASA models
- **AFWERX** (US Air Force's R&D center):
  - Hydrogen systems research
  - Electric Mobility fueling infrastructure planning
  - Grid modernization (focus on issues such as renewables integration and vehicle charging optimization)
  - Energy storage and electric motors
  - Technical system validation
- **Airport Consortium:** Previously negotiated but never executed (COVID) consortium of Dallas-Fort Worth, Port Authority NY-NJ airports, Los Angeles, Denver, and Atlanta airports on areas of SAF, energy resilience, and electrification

Alignment with Biden Administration Initiatives

100% Clean Energy & Net Zero by 2050

Stronger, More Resilient Nation

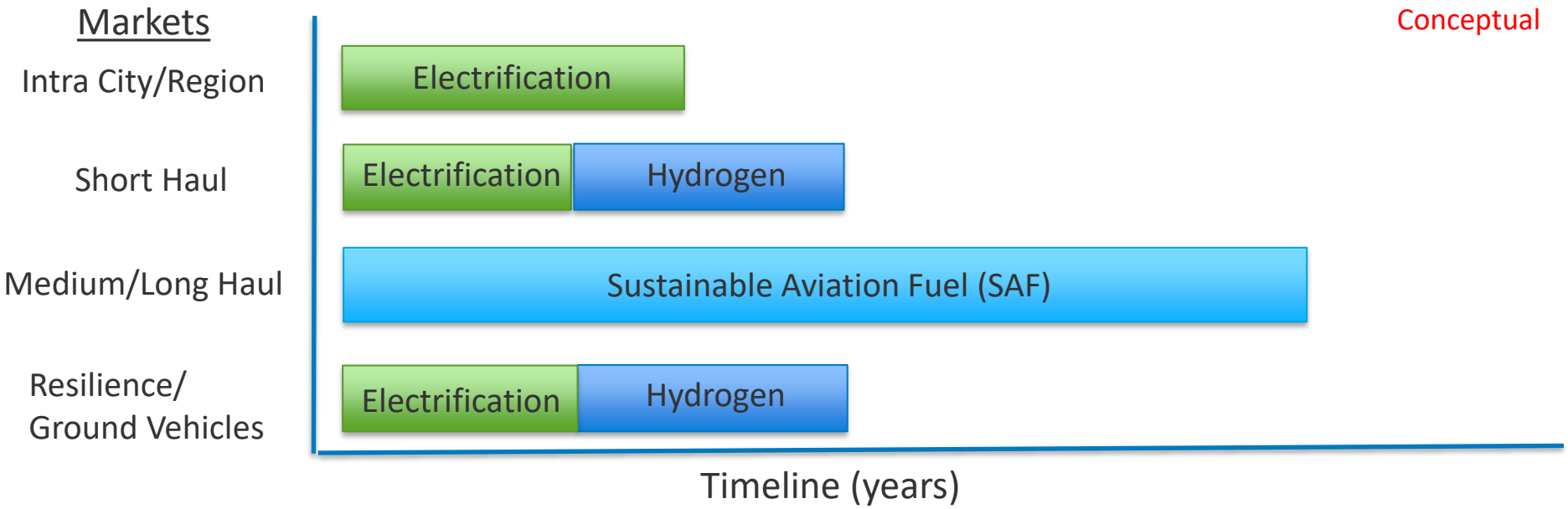
Address Climate Change

Build Modern Infrastructure

Clean Energy Innovation

Investment in Sustainable Agriculture

Sustainable Aviation focus areas by use

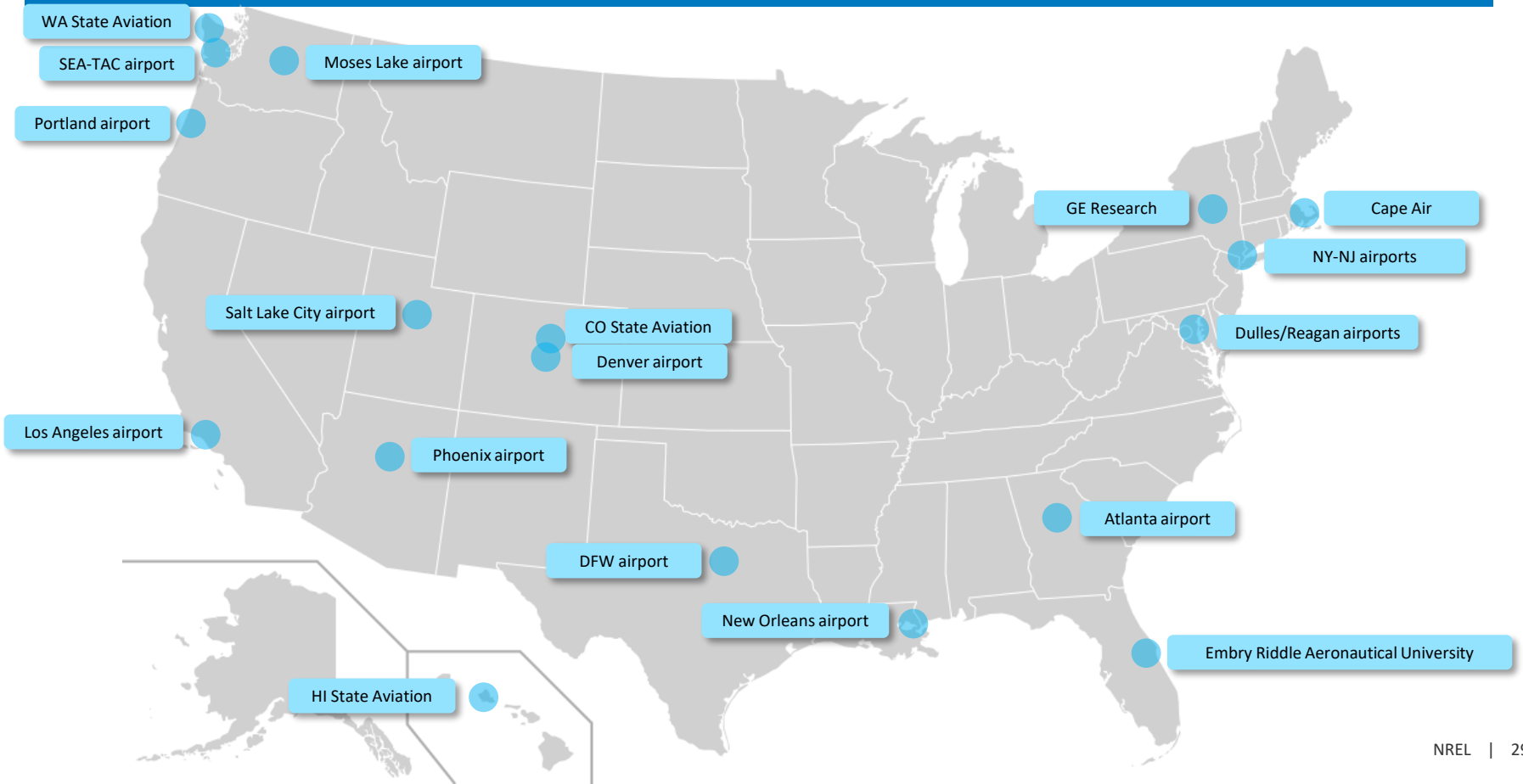


Significant challenges exist today for fully electrified aviation (especially long haul)

- *Sufficient battery size (energy capacity) for flights over >500 miles*
- *Energy storage need to "refuel" plane would be astronomical (TWhs of energy)*
- *Charging Infrastructure poses very high hurdles to deliver energy in 30-45 minutes for each plane*

➢ ***NREL addressing various segments of aviation market with SAF, electrified, and hydrogen solutions***

Existing regional interest in collaborations



Questions?

NREL
Transforming ENERGY

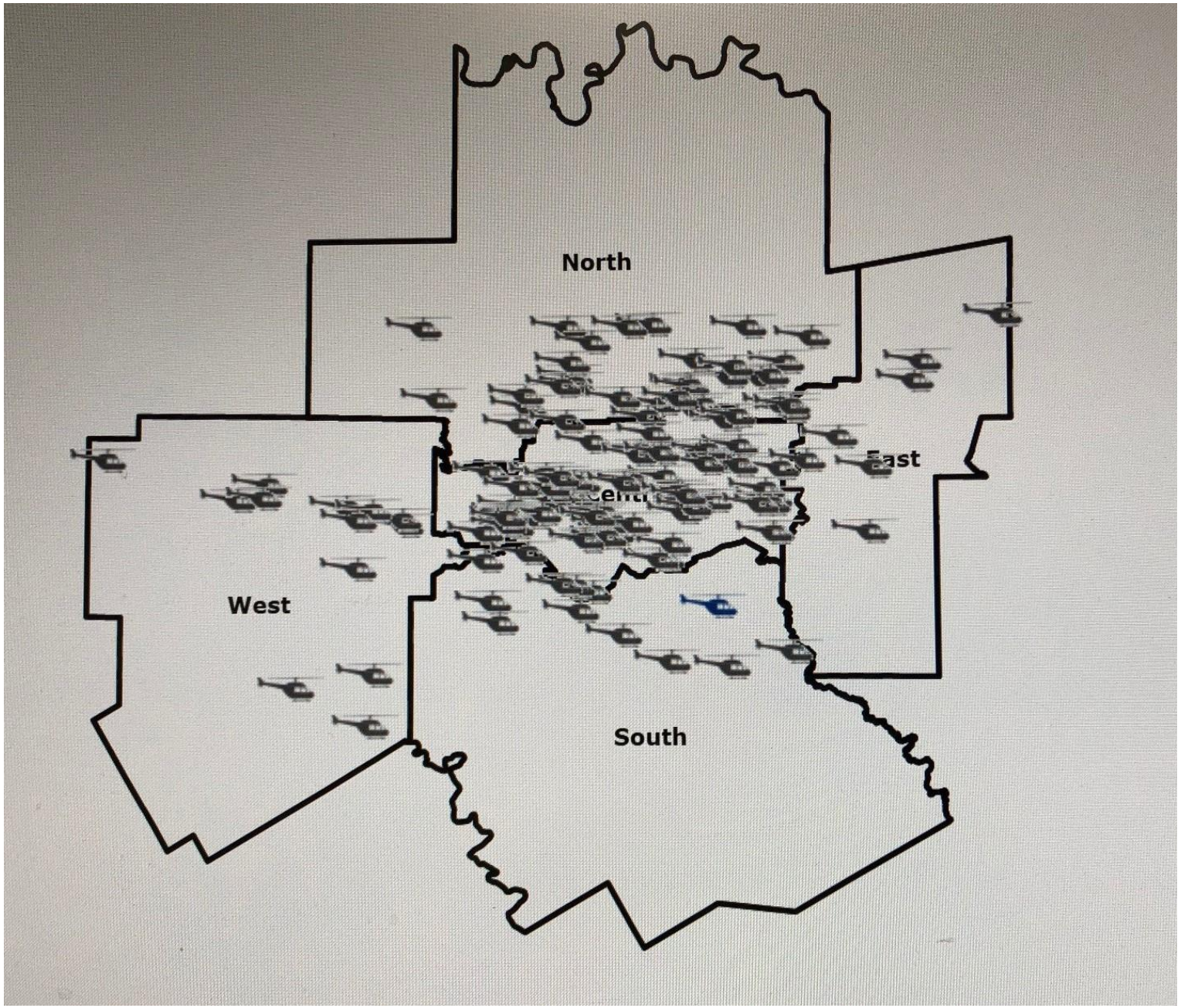
UAS Safety and Integration Task Force Meeting

June 29, 2021

DFW Area Heliports

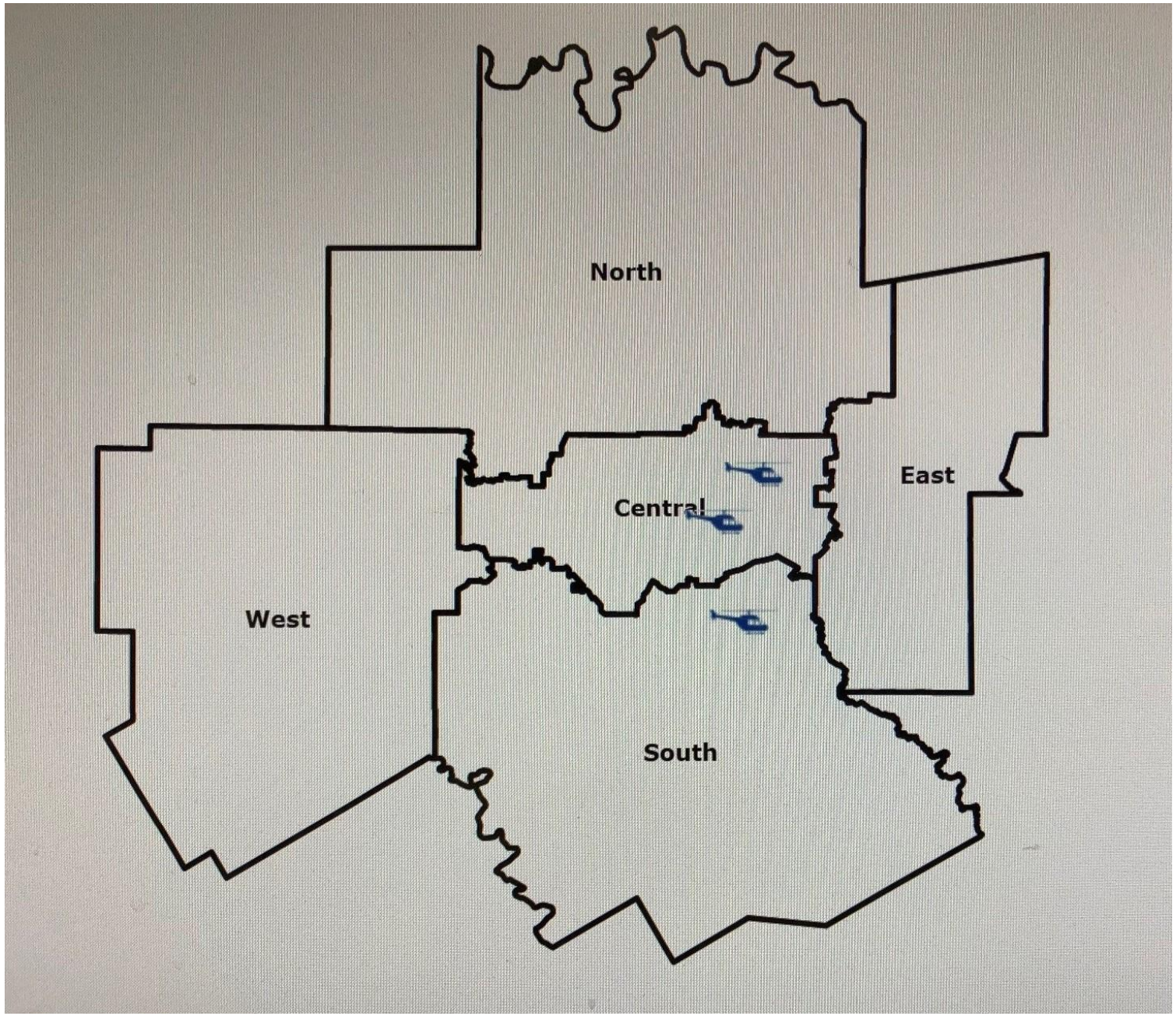
DFW AREA HELIPORTS

Source: NCTCOG
General Aviation & Heliport System Plan - Mapping Tool



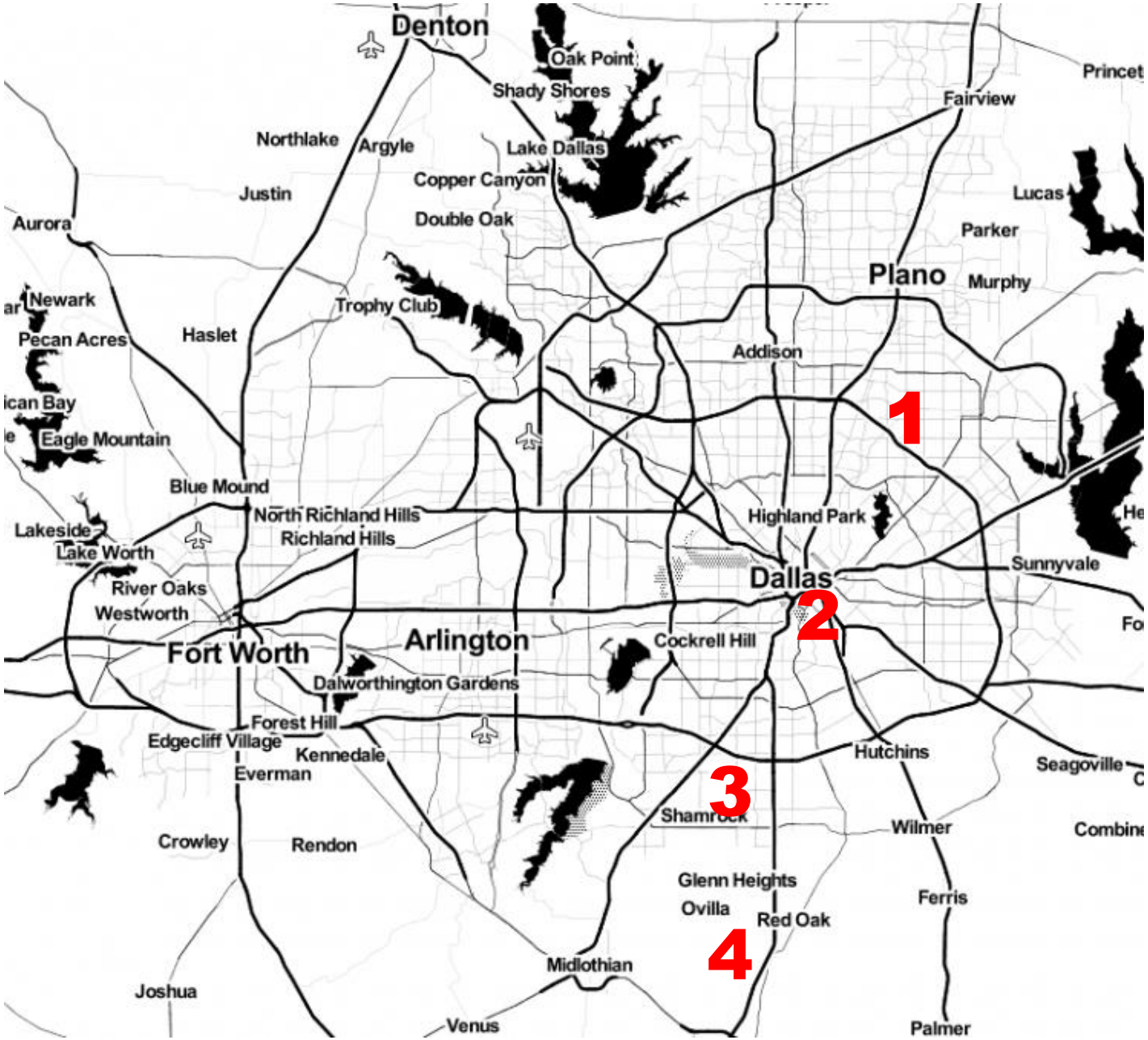
DFW AREA *PUBLIC* HELIPORTS

Source: NCTCOG
General Aviation & Heliport System Plan – Mapping Tool



DFW AREA *PUBLIC* HELIPORTS

1. Garland/DFW Heliport
2. Dallas CBD Vertiport
3. Heliport DeSoto
4. Ferris Red Oak Heliport



Ferris Red Oak Heliport

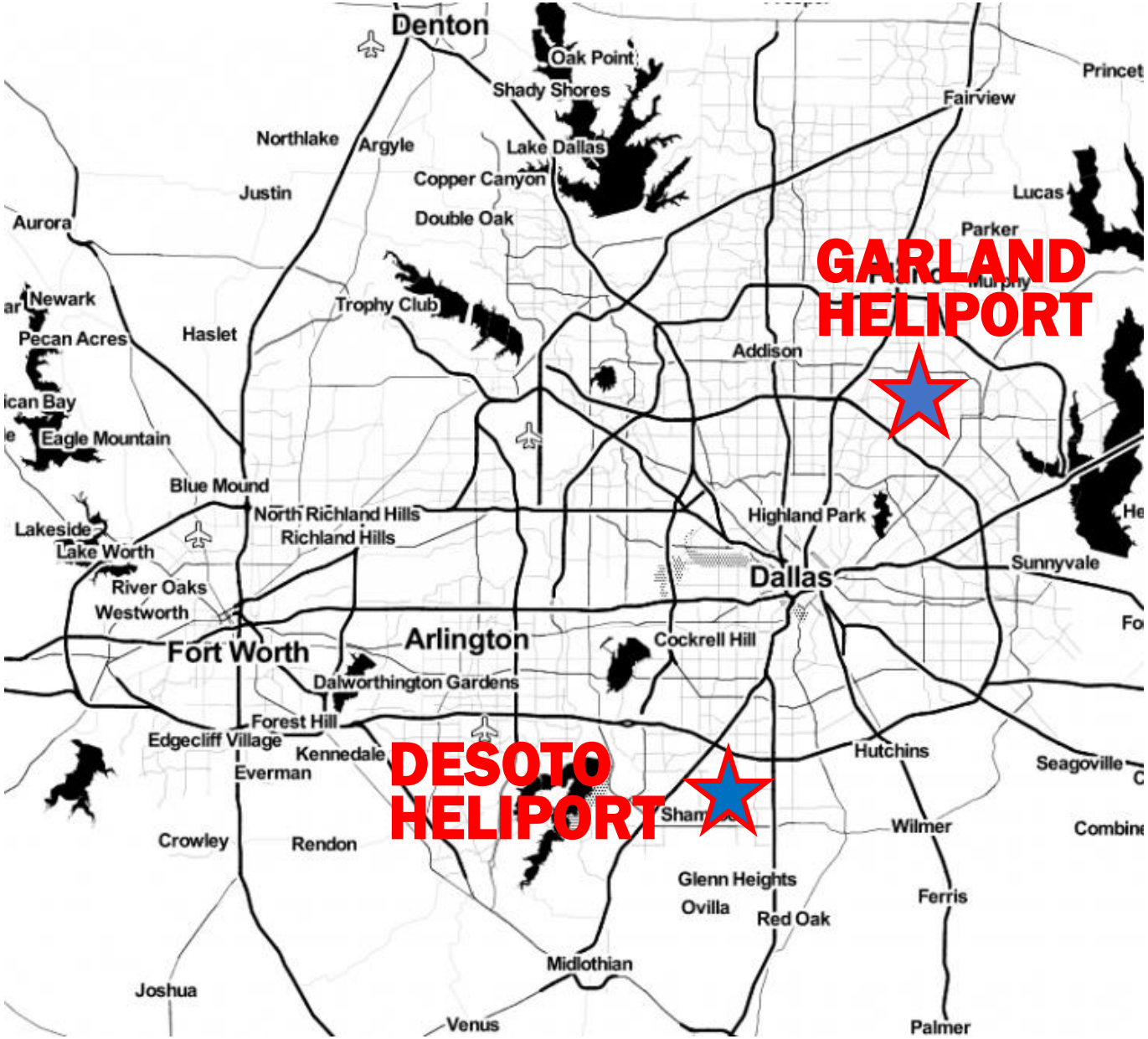
Ellis county

Dallas CBD Vertiport

Downtown Convention Center

DFW AREA *PUBLIC* HELIPORTS

with FBO Services,
Hangar & Fuel Sales
480V 3Φ Power
Fiber Internet



Garland/DFW HELIPORT

FAA-Approved Public Facility
Opened 1989
Initial Build-out 1993
Expanded 2005
Expanded 2012

Garland/DFW HELIPORT

SKY Helicopters - FBO

8 Acres - Long-Term Land Lease

part 145 Repair Station

part 135 Air Carrier

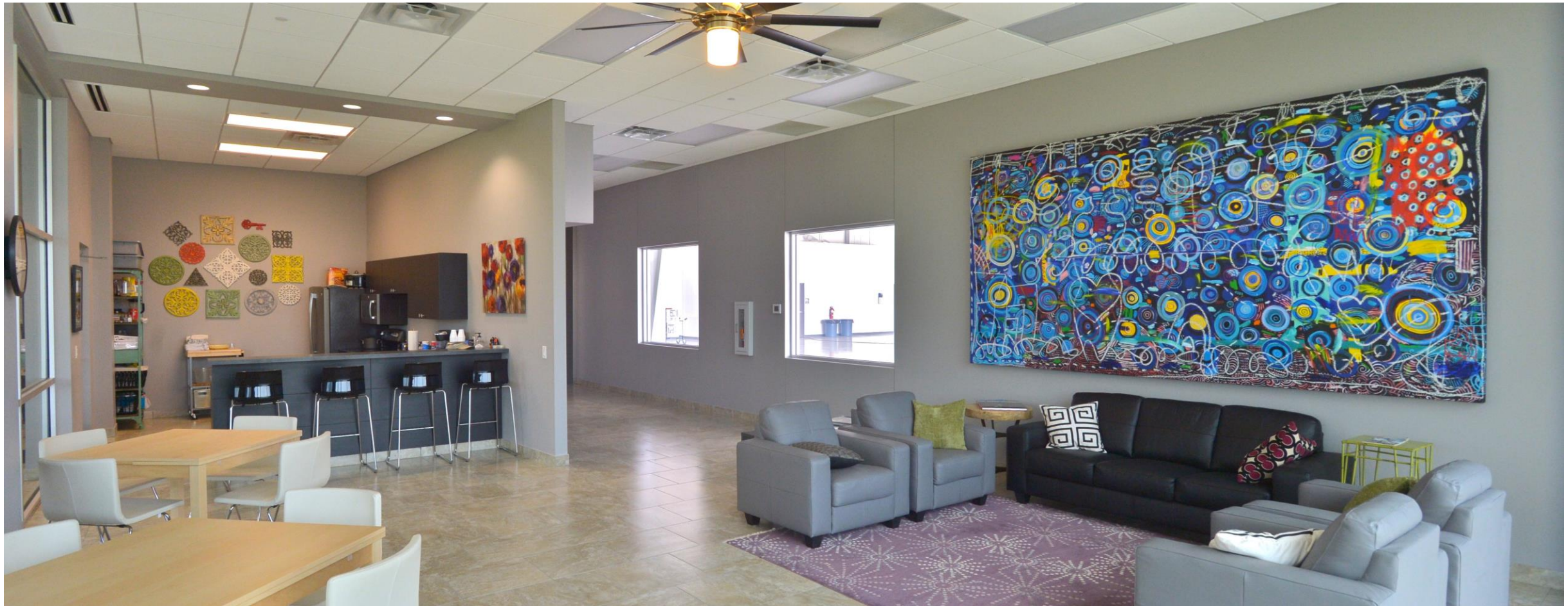
part 141 Training

HELIPORT DeSoto

FAA-Approved Public Facility *SKY Helicopters – FBO*

HELIPORT DeSoto

Corporate Tennant - *PHI AirMedical*



HELIPORT DeSoto

EMS, Maintenance Base

HELIPORT DeSoto

US Training base, Fuel Sales

HELIPORT DeSoto

19 Acres, Long-Term Land Lease

HELIPORT DeSoto

Easy Metroplex Access, I-20/I-35/I-45

Questions?

Contact Info:

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SKY Helicopters, Inc.
Garland/DFW Heliport
2559 S. Jupiter Road
Garland, TX 75041
(214) 349-7000
www.skyhelicopters.com

Can Texas lead Advanced Air Mobility?

Dan De Clute-Melancon - SkyStations

Intro

- AAM – Advanced Air Mobility
  - RAM – Regional Air Mobility
  - UAM – Urban Air Mobility

DoD interest & support – Agility Prime / SBIR / STTR

- Round 1 – Drones
- $42 billion by 2025

- Round 2 – eVTOL aircraft
- $9 trillion by 2050

AGILITY PRIME

NASA

NARI
NASA AERONAUTICS RESEARCH INSTITUTE

eVTOL Aircraft

Vertical Aerospace
$2.2B SPAC - $BSN

Archer Aviation
$3.8B SPAC - $ACHR

Joby Aviation
$5.7B SPAC - $RTP

Lilium
$3.3B SPAC - $QELL

Airbus

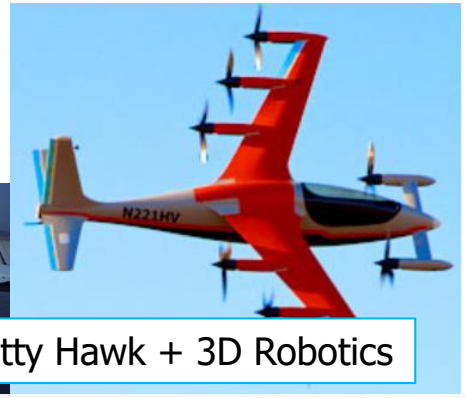
Lift Aircraft – Austin, TX

Ehang
NASDAQ: EH

Volocopter

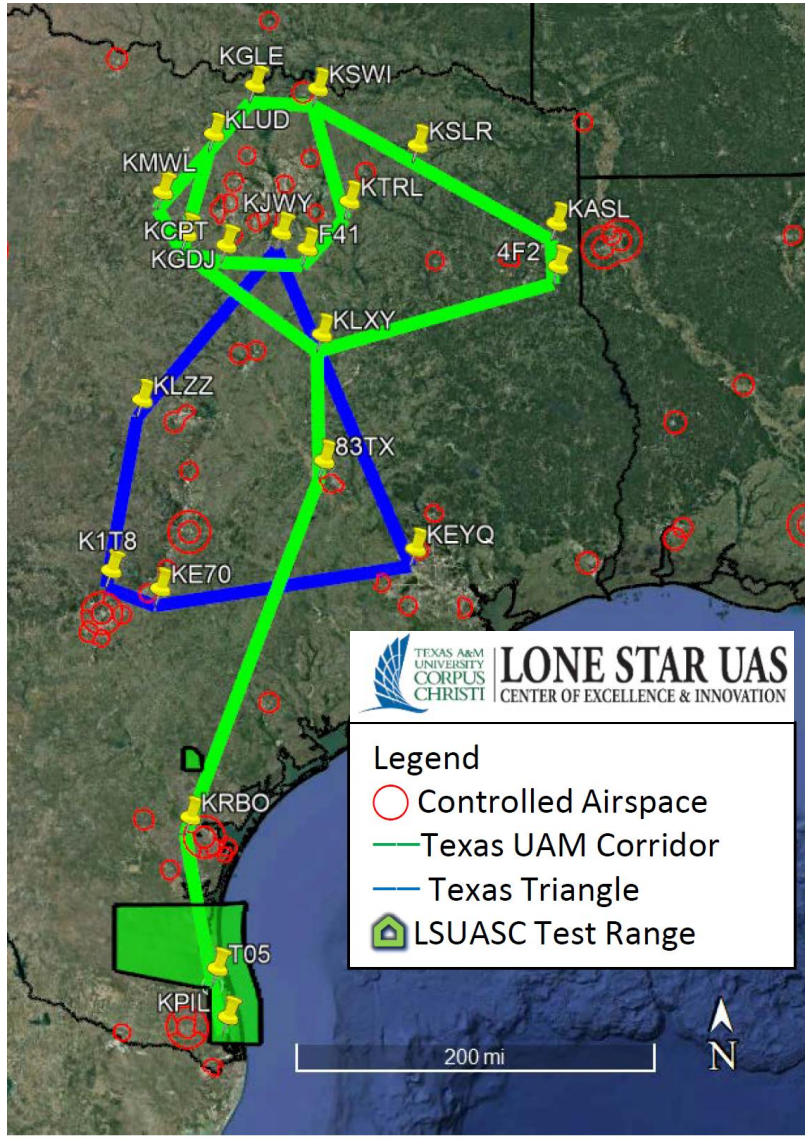
Beta Technologies

Wisk Aero (Boeing JV)



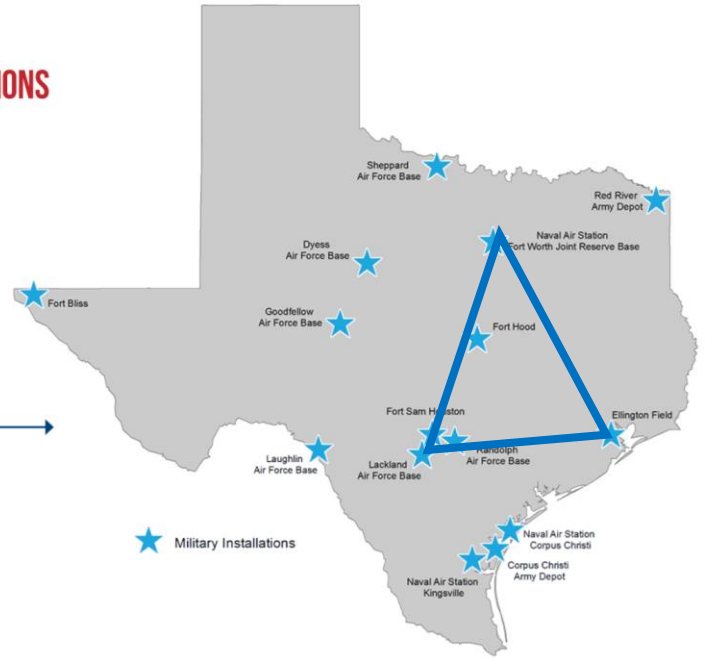
Kitty Hawk + 3D Robotics

Texas - AAM / RAM / UAM



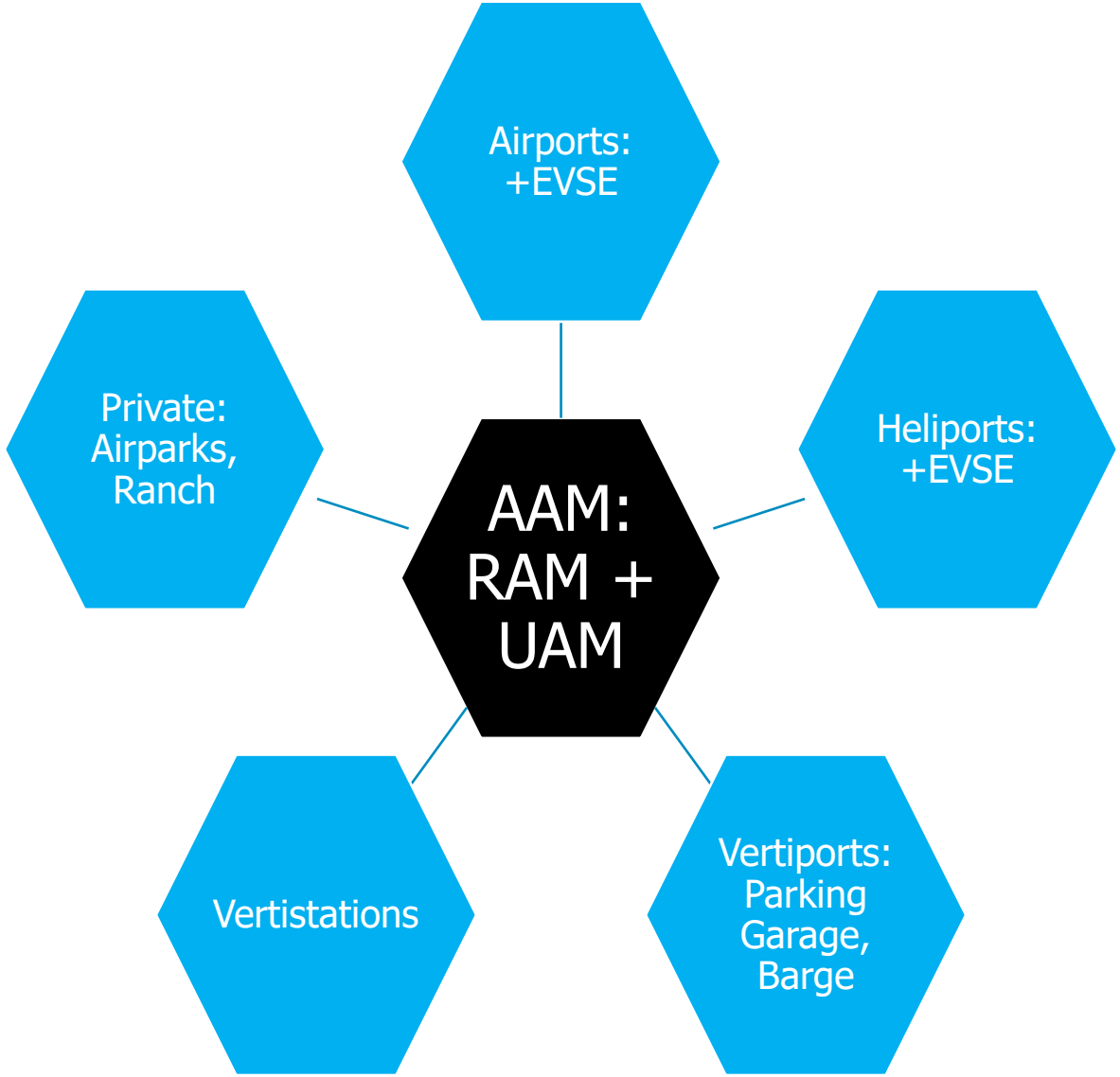
TEXAS COMMERCIAL AIRPORTS

MILITARY INSTALLATIONS IN TEXAS



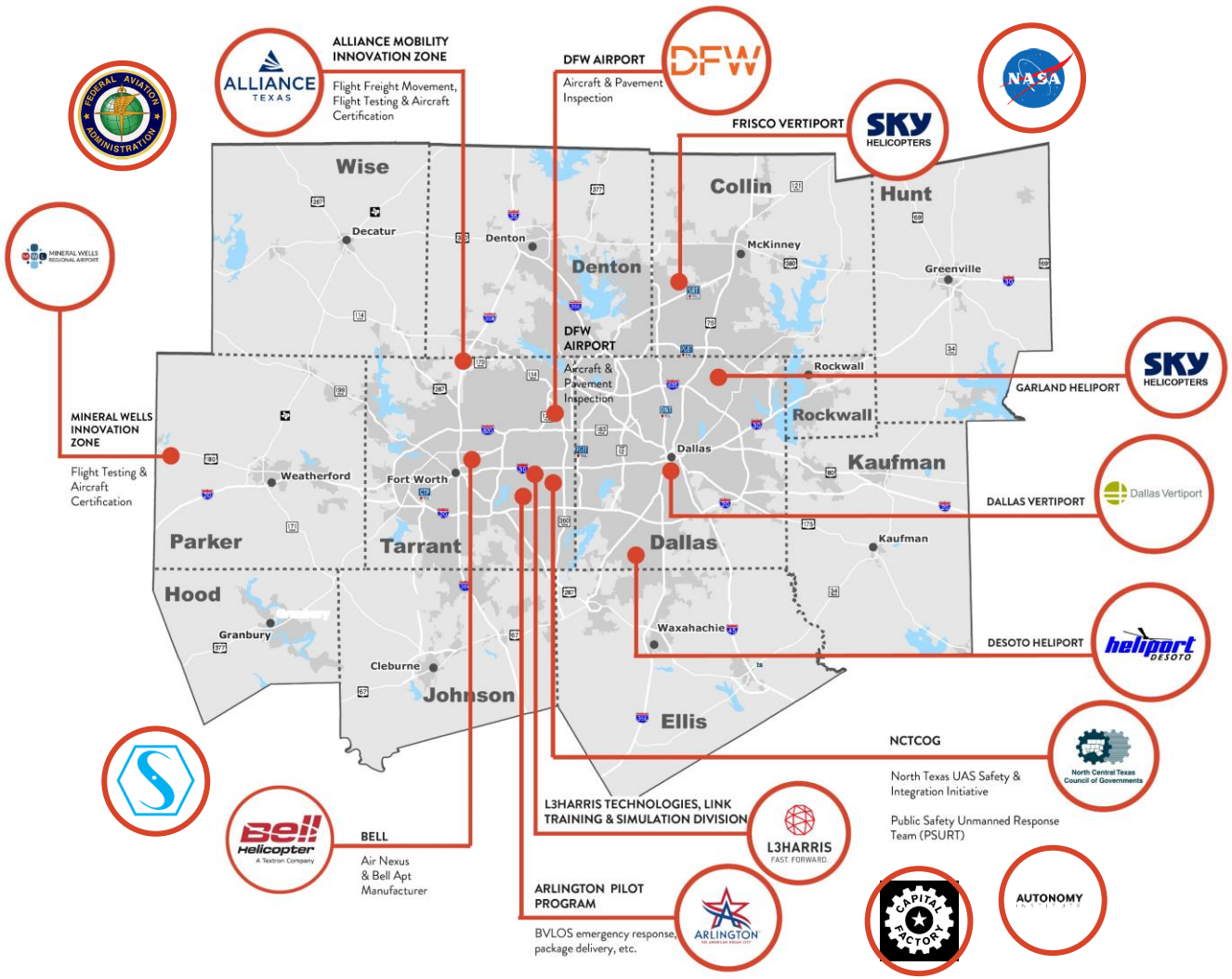
AAM Infrastructure – Need Electrification

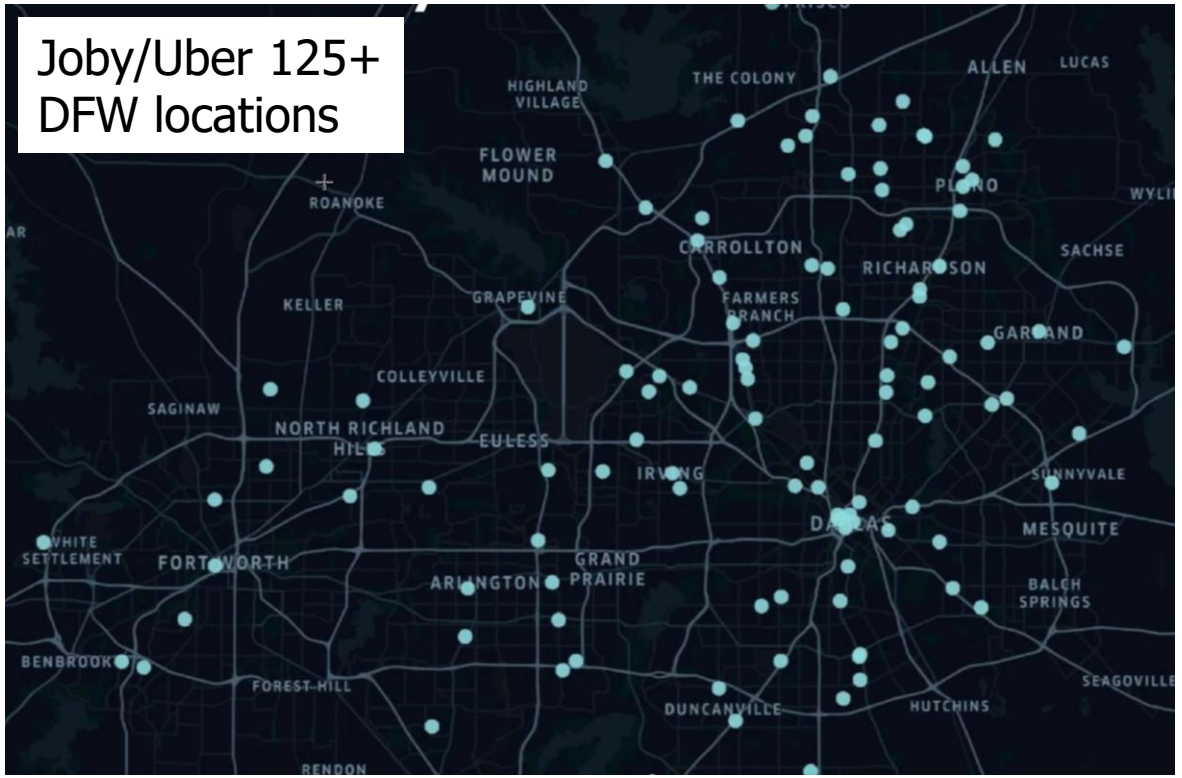
"Dallas Skyport" by The Beck Group, Dallas



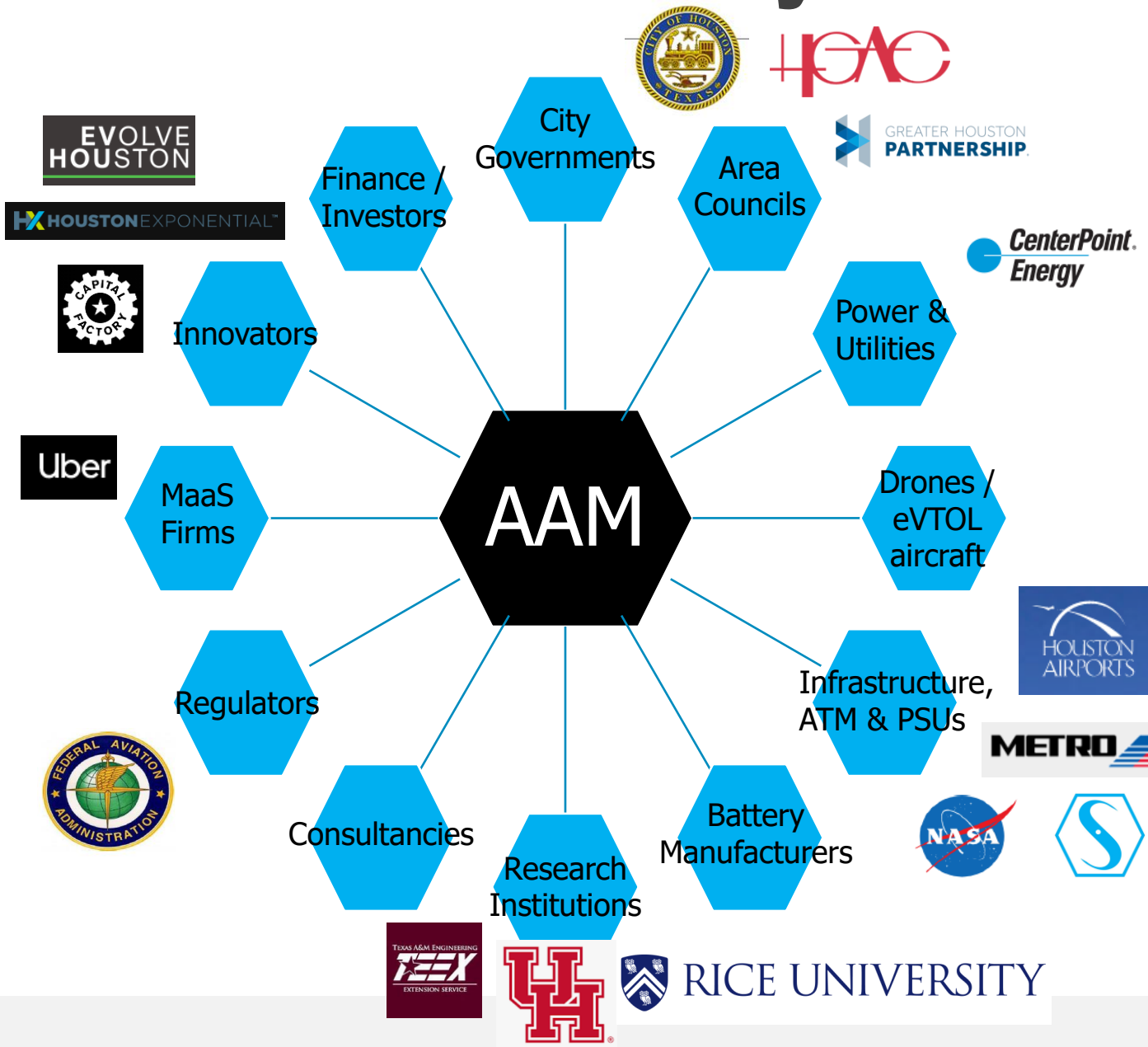
Dallas-Fort Worth - AAM Ecosystem

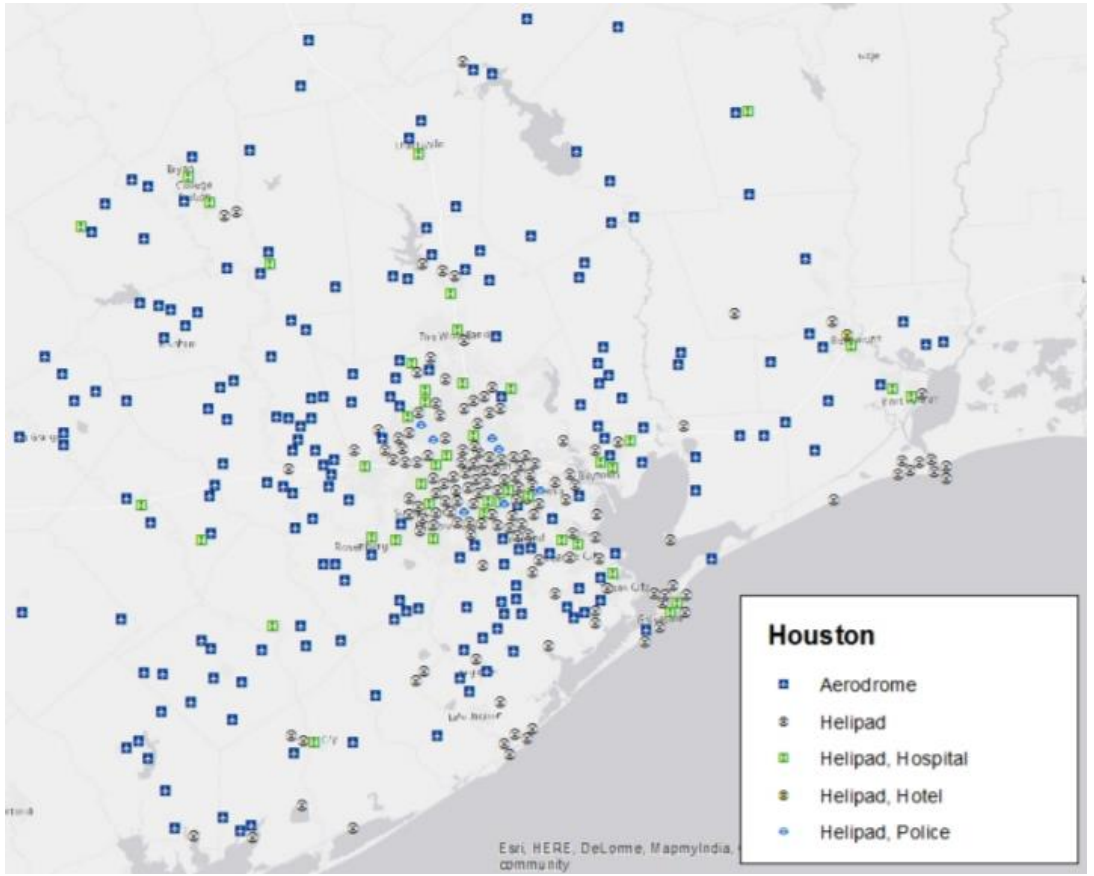
North Central Texas Council of Governments





Houston - AAM Ecosystem

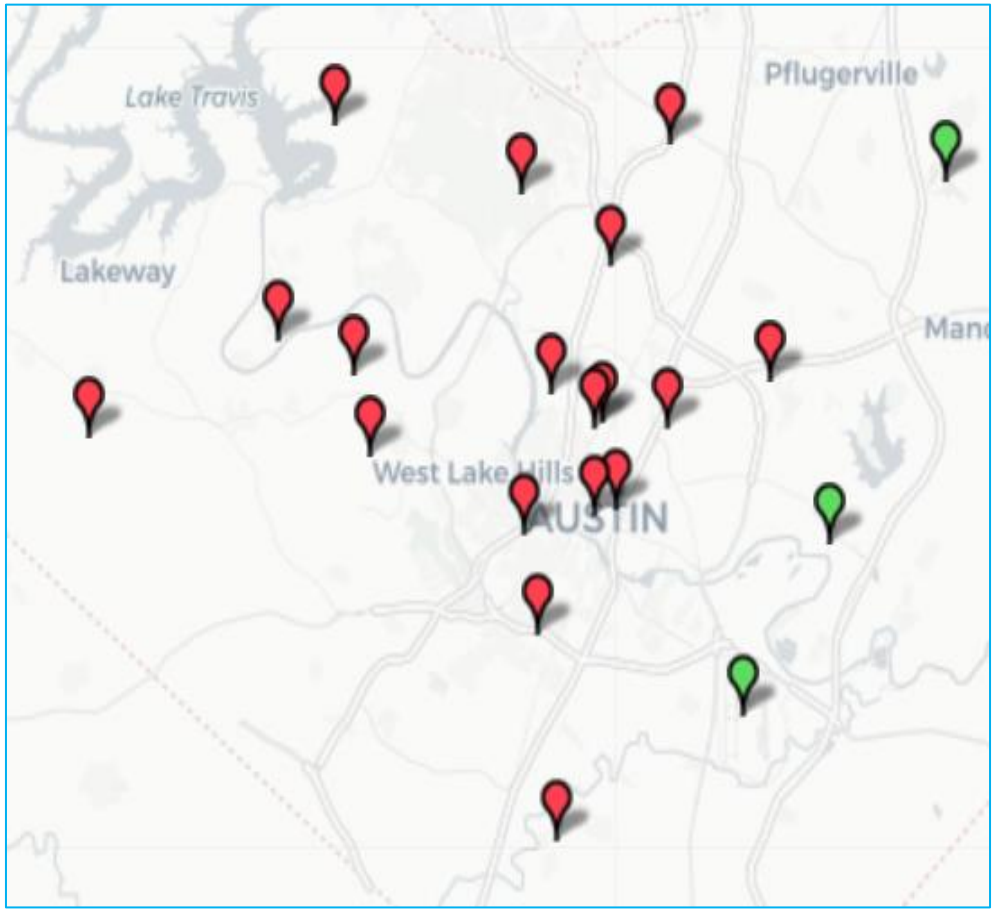




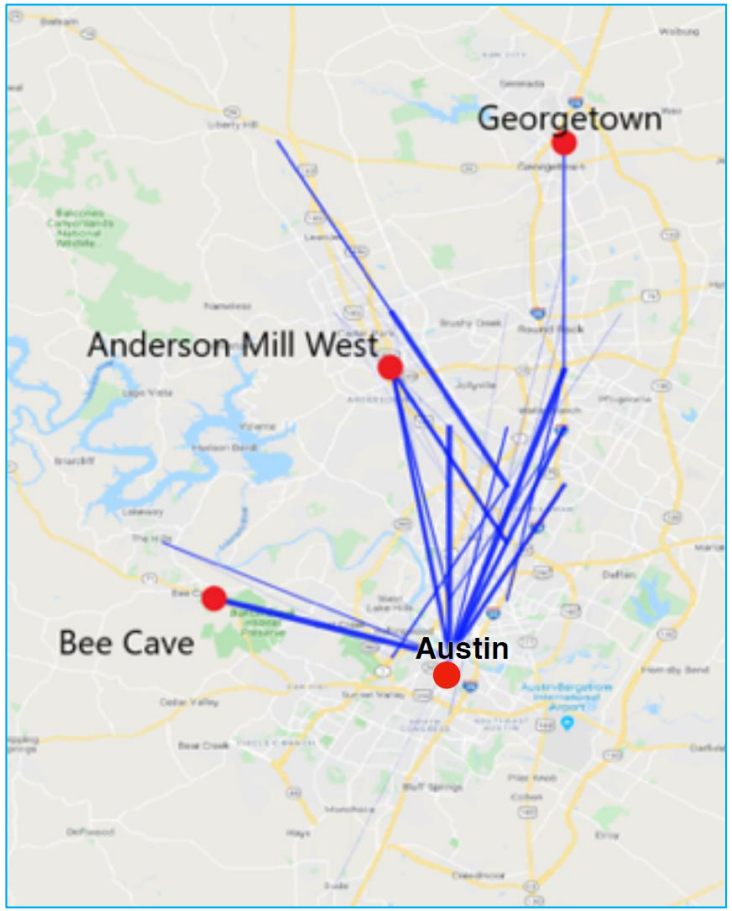
Black & Veatch

189 aerodromes
195 helipads
100 mile radius

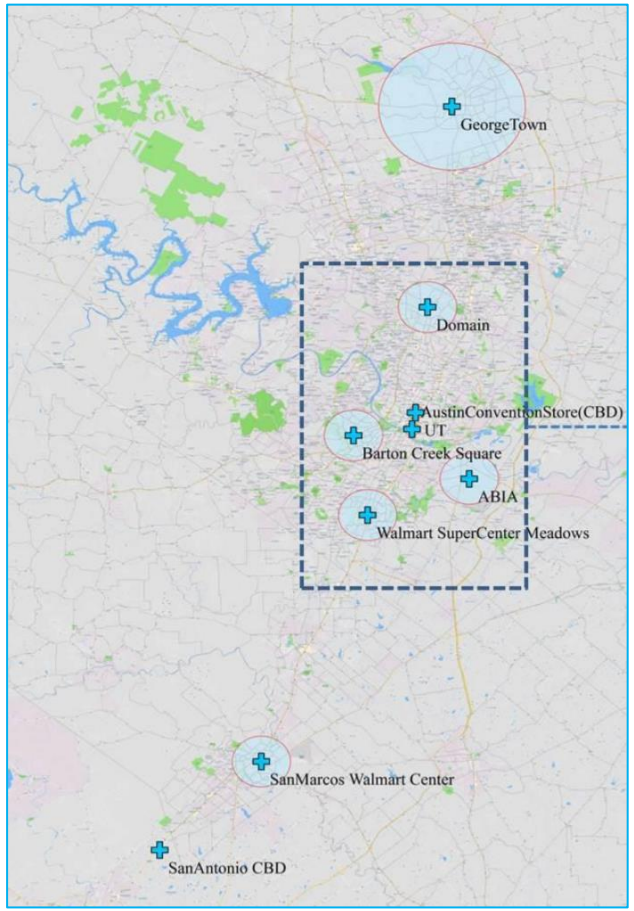
Austin – Urban Air Mobility



Existing
Heliports & Airports



4 Vertiports
INRIX Research (2019)



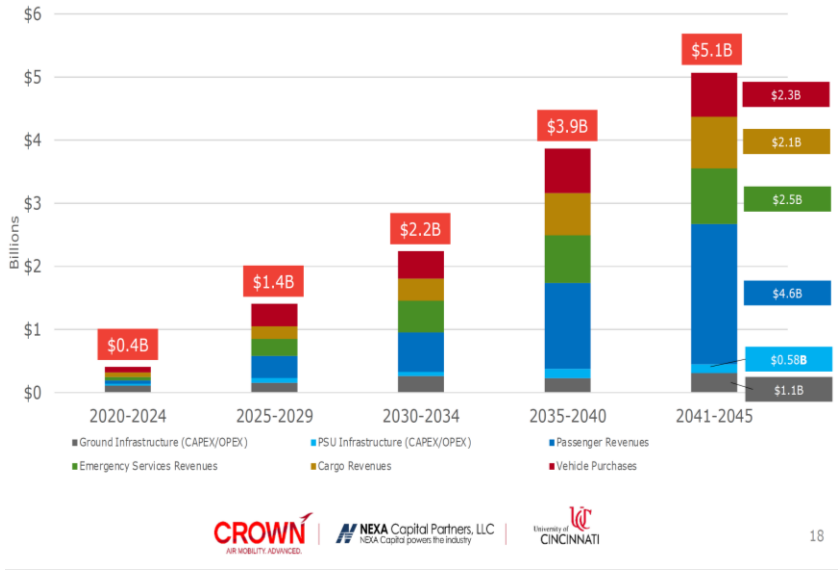
9 Vertiports
UT Austin Research (2020)

Ohio Advanced Air Mobility Opportunity

$13B
Economic Activity

15,000
Additional Jobs

$2.5 Billion
Tax Revenues



1st AAM Charger
$226,000 in grant from JobsOhio's Ohio Site Inventory Program (OSIP) to the Springfield-Beckley Municipal Airport (SGH)

	Ohio	Texas
Area	44,825 mi^2	268,597 mi^2 (6x)
Population	11.8 million	29.1 million (2.5x)
GDP (2020)	$0.59 trillion	$1.76 trillion (3x) (world's 9th largest)

Interested in Joint Industry Partnership for Texas AAM Economic Analysis?

AAM Launch Cities

Minneapolis
City of Lakes

Canadian
AIR MOBILITY

massDOT
Massachusetts Department of Transportation

massport

WSDOT

Ohio

New York City

CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

Can Texas Lead AAM?

Orlando

Miami

LADOT

North Central Texas Council of Governments

ODOT Oklahoma Department of Transportation

GDOT Georgia Department of Transportation

SkyStations™

What's the next step?

Daniel De Clute-Melancon

+1.346.228.5572

dan@skystations.co

www.skystations.co

Legislative Update

Nicholas Allen

North Central Texas Council of Governments

UAS Safety and Integration Task Force Meeting

June 28, 2021

87th Legislative Session

HB 1758 (Krause) - Relating to the operation and use of an unmanned aircraft.

- Defines “drone”
- HB 1758 also ensures that law enforcement agencies seeking to use drones must adopt written policies detailing the agency’s use of force via drone and transmit those policies to the Texas Commission on Law Enforcement annually.

SB 149 (Powell) - Relating to the prosecution of the offense of operation of an unmanned aircraft over certain facilities.

- Also adds airports and military installations to the list of critical infrastructure

Questions and Comments

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