

Texas A&M Transportation Institute



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Senior Research Scientist

Presentation Outline

- Who is the Texas A&M Transportation Institute
- Literature Review
- TTI Team
- Deliverables
- Timeline

Vision

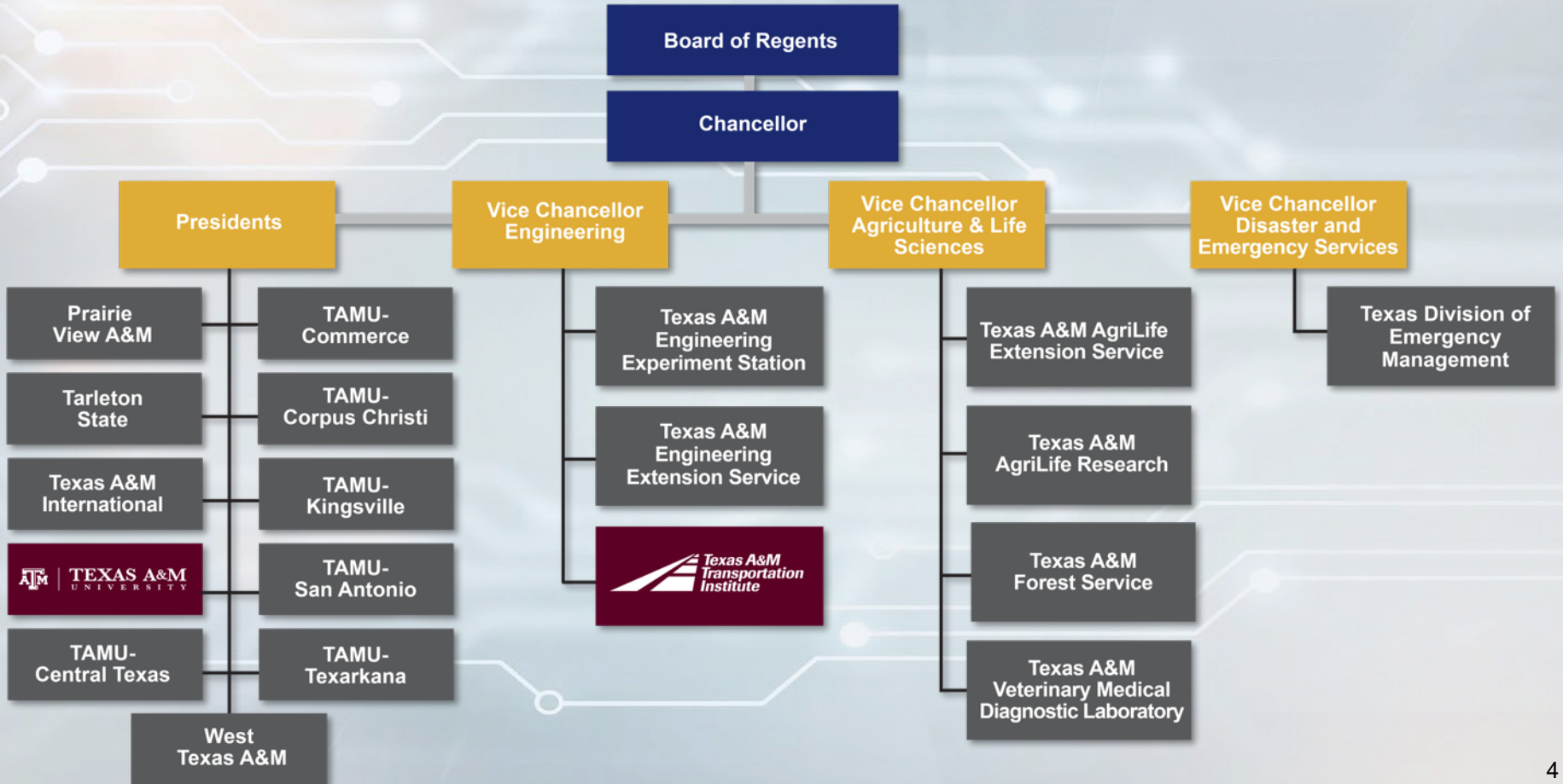
TTI leads in the creation of knowledge that transforms transportation for the benefit of society.



Mission

TTI delivers practical, innovative and sustainable solutions to improve the movement of people, data, and goods through research, education, and technology transfer.

THE TEXAS A&M UNIVERSITY SYSTEM



Our Research Portfolio



Facts & Locations

★ **Headquarters**
College Station
Bryan

■ **Urban Offices**
Arlington
Austin
Dallas
El Paso
Houston
San Antonio
Waco

● **TTI Presence**

El Paso

Arlington Dallas

Waco

TTI-HQ

Austin

San Antonio

Houston

Public and
Private
Sponsors



200+

700+



Annual
Projects



\$66.9M

Annual
Research
Expenditures

Professional
Researchers

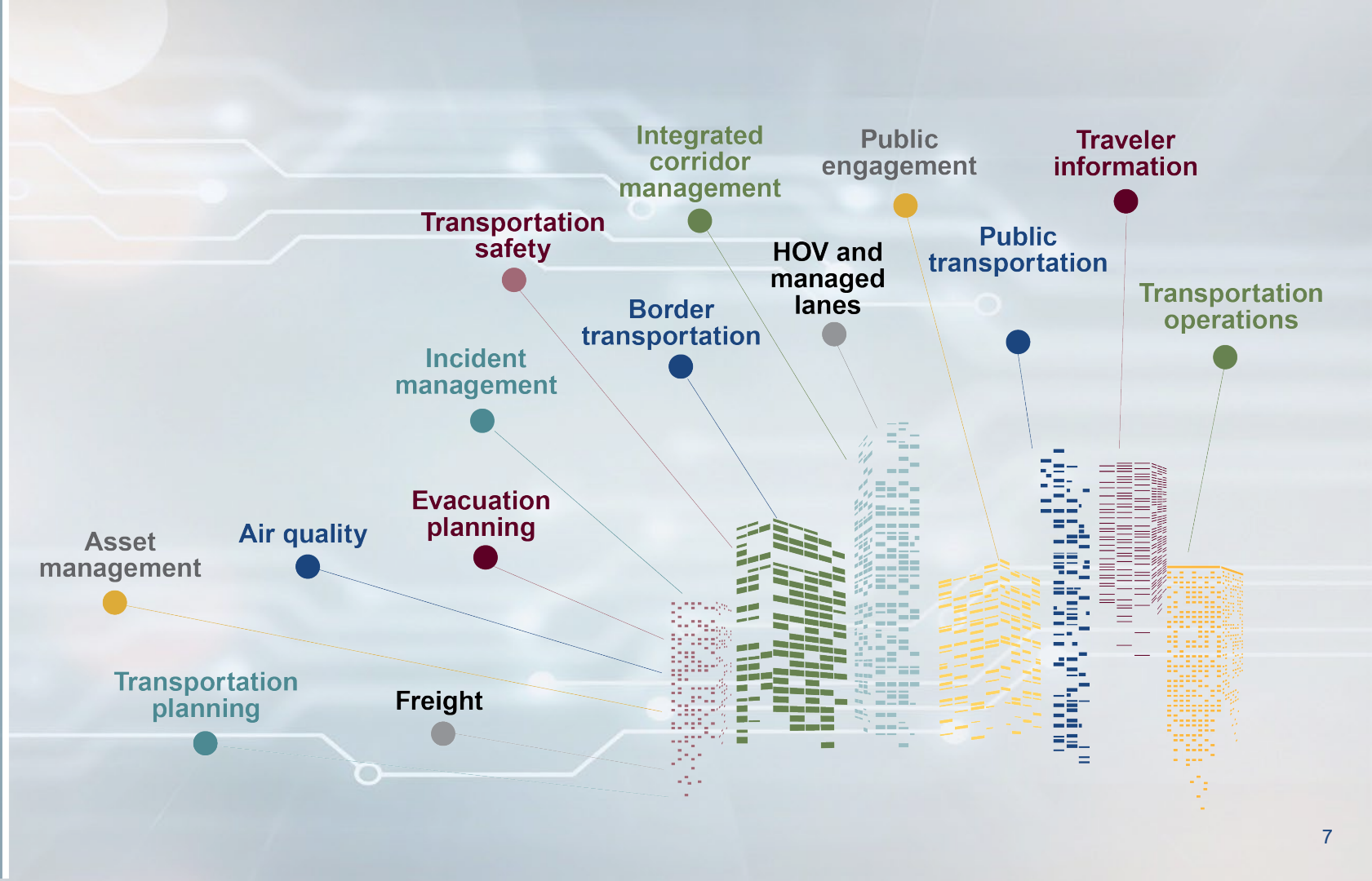
400+



200+

Students

Mobility in the Urban Environment



Environmental and Emissions Research Facility

- **Environmentally controlled test chamber**
- **Large enough for a full size tractor/trailer combination**
- **Controls include:**
 - Temperature (-20 – 55 °C)
 - Humidity
 - Solar Loading
 - Wind
- **Used with emissions testing, cold starts, performance testing, and many other temperature-controlled tests**
- **Fully automated controls for long term exposure testing under any temperature cycle**



New TTI complex

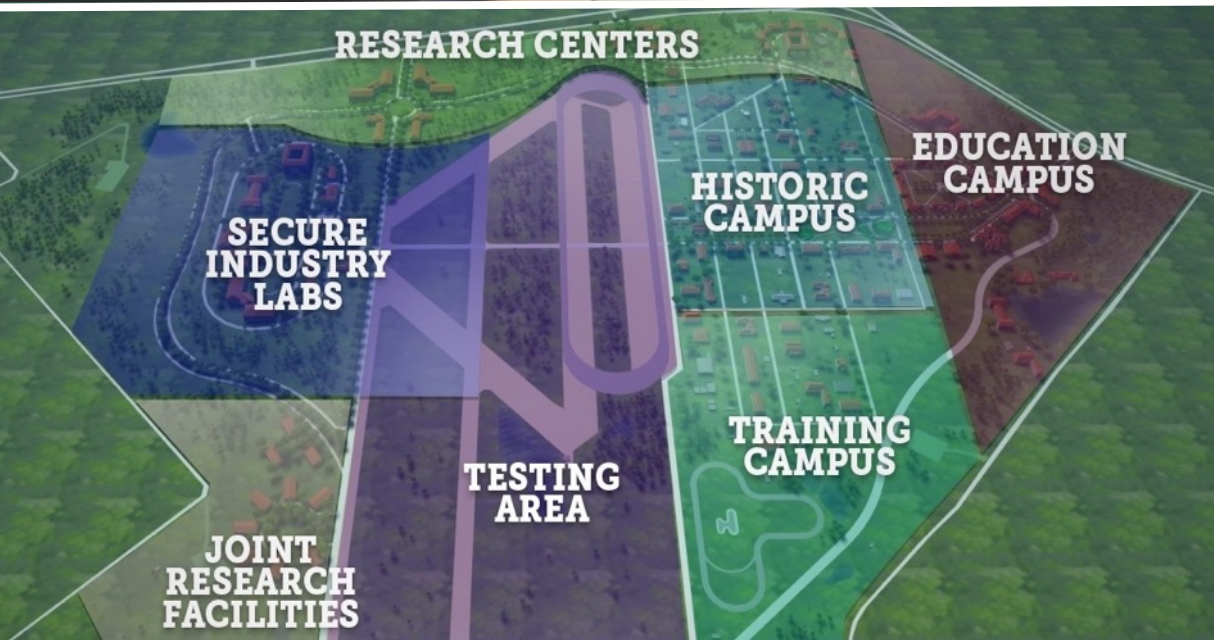


- **New Facility will include:**

- Upgraded cooling capacity (-40°C) in chamber
- New heavy duty chassis dynamometer
- New Small chamber for component testing
- New power lab
- EV charging stations for research

Visibility Lab – Signs and Markings





ATM **RELLIS**
THE TEXAS A&M UNIVERSITY SYSTEM

2,000 Acres
TTI Facilities
Workforce Development
Industry Collaboration

Connected Transportation is Our Future



Literature Review

- Purpose

- Provide background information on UAM/AAM
- Develop materials for public meetings
- Provide a starting point for the committee's work
- Provide a focus on those areas that can help the state “facilitate the development of urban air mobility operations and infrastructure.”

Literature Review

- Worked with TTI Research Librarian
 - TRID Database and Westlaw
 - **TRID** is an integrated database that combines the records from TRB's Transportation Research Information Services ([TRIS](#)) Database and the OECD's Joint Transport Research Centre's International Transport Research Documentation ([ITRD](#)) Database. TRID provides access to more than 1.3 million records of transportation research worldwide.
 - Industry Publications
 - Private, Governmental, Non-Profit
 - Existing State Legislation
 - Additional Expert Interviews (next year)

Literature Review

- **Numerous UAM/AAM Studies**
 - NASA Sponsored Market Studies (Booz/Crown)
 - National Academies: Advanced Aerial Mobility: A National Blueprint
 - Consulting Firms: McKinsey, KPMG, Others
 - Industry/Corporate Reports (Airbus)
 - Industry Trade Organizations (NATA)
 - Universities (George Mason, Georgia Tech)
 - States and Cities (Ohio, North Dakota, Toronto, Others)

Literature Review

Emerging Topic Areas

- Legal
- Environmental
- Regulations
- Infrastructure
- Safety
- Operations
- Public Acceptance/Technology Adaption
- Demand

Other Key Issues

- Funding/Financing
- Facility Location
- Business Models

Literature Review: Preliminary Takeaways

Regulation/Legal/Environmental Issues

- A lot of focus on privacy, noise, and nuisance issues and the various roles of the Local, State and Federal Governments.
- Most of the literature assumes safety standards and equipment certifications will be handled at the federal level, but that states will play a role in regulations surrounding privacy, airspace management, environmental conditions, and land use.
- Airspace or traffic management may rely on state legislation and regulation to avoid a patchwork of local rules. Greater flexibility should be considered with an urban air traffic management system as opposed to traditional air traffic control in terms of design separation but also rules relating to automated operations.
- Key areas for regulation: flight crew licensing and training, landing areas, maintenance regulations, requirements for operators, UAM traffic management, databases for obstacles and terrain, and security regulations for passengers and personnel.

Literature Review: Preliminary Takeaways

Safety/Operations

- Standards and certifications are required for the new UAM vehicles, such as electric propulsion, tilt wing powered lift, and some future concepts, e.g. folding propellers.
- State regulations should consider the needs for an urban air mobility traffic management system (UTM), especially setting rules relating to minimum separation between vehicles in situations where a pilot may not be present. Pilot and user certification may differ under a UTM that is led by the state, but design and technical requirements should be standardized at the federal level.
- There is a greater need for standards in UAM in terms of minimum separation because of the higher densities and the greater number of origin and destination pairs
- Key areas for future consideration will surround autonomous operations, safety, and in-vehicle requirements for user operability or “piloted” conditions. Autonomous operations will bring additional challenges for a UTM such as separation, hazard detection, and communication with an operator on the ground.

Literature Review: Preliminary Takeaways

Operations (Continued)

- One possible approach to allow more air traffic is by creating airspace “cutouts” separate from traditional traffic and does not require air traffic control services
- Routing models, or dynamic routing, for optimal and cost-effective scheduling are being researched. These models consider different factors affecting flight times such as maintenance, passenger transfer, refueling, and other incoming and departing flights.
- Designated airspace corridors over public rights-of-way and airspace leasing are also being studied.

Literature Review: Preliminary Takeaways

Public Acceptance/Use

- Fast access and egress to vertiports as well as strong connections to other modes will be required to incentivize use of UAM.
- Acceptance and Adoption varies by demographics

Demand

- User's willingness to pay with relation to UAM is being studied to determine an appropriate cost of trips
- Initial UAM sites should be located in cities where demand exists, congestion is present, and people are wealthier. Weather can also impact where UAM is feasible. Areas like Colorado or Washington D.C. are not suitable locations at the moment given the harsh weather these states experience, while Florida and California are suitable due to their population size and land availability.
- A NASA market study found that to meet daily demand (about 55,000 trips) around 4,000 aircraft will be needed. Additionally, the market value of UAM demand was found to be worth approximately \$500 billion, but the initial operational and logistical issues could hinder how much of that value is captured.

Literature Review: Preliminary Takeaways

Infrastructure

- The literature proposes installing TOLAs where unused land is available, noise is already present, and obstruction is minimal. TOLA could be installed within clover leaf clearings, barges, parking lots/garages.
- In terms of infrastructure design, the type of aircraft will affect the site dimensions and therefore costs. For example, a site for a 3-pod landing, including electric infrastructure, could cost anywhere from \$900 thousand to \$10 million to install.
- An investigation of Texas' electrical grid is necessary to integrate eVTOL in the state. This includes looking at upgrades, changes in electricity demand, and how use will change in the upcoming years.
- Infrastructure availability and capacity, along with cost, can be a major barrier to realizing demand potential.
- Potential use of existing, underutilized airports

Other States

- Reviewing state UAM Studies/Planning Efforts

Literature Review: Preliminary Takeaways

Existing Texas Legislation

Initial review of Texas Code shows no statutes which limit the ability to develop operate an urban air system if aircraft are operating at a height of 400 feet or greater. Some considerations include the following:

Noise

- Under current law, air navigation facilities (federally obligated) are required to provide adequate noise abatement and soundproofing for public buildings within 65 feet of the facility or which meet federal standards for requiring noise abatement assistance. It is anticipated that many of the vehicles utilized for urban air operations will be electric, lessening noise significantly, but there could be noise conflicts with buildings in very close proximity.

Privacy

- Texas statute does not prohibit the operation of aircraft in a UAM capacity, as long as these vehicles are operating at 400 feet or higher. Like privacy concerns with drones, privacy issues could arise. Under Texas General Code Section 423.006, there is statute related to civil action for an owner or tenant of privately owned real property in this state for an unauthorized image.

Literature Review: Preliminary Takeaways

Existing Texas Legislation (continued)

Airspace

- Air rights is defined as a part of what is considered “real property” in Texas statute, but air rights are never explicitly defined. Airspace in urban areas is in large part controlled by the Federal Aviation Administration or local ordinances related to building heights, and many questions exist related to how much of the air above a property the owner actually owns and controls. Airspace above private property is no longer private at a certain point for air traffic, and airspace above private property is subject to reasonable air traffic travel.

Traffic Management/Operations

- While traffic management is a core issue in urban air mobility, Texas code leaves flexibility in certain situations for aircraft landing on county roads. There are also provisions for licensing ground vehicles at airports that may have some relevance to vertiports or UAM facilities.

TTI Team

- Jeff Borowiec, Ph.D.
- Brianne Glover, J.D.
- Jacki Kuzio, Ph.D.
- Bill Prieto, MPA
- Kirbie Ferrell, MPA

Deliverables and Timeline

- Literature Review is a starting point for the committee's work
 - Your input is critical
 - *“...the advisory committee shall report to the commission and to the members of the legislature the committee's findings and recommendations on any changes to state law that are needed to facilitate the development of urban air mobility operations and infrastructure.”*
- Preliminary Draft Report: December 31, 2021
- Public Hearings/Meetings: January 15, 2022 – April 30, 2022
- Draft Report Due to Advisory Committee: June 1, 2022
- Final Report Due to TxDOT: August 1, 2022
- Report (Findings and Recommendations) Due to Legislature: September 1, 2022

Questions?



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