TEXAS

ADVANCED AIR MOBILITY

Report and Recommendations of the Advanced Air Mobility Advisory Committee

Prepared for
The Texas Legislature

Prepared by
Texas State University

September 2024

This report was prepared on behalf of the Texas Advanced Air Mobility (AAM) Advisory Committee by Texas State University with support from the Texas Department of Transportation

Special thanks to Senator Tan Parker and Representative David Cook for sponsoring the enabling legislation and their staff members, especially Nick Eastwood and Sara Trott.

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EXECUTIVE SUMMARY

The Advanced Air Mobility (AAM) Advisory Committee, created by the Texas Department of Transportation as required by SB 2144 [88(R), 2023] offers this report to provide information and recommendations to support the Texas Legislature's decision-making regarding AAM.

WHAT IS ADVANCED AIR MOBILITY (AAM)?

The US Congress believes the US should become a global leader in AAM, which the Federal Aviation Administration (FAA) refers to as a new era of aviation. As frequently occurs in the beginning of any emerging industry, there is not a consistent definition of all terms. Advanced Air Mobility (AAM) is a term for which different entities offer slightly different definitions.

The AAM Advisory Committee has chosen to follow the federal working definition of AAM used in the AAM Coordination and Leadership Act of 2022: "a transportation system that transports people and property by air between two points in the United States using aircraft with advanced technologies, including electric aircraft or electric vertical take-off and landing aircraft, in both controlled and uncontrolled airspace." In May 2024, the FAA Reauthorization Act of 2024 became law and officially defined AAM. AAM includes Urban Air Mobility (UAM) and Regional Air Mobility (RAM). UAM focuses on travel within urban areas (intra-city), while RAM aims to use underutilized airports for regional travel (inter-city). Both UAM and RAM, as components of AAM, will provide some form of services (e.g., cargo delivery, air taxis, medical evacuation).

These services are made possible by the AAM system, which includes aircraft, infrastructure, and regulatory landscape. For the purposes of this report, AAM aircraft include small Unmanned Aircraft Systems (sUAS) or "drones", and larger electric Vertical Take-Off and Landing (eVTOL) aircraft. Drones are typically electric, weigh less than 55 pounds, and operate autonomously or with a remote pilot. Though vertical take-off and landing aircraft like helicopters have transported people and cargo for years, eVTOLs use new propulsion technologies. Companies are developing piloted and autonomous eVTOL aircraft. As of the writing of this report, no company has received final FAA approval to carry people or cargo for hire. That said, the AAM industry is progressing rapidly, with nearly $10B invested in this space in 2022 and 2023, according to a study by McKinsey & Company. Additionally, the FAA is expecting to start approving aircraft for commercial operations starting in 2025 and continuing into the next decade.

Texas has existing physical infrastructure (airports, heliports) that can support AAM, but modifications and additional infrastructure will likely be needed for the scale-up and full implementation of this new sector. There is some digital infrastructure (air traffic control, flight management) that can support AAM in Texas, but it is available on a more limited geographic basis currently and will need to be expanded for full implementation.

WHAT IS AAM? (CONTINUED)

The FAA has exclusive authority over US airspace, managing air traffic control, airspace use, and safety. The FAA also regulates AAM aircraft and operator certifications and evaluates human impacts like noise and air quality. Integration of AAM into airspace will evolve over time, with near-term management using existing rules. State and local governments in Texas cannot regulate airspace use or aviation safety because of the FAA's exclusive authority. That said, the FAA works closely with the Texas Department of Transportation to maximize collaboration and aviation safety for Texans and those who visit Texas by air every day.

AAM has diverse uses in Texas, with many drone operations already active. Wing, partnered with Walmart and DoorDash, offers drone deliveries in Dallas-Fort Worth, Manna delivers food, coffee, and medical supplies in DFW, and Amazon provides drone delivery of small packages and prescriptions in College Station.

Drones deliver medications and medical supplies, aiding mobility-impaired people and providing emergency care. The Matador UAS Consortium aims to transport organs in the Panhandle. The Texas Department of Public Safety uses drones for inspections, border operations, emergency response, and locating suspects and recovering assets. According to Bard College, Texas leads in UAS adoption and utilization by public safety agencies.

Drones increase efficiency in public works and agriculture and have other diverse applications. In Texas, the Burlington Northern Santa Fe railroad uses drones for rail inspections, and Hylio offers cost-effective agricultural drones. Galaxy UAS in Fort Worth offers drone and airship solutions for overwatch and advertising, and the Texas Drone Company in Denton uses drones for inspections and 3D modeling.

To complement commercial activities, Texas also has several research centers expanding drone testing. The Texas A&M University-Corpus Christi's Autonomy Research Institute is one of seven FAA UAS test sites and includes a 12.9-mile beyond visual line of sight corridor. The North Central Texas Council of Governments (NCTCOG) runs an airspace awareness pilot program including 20 cities. Texas A&M's RELLIS Campus has a 2,300-acre Proving Grounds with several FAA waivers, including a 12-mile beyond visual line of sight corridor. The UAS Traffic Management (UTM) Key Site in DFW allows UAS operators to share data to inform the FAA's policy decisions and enable a safer shared airspace. The AllianceTexas Mobility Innovation Zone in Fort Worth supports real-world testing for AAM operations. The University of North Texas has a dedicated AAM test facility.

Furthermore, several companies are planning eVTOL operations in Texas. Bristow Group, a global helicopter operator headquartered in Houston, intends to diversify their operations and service offerings by utilizing AAM aircraft to support various end markets including its Gulf of Mexico energy customer base.

Wisk Aero aims to offer electric autonomous air taxi services in Houston by 2030 and is currently partnering with both the Sugarland Airport and the Houston Airport System to achieve this. United Airlines, Archer Aviation, and Eve Air Mobility are also among the companies planning for cargo and passenger AAM operations at the Houston Airport System within the next 10 years. DFW International Airport is moving forward with its strategic plan to support eVTOL (electric Vertical Take-Off and Landing) limited operations by 2026. The City of Arlington, along with the NCTCOG and DFW International Airport, is planning for a vertiport location at the Arlington Municipal Airport to use for the World Cup in 2026.

Texas also has some other eVTOL developments. Port San Antonio, a 1,900-acre tech campus in San Antonio, is considering AAM for cargo and employee transport. Joby and NASA conducted simulations in the DFW airspace to test eVTOL integration into busy airspace, showing dozens of aircraft per hour could operate from airport terminals. Skygrid is an Austin-based company developing integrated systems to address gaps in traditional air traffic management. The City of Fort Worth received a $2M SMART grant in 2023 to fund a program for testing weather sensors on routes used by autonomous vehicles.

WHAT ARE THE BENEFITS TO TEXANS?

Economic: The AAM industry can create jobs and boost economic activity in Texas. A national economic impact estimate, completed by Deloitte in 2021, projects the AAM industry to reach $115 billion by 2035, creating over 280,000 jobs. An economic study for Ohio forecasts $13 billion in economic impact and 15,000 jobs over 25 years. A similar study in Virginia predicts $16 billion in business activity and 17,000 jobs by 2045. A regional study by CalState Long Beach and Wisk shows significant economic benefits from constructing and operating a 20-vertiport network in the LA region. Construction would generate $174 million in labor income and $423 million in economic output, while yearly operation would generate $173 million in expenditures and $90 million in labor income. Additionally, a study done by Virginia Tech on drone deliveries shows they save time and increase sales, benefiting consumers and businesses. An Accenture study for the DFW Metroplex shows similar benefits.

Societal: AAM can also bring about societal benefits by improving access to emergency and healthcare services, increasing access to goods, reducing traffic, and increasing efficiency in other industries. An article by Mateen et al. shows that drones can reduce emergency response times of Automated External Defibrillator (AED) delivery by 78.8% and assist mobility-impaired residents, providing significant healthcare benefits. Drone deliveries can also improve access to goods, help avoid car crashes, and save travel miles.

Environmental: AAM aircraft, being predominantly electric, could significantly reduce greenhouse gas emissions in the transportation sector. Based on an article by Rodrigues et al., using delivery drones rather than diesel trucks can lower energy consumption by up to 94% and cut emissions by up to 84%.

WHAT ARE THE CHALLENGES?

Communication: Public understanding of AAM is limited, with concerns about privacy, noise, and safety. The AAM industry must communicate benefits and address concerns effectively. Developing communication resources can improve public awareness and mitigate issues.

Electricity: The growing AAM industry could strain Texas' electric grid, though it is unclear when this might happen. AAM operations, which rely heavily on electricity, could demand significant electrical capacity, with vertiports requiring 1 MW to 20 MW. Accurate estimates of demand and early communication with utility providers are crucial to ensure adequate capacity.

Safety: Ensuring the safety of AAM passengers and people on the ground is crucial. Managing air traffic for drones and eVTOLs at lower altitudes is challenging, especially in urban areas with obstructions. Integration with current airspace is necessary to prevent accidents. The automated nature of AAM also introduces cybersecurity risks. A collaborative, multidisciplinary approach can help ensure safety in Texas and the US.

Workforce: Piloting eVTOLs differs from piloting traditional aircraft, involving the navigation of dense urban environments with frequent take-offs and landings. eVTOL pilots require specialized training as take-off and landing technology is not fully automated. A 2022 McKinsey & Company study estimated 60,000 eVTOL pilots will be required nationwide by 2028. Additional workforce will be needed in other aviation-related occupations, such as mechanics, technicians, line staff, hospitality staff, drone operators and engineers. A coordinated approach among Texas education providers will help meet workforce needs.

WHAT ARE THE CHALLENGES? (CONTINUED)

Standards: Standards are crucial for aviation to ensure safety, streamlined operations, and consumer trust. While the FAA regulates AAM, Texas can promote uniformity in vertiport standards and zoning regulations. Without state encouragement, Texas could face a patchwork of different AAM regulations, making Texas unfavorable to industry.

Research and Development (R&D): The AAM industry faces R&D challenges due to its nascent technologies and operational frameworks. Key unknowns include optimizing battery and fuel technology, integrating AAM systems with air traffic management, vertiport infrastructure, and ensuring safety and security. Focused R&D efforts are needed to address these gaps.

HOW ARE OTHER STATES ADDRESSING THESE CHALLENGES?

Several states are preparing for the AAM industry. Based on the opinion of the AAM Advisory Committee, research for this analysis focused on state-led actions in Florida, Georgia, Ohio, and Virginia. When looking across these states and the various activities they are doing, all the efforts can be grouped into three major strategies: leadership, planning, and innovation. Texas would be well served by taking a similar approach.

To maximize the potential significant benefits of AAM and capitalize on Texas' natural advantages, the State needs to overcome some key challenges by providing leadership, plannintg, and innovation.

The recommendations are presented in more detail on the next three pages.

HOW CAN THE STATE HELP?

RECOMMENDATION 1.

LEADERSHIP

Designate key industry and state points of contact to lead and coordinate the development of AAM in Texas.

1.1. AAM Advisory Committee
1.2. AAM Office (TxDOT)
1.3. AAM Position (OOG)
1.4. State Agency Information Sharing
1.5. AAM Pubic Awareness

RECOMMENDATION 2.

PLANNING

Create a series of coordinated statewide plans and working groups to help shape the future of AAM in Texas.

2.1. Statewide Strategic Plan
2.2. Statewide Economic Impact
2.3. Cybersecurity Risk Mitigation
2.4. First Responder Training
2.5. Statewide Airspace Infrastructure
2.6. Uniform Infrastructure Standards
2.7. Electrical Infrastructure
2.8. Workforce Development

RECOMMENDATION 3.

INNOVATION

Provide funding to TxDOT to create a program for state universities to support research and development for AAM technologies, products, and services in Texas by providing matching funds for federal grants and requiring a minimum percentage of community or industry match.

Recommendation 1. Leadership

Designate key industry and state points of contact to lead and coordinate the development of AAM in Texas.

Leadership is crucial for success and is essential for proper planning and strategic innovation. Without strong leadership, Texas will fail to capitalize on its natural advantages and reap the full benefits the AAM industry can bring, thereby falling behind other states.

1.1. AAM Advisory Committee. Direct TxDOT to continue and expand the AAM Advisory Committee, in part to support the development of the Statewide AAM plan.

Rationale: Continuation of the AAM Advisory Committee will allow members of the industry to share their contemporary and critical knowledge with policymakers and state leaders. Expanding Committee membership will also ensure all aspects of this wide-ranging emerging industry are represented. Additionally, Committee input on future AAM plans will be critical. Their contribution to planning ensures that the State and industry work together on critical issues to produce comprehensive plans.

AAM leadership in Texas will require a combination of appointing key leadership roles and coordinating communication, as detailed in action steps 1.1 – 1.5.

1.2. AAM Office (TxDOT). Create an office at TxDOT to provide technical support for AAM infrastructure at Texas airports, with a particular focus on electric and autonomous AAM aircraft needs.

Rationale: TxDOT coordinates the funding and management of capital improvement projects at the State's nearly three hundred General Aviation airports, which will play an important role in AAM implementation. TxDOT needs a focused office dedicated to AAM to foster expertise and allow for the efficient integration of AAM infrastructure into the existing transportation network. Combining the knowledge and understanding of AAM with traditional aviation will accelerate the efficient adoption of AAM technology into cargo and passenger mobility operations.

1.3. AAM Position (OOG). Create a position at the Office of the Governor to increase adoption and awareness of Texas on the national and international stage to attract investment in autonomous vehicles including AAM technologies (for example, through demonstration day coordination, conference booths and presentations). Additionally, this position could provide guidance and resources to public safety agencies across the state to assist in the awareness of AAM technologies and how to safely interact with these services.

Rationale: The AAM industry has only recently emerged and faces issues related to public perception and understanding. A representative at the Office of the Governor (OOG) will raise awareness of Texas as a welcoming environment for AAM among industry leaders. The position will also serve as an AAM single point of contact for industry interests and public awareness.

1.4. State Agency Information Sharing. Reestablish the working group from HB 2340 (2019) and include members of the AAM community in the group.

> Sec. 418.055. The work group shall develop recommendations for improving the manner in which electronic information is stored by and shared among state agencies and between state agencies and federal agencies to improve the capacity of the agencies to:
>
> (1) respond to a disaster; and
> (2) coordinate the agencies' responses to a disaster.

Rationale: AAM aircraft can provide timely and critical information during disasters. Close coordination between agencies during a disaster is critical and inclusion of AAM information sharing protocols will maximize response efforts and ensure safe operations.

1.5. AAM Public Awareness. Develop communication materials to be posted on TxDOT's website to inform decision makers, the public, the aviation community, and recreational drone users about AAM.

Rationale: Other AAM leader states have addressed communication in part by having webpages dedicated to AAM on their Department of Transportation websites. These pages act as AAM information hubs, providing basic knowledge about the industry and linking to other authoritative sources. TxDOT should have space on their website allocated to AAM to help inform decision makers and the general public about AAM in Texas.

Recommendation 2: Planning

Create a series of coordinated statewide plans and working groups to help shape the future of AAM in Texas.

Planning will help ensure coordinated action at the state and local levels, bringing diverse opinions from a variety of players together. Planning will help maximize benefits and minimize risks and challenges. Without proper planning, Texas will fail to maximize the benefits of AAM for its residents and businesses.

2.1. Statewide Strategic Plan. Develop a statewide strategic plan which establishes a vision and direction for AAM including near-term, medium, and long-range goals in conjunction with industry and community representatives. This plan should include topics like AAM use cases; evaluation of existing infrastructure and necessary infrastructure upgrades, including ones allowing for autonomous operations; potential route planning; regulatory best practices; next steps; and other pertinent information.

Rationale: Other AAM leader states have statewide strategic plans which provide information about AAM and lay out future steps. Developing a consensus based strategic plan for AAM in Texas will provide industry and state and local policymakers with an idea of how AAM can function in Texas.

2.2. Statewide Economic Impact. Estimate the economic impact of AAM in Texas, similar to other AAM leader states, with a particular focus on electric and autonomous aircraft.

Rationale: The AAM industry has the potential to generate significant economic benefits. Currently, Texas must rely on national estimates and is at a disadvantage competing against states that have already completed state-specific economic impact assessments. A statewide economic impact study for Texas will quantify the potential economic impact of the AAM industry for state leaders and help generate private investment to act as a building block for long-term planning.

2.3. Cybersecurity Risk Mitigation. Establish a statewide working group to evaluate cybersecurity and data risks posed by AAM technologies and develop strategies to minimize risks. The working group shall include representatives from state and local public safety agencies, National Institute of Standards and Technology (NIST), Cybersecurity and Infrastructure Security Agency (CISA), and industry.

Rationale: The highly automated nature of AAM aircraft introduces potential cybersecurity issues, which could lead to data leaks or other problems. With a collaborative multi-disciplinary effort between state, federal, and industry representatives, these cybersecurity risks to autonomous vehicles can be thoroughly investigated and minimized. This working group could also collaborate with other established groups that are evaluating autonomous vehicles more broadly.

2.4. First Responder Training. Create a Texas Division of Emergency Management-led industry and agency working group to develop curriculum and a resource repository to assist first responders in dealing with AAM-related emergencies.

Rationale: AAM aircraft are new and continually evolving, and first responders are not fully prepared to deal with them should they malfunction. With the proper training and resources, first responders will be able to more effectively respond to AAM-related emergencies, keeping themselves and the public safe. To ensure the optimal design of training materials and resources, there should be a collaborative effort between experienced members of both private industry and agency.

2.5. Statewide Airspace Infrastructure. Develop a plan for an AAM Airspace Integration System to provide airspace awareness that includes:

i. Proposed operator
ii. System capabilities and architecture
iii. Phased implementation
iv. Data exchange mechanisms between public and private third-party system operators
v. Support for public safety to integrate into airspace infrastructure

Rationale: AAM aircraft and traditional aircraft will share the airspace regardless of their function. With an increase in these technologies populating the airspace, a system designed to safely integrate these aircraft and improve communication between operators will be critical in ensuring the safety and security of cargo and passengers in the air.

Successful AAM planning in Texas will require a coordinated effort from multiple expert stakeholders, as detailed in action steps 2.1 – 2.8.

Recommendation 2. Planning (continued)

2.6. Uniform Infrastructure Standards. Identify ways to encourage the use of consensus-based vertiport standards (e.g., templates) and support uniform planning and zoning enabling language related to powered-lift aircraft, autonomous aircraft, electric aviation, and other advances in aviation technology across the state.

Rationale: Consistency, predictability, and interoperability will be important in establishing this industry throughout Texas. There are two areas where uniformity is especially important: infrastructure standards, and planning and zoning. Encouraging the use of AAM standards, such as for vertiport infrastructure, will allow industry partners to function in a consistent manner across the state, create a predictable operating environment, and enable the entrance and competition of multiple AAM Offices of Emergency Management (OEMs) and operators. Without statewide best practice guidelines relating to planning and zoning, the development of the AAM industry in Texas and its related benefits could face a patchwork of conflicting rules.

2.7. Electrical Infrastructure. Estimate the required electrical generation and transmission capacity in conjunction with the major state utilities, ERCOT, etc. for the different implementation phases of AAM in Texas and evaluate the use of other fuel sources.

Rationale: The potential electrical demand of the AAM industry is one of the most pressing issues in its full-scale implementation. To support the burgeoning field of AAM in Texas, it is imperative to develop a comprehensive electrical capacity plan that addresses the anticipated demands of this transformative technology. Long lead times for establishing additional electrical capacity necessitate planning for the establishment of vertiports and associated infrastructure. By proactively planning, Texas can ensure the reliability and efficiency of its electrical grid for AAM and understand how to leverage and augment planned ground EVs infrastructure development for more efficient development.

2.8. Workforce Development. Direct the Texas Workforce Commission, the Higher Education Coordinating Board, Texas State Technical College, and the Texas Education Agency to develop an action plan to educate the workforce required to support a robust AAM industry in Texas, with a particular focus on electric and autonomous aircraft.

Rationale: This industry is expected to create thousands of high-paying jobs, and because AAM aircraft function differently than traditional aircraft, these jobs will require specialized training. Training programs for aviation-related occupations, such as mechanics, technicians, line staff, hospitality staff, eVTOL pilots, drone operators, engineers, and other workers who understand the nuances of the technology and operating system will be crucial to meet future workforce needs.

Recommendation 3. Innovation

Provide funding to TxDOT to create a program for state universities to support research and development for AAM technologies, products, and services in Texas by providing matching funds for federal grants and requiring a minimum percentage of community or industry match.

Example topics include autonomous aviation integration into the National Airspace System, improved batteries, fuel cell technology, alternative fuels, and AAM use cases for various markets.

Although there are ongoing AAM research efforts in the state, a cohesive and coordinated structured research initiative is needed to avoid redundant research, increase efficiency, and accelerate results. An organized and flexible approach would accelerate the development of viable AAM solutions and promote rapid innovation. This would make Texas and its universities a focal point for AAM technology research and potentially improve its appeal for students across the country.

An approach similar to the National Science Foundation's AI research institutes could be used, establishing dedicated R&D centers within Texas university systems. Each center would focus on specific R&D themes and promote interdisciplinary collaboration in engineering, technology, urban planning, and regulatory affairs, focusing on themes like battery technology, system integration, safety protocols, and infrastructure design. Collaboration with industry leaders and government agencies would ensure applicable research outcomes for the AAM industry.

INTRODUCTION

In May 2023, the Texas Legislature passed Senate Bill 2144 during the 88th Regular Session. Sponsored by Senator Tan Parker, SB 2144 (co-sponsored by Representative David Cook) is an act related to Advanced Air Mobility (AAM) technology that charged the Texas Department of Transportation (TxDOT) with creating an AAM Advisory Committee. The Committee's role was to assess current state law and recommend any potential changes to state law that were needed to facilitate the implementation of AAM technology in the state.

Based on the definition provided in SB 2144, "*advanced air mobility* means an aviation transportation system that uses highly automated aircraft, which may be manned or unmanned, to operate and transport passengers or cargo at lower altitudes for commercial, public service, private, or recreational purposes" (1). For the purposes of this report, AAM aircraft include everything from small drones to larger aircraft designed to carry passengers or larger cargo.

The purpose of this report is to provide information and recommendations to support the Texas Legislature's decision-making regarding AAM.

AAM has the potential to bring economic, societal, and environmental benefits to Texas. These benefits include, for example, the creation of new jobs and revenue streams, improved access to goods and services, and reduced greenhouse gas emissions.

AAM is coming to Texas. To maximize the potential significant economic, societal, and environmental benefits it can bring, the State should invest in leadership, planning, and innovation for AAM.

The remainder of this report will answer a series of questions that help understand and contextualize this emerging field as simply as possible to help support the recommendations.

- **How was this report developed?**
  This section will outline the participants and the process to develop this report and the recommendations.

- **What is AAM?**
  This section will help explain the current definition of AAM, the AAM system (including the aircraft, the infrastructure, and regulations), and the uses of AAM.

- **What are the benefits to Texans?**
  This section will detail the economic, societal, and environmental benefits to Texans.

- **What are the challenges?**
  This section will explain the challenges the AAM industry faces in Texas.

- **How are other states addressing these challenges?**
  This section will summarize the activities of Committee-identified AAM-leader states.

- **Recommendations (How can the State help?)**
  This section will include a series of legislative recommendations developed by the AAM Advisory Committee.

HOW WAS THIS REPORT DEVELOPED?

The Texas Department of Transportation (TxDOT) created the Advanced Air Mobility (AAM) Advisory Committee consisting of people with AAM expertise, representing a variety of interests.

The Committee consisted of 26 members:

- Maruthi R. Akella
- Jeff Bilyeu
- Andrew Chang
- Ahsan Choudhuri
- Cade Clark
- Dan Dalton (Chair)
- Jason L. Day
- David Fields
- Grant Guillot
- Ernest Huffman
- Ben Ivers
- Gus Khankarli
- George Kivork
- Brent Klavon
- Amanda Nelson
- Angel Newhart
- Mark Ozenick
- Jim Perschbach
- Kendal Prosack
- Sergio Saenz
- Michael Sanders (Vice Chair)
- Brent Skorup
- Thomas Swoyer
- Nathan Trail
- Cameron Walker
- Kimberly Williams

Committee member biographies are in Appendix A.

This Committee held hybrid and fully online meetings seven times over a nine-month period. Meetings were held openly, enabling significant input from non-Committee members. There were also five different subcommittees within the Committee that each met four-to-five times online. Table 1 shows the five subcommittees and their Leaders/Vice Leaders.

Table 1. Subcommittees and their leaders

Subcommittee	Leader	Vice Leader
Community Integration	Jim Perschbach	Amanda Nelson
Economic Impact	Cameron Walker	
Funding	Ernest Huffman	
Infrastructure	Cade Clark	Mark Ozenick
Safety and Public Good Use-Cases	Jason Day	

Discussions from full Committee and subcommittee meetings informed the findings within this report and the final recommendations. Any research requests from the Committee and subcommittees were completed by the research support team at Texas State University.

The Texas State University team conducted interviews with Committee members to aid in the development of survey questions. With those questions, the team commissioned a Qualtrics survey of 1,000 representatives of the traveling public in Texas. All respondents were over age 18 and were reflective of the State's population, including representation from rural, suburban, and urban populations. The full survey questions are in Appendix B. Some survey results are provided in sections throughout this report and are shown in purple boxes.

During one full Committee meeting, representatives from companies, organizations, and universities involved with AAM gave short presentations about their AAM efforts in Texas. These presentations informed our understanding of AAM activity in Texas. Examples of these activities are shown in light blue boxes.

WHAT IS AAM?

DEFINITION AND CONTEXT

AAM has two geographic subsets differentiated by where the air travel is occurring: Urban Air Mobility (UAM) and Regional Air Mobility (RAM). Although both UAM and RAM can be categorized under AAM, they can be differentiated by the scale at which they operate. The goal of RAM, based on a NASA report, is to use existing underutilized airports to create a more affordable and accessible network of regional travel (2). UAM "focuses on operations moving people and cargo in metropolitan and urban areas" (3). As of May 2024, the federal government defines AAM as comprised of UAM and RAM (4).

The US Congress believes the US should become a global leader in AAM, which the Federal Aviation Administration (FAA) refers to as a "new era of aviation" (4, 5). As frequently occurs in the beginning of any emerging industry, there is not a consistent definition of all terms. Advanced Air Mobility (AAM) is a term for which different entities offer slightly different definitions.

There are differing AAM definitions at both the State and federal level, pointing to the fluidity of the still developing industry. Both State and federal definitions are provided here.

AAM can be fundamentally defined as a system made up of aircraft, infrastructure, and regulations, which can be utilized to enhance healthcare, emergency response, and other industries in Texas.

Texas definition

In SB 2144, AAM is defined as "an aviation transportation system that uses highly automated aircraft, which may be manned or unmanned, to operate and transport passengers or cargo at lower altitudes for commercial, public service, private, or recreational purposes" (1).

Federal definition

In the AAM Coordination and Leadership Act of 2022, the working definition of AAM was "a transportation system that transports people and property by air between two points in the United States using aircraft with advanced technologies, including electric aircraft or electric vertical take-off and landing aircraft, in both controlled and uncontrolled airspace" (6). This definition, likely due to the emerging nature of these technologies, was purposefully broad. This was the federal definition in use at the establishment of this AAM Advisory Committee, used during all subcommittee meetings and during the drafting of this report. However, on May 16, 2024, the FAA Reauthorization Act of 2024 (HR 3935) became a law and provided an official AAM definition. The AAM definition in this act is:

> A transportation system that is comprised of urban air mobility and regional air mobility using manned or unmanned aircraft.

This act also formally defined RAM and UAM. The full AAM definition, as well as RAM and UAM, can be found in full in Appendix C.

AAM SYSTEM

The federal definition describes AAM as a "system." This section of the report will further explain the AAM system, which is made up of many components, including the aircraft, infrastructure, and regulations.

Aircraft

According to the Texas Transportation Code, 'aircraft' means "a device that is invented, used, or designated for air navigation or flight, other than a parachute or other device used primarily as safety equipment" (7). This definition is very broad and includes all aircraft ranging from AAM aircraft to helicopters to airplanes.

To further discuss AAM aircraft, we can consider two broad types of aircraft.

The first are small Unmanned Aircraft Systems (sUAS), commonly referred to as drones, which are used for a variety of purposes. They are typically electric and operate fully autonomously or with a remote pilot, and they weigh less than 55 pounds. The FAA defines sUAS as "a small unmanned aircraft and its associated elements (including communication links and the components that control the small unmanned aircraft) that are required for the safe and efficient operation of the small unmanned aircraft in the national airspace system" (8).

The second type of aircraft can be used as air taxis to transport people or to transport cargo, among other uses, and are commonly referred to as eVTOLs (electric Vertical Take-Off and Landing). Currently, these eVTOLs use powered-lift and have characteristics of a rotorcraft and an airplane. Though vertical take-off and landing aircraft like helicopters have existed for years, what makes eVTOLs new are the propulsion technologies used, including electric motors, hydrogen fuel, and hybrid designs (9). Some eVTOLs are designed to have a pilot on-board and others are designed to be autonomous with human oversight. Based on current designs, it is common for these aircraft to hold four-to-six passengers, use electricity as fuel, and have a range of about 100 miles. This range can potentially be greatly expanded by using different fuel types, which are currently being researched and tested. For example, in 2024, a Joby test flight with a hydrogen-electric air taxi flew 523 miles with no passengers on board (10).

One of the debates about AAM in this Committee is whether or not drones are considered AAM. Advisory Committee members discussed that eVTOLs and drones currently share many commonalities, including use of the same lower altitude (below 400') airspace, use of electricity as a typical fuel source, shared future need for digital airspace management systems and more localized weather information, and even some common uses like transporting cargo or emergency response.

Just as the Committee considered the similarities, they also considered the differences between drones and eVTOLs. The Chair pointed out the differences in Aircraft, Airspace, and Aircrews (e.g., pilots) between these two types of aircraft. eVTOLs require a safety certification that drones may not necessarily require. Drones typically operate in lower airspace (below 400') than eVTOLs which will frequently fly thousands of feet above ground. Commercial drone operators are required to be FAA Part 107 certified while eVTOL operators will likely need to meet Part 61, 91, and 135 requirements.

Continuing to explore the similarities and differences between these two types or aircraft will be helpful as the State looks ahead in potentially developing any regulatory environment.

This report will include—as the Committee did—both sUAS/drones and eVTOLs, although the May 2024 federal AAM definition established aircraft weight

AAM SYSTEM (CONTINUED)

requirements that may exclude sUAS from AAM. For the remainder of this report, the phrases "AAM" or "AAM aircraft" will broadly refer to both eVTOLs and sUAS/drones, unless otherwise specified.

Infrastructure

Texas has existing infrastructure, both physical and digital, that could be used during the initial implementation of AAM. Physical infrastructure includes hundreds of airports and heliports. Existing physical infrastructure will likely require some modifications to function as a vertiport to support AAM (9). Vertiports are structures or areas of land that serve as the takeoff and landing area for eVTOLs (11). Existing digital infrastructure includes air traffic control services and flight management systems. The development of additional physical and digital infrastructure will be required to reach the full potential of AAM.

Regulatory Landscape

The regulatory landscape of AAM is still evolving due to the maturing nature of the industry. Although the FAA has overarching authority over all airspace in the US, there have been laws passed at the state and local level to help facilitate the development of AAM at all levels.

FAA Role

The FAA has exclusive authority to manage all airspace within the US Their management includes air traffic control, airspace use, and safety. Because of the FAA's exclusive management authority, state and local governments within Texas cannot regulate airspace use or aviation safety (12). Along with managing the airspace, the FAA regulates vehicle and operator certifications for AAM aircraft (4). Additionally, the FAA evaluates the human impacts of aviation, including AAM, and discloses them to the public. Human impacts include "noise, air quality, visual disturbances, and disruption to wildlife" (9).

Air Traffic Management

The integration of AAM into the airspace is an important concern. The FAA's AAM Implementation Plan (2023) offers some insight into how AAM aircraft will be integrated in the near-term.

> AAM infrastructure, automation, and traffic management approaches will evolve over time as the AAM operational tempo increases in airspace across the NAS [National Airspace System]. AAM aircraft will be integrated at greater scale with commercial and general aviation (GA) traffic, as well as other low-altitude airspace users, such as recreational and commercial small unmanned aircraft systems or drones. In the near-term for I28 [Innovate28], however, these interactions are minimized and thus can be managed with existing ATC tools, procedures, and protocols. AAM aircraft are expected to be operating with a pilot on board and under VFR [visual flight rules] in VMC [visual meteorological conditions] conditions; it is likely these aircraft will be treated as any other fixed wing/rotorcraft operating under VFR conditions, to the extent they are able to comply with existing rules, regulations, and procedures (9).

Federal Aviation Regulations

Title 14, Aeronautics and Space, in the Code of Federal Regulations covers the many rules relating to flight. There are nearly 1,400 parts within Title 14, so this section will only briefly cover a few parts most relevant to AAM operators.

FAA Part 61 relates to issuing pilot, flight instructor, or ground instructor certificates (13).

AAM SYSTEM (CONTINUED)

FAA Part 91 relates to the most basic flight rules and is relevant to everyone that is flying. It includes information about flying in different airspaces, Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) (14).

FAA Part 107 relates to the operation of sUAS, or drones, for work or business purposes. To fly under Part 107, users must pass the Part 107 Knowledge Test and then register their drone with the FAA (15).

There are several types of waivers within Part 107 that drone pilots must obtain if they want to perform certain actions, such as flying a drone from a moving vehicle or flying at night. Another waiver is commonly known as the beyond visual line of sight (BVLOS) waiver, which allows drone pilots to fly without maintaining a visual on the aircraft.

FAA Part 135 relates to the operation of aircraft for commuter and on-demand passenger or cargo purposes. Drone package delivery operations are generally conducted under Part 135, as package delivery for compensation or hire is not allowed under Part 107. In addition, any eVTOL acting as an air taxi and flying passengers or cargo for commercial purposes would fall under Part 135 and need to comply with its requirements (16).

Recent Developments

In July 2024, the FAA approved two drone companies, Wing and Zipline, to conduct deliveries in the DFW airspace without visual observers. These companies will now be able to use UAS Traffic Management (UTM) technology to manage drone-to-drone interactions with FAA oversight. This is the first time the FAA has allowed a third party UTM company to perform this role. Using UTM is a critical step for a safe, shared airspace, and if efforts are successful in DFW, it will set an example that can be repeated nationwide (17).

Many companies are developing air taxis, but at this time no air taxis are approved to carry people or cargo for hire. At their Drone and AAM Symposium in July 2024, the FAA said they expect to issue a type certificate for the first AAM aircraft before the end of 2025 (18). In fact, the FAA, Joby, and Archer *agreed on the final certification basis* for the companies' aircraft in August 2024, moving the industry one step closer to commercial operation (4).

Existing State Law

Since 1995, several laws have been passed in Texas that relate to the use of drones and uncrewed aircraft and potential issues with their use. None of these laws negatively impact industry's ability to conduct AAM operations. Appendix D provides an overview of these laws.

Local Ordinances

Though the FAA controls the airspace and the flight of aircraft, the take-off, landing, and delivery areas can be influenced by local rules. Local governments are limited in what they can do from an airspace perspective, but they have some ability to regulate drone use in specific areas, subject to State law.

Localities can also have an impact through zoning, which can control where vertiports are located or set regulations around the areas where delivery drones take-off and land. Additionally, they can play a large role in integration of vertiports with bus stops, highways, train stations, and other modes of transportation. Furthermore, local governments can ensure the development of infrastructure surrounding vertiports is compatible with airspace requirements, for example, building height.

AAM USES

Understanding the various uses of AAM technology and the services that are and will be provided is one of the best ways to understand what AAM is. This section will give examples of AAM uses in different industries, as well as provide a sampling of some of the activities occurring or planned in Texas. These examples are not comprehensive of all AAM activity in Texas but rather give further insights into how it is currently being or planned to be used.

Drone-related uses

Drones are used for a variety of purposes including deliveries, healthcare, emergency response, public works, agriculture, other services, research and testing, and more.

Healthcare

In the healthcare industry, drones can be used to deliver medications and other medical supplies, which is particularly helpful for mobility impaired people, both in urban and rural areas. Drones can also be used to send emergency care faster and more efficiently, such as sending bags of blood, a defibrillator, or even organs (19).

TEXAS EXAMPLES

The **Matador UAS Consortium**, established by the Texas Tech Health Science Center and 2THEDGE in 2022, is partnered with multiple organizations, including the Texas Organ Sharing Alliance, to work toward using drones to transport organs and tissues in rural areas. Their work is focused in 108 counties in the Texas Panhandle.

Deliveries

Drone package deliveries are one of the most well-known uses of drones. This section briefly describes some of the companies delivering in Texas.

TEXAS EXAMPLES

Wing, headquartered in Palo Alto, California, has been offering drone delivery services in the Dallas-Fort Worth (DFW) Metroplex since April 2022. Wing is partnered with Walmart and DoorDash to provide drone deliveries to customer homes. Wing's current delivery drone weighs about 11 pounds, has a wingspan of almost five feet, and is able to travel about 12 miles round trip. Packages are typically around 2.5 pounds or lighter. To make delivery drops, the drone hovers and lowers the package on a tether, and once the package is on the ground, it is released.

Manna, headquartered in Ireland, offers drone deliveries in the DFW area for basic goods including food, coffee, and medical supplies. The optimal operating range for Manna drones is about two miles, with a maximum distance of five miles one-way. To make deliveries, drones descend to about 50 feet above the ground and then lower packages on a tether.

Amazon offers drone delivery of small packages and prescriptions in College Station. For drone delivery eligible items and in eligible areas, drone delivery is free and occurs within one hour of purchasing.

AAM USES > DRONE-RELATED USES (CONTINUED)

Public Works

Drones can be used in various public works-related tasks, providing the benefit of increased efficiency and of not having to send personnel into dangerous settings. For example, the state of New York launched a UAS program in 2021, and since then they have used drones to inspect hard-to reach places like bridges and drill holes, gather data for mapping, and help provide media coverage of events (22).

TEXAS EXAMPLES

In Texas, the **Burlington Northern Santa Fe** railroad began using UAS in 2013 to assist with addressing rail traffic disruptions. Their drones are used in projects like inspecting bridges and gaining information about railways after flood or fire events. They have projects across much of the State, and their extensive network of drone pilots allows them to respond to issues within one hour.

Public Safety

Drones can be used in emergency response and public safety in several ways, such as providing situational awareness, faster search and rescue efforts, and transport of essential supplies (20).

According to Bard College, Texas is a leader in the nation in both the adoption and utilization of UAS by public safety agencies (21). The state boasts not only the largest public safety UAS program (Texas Department of Public Safety) but the largest statewide coalition in the nation. Every week in Texas, public safety agencies conduct thousands of UAS flights to fight fires, map crash scenes, provide security and overwatch at mass gathering events, and secure the border. Texas public safety agencies also utilize drone technology for disaster assessment, search and rescue, and infrastructure assessments. Texas has proven how to use public safety drones to protect the citizens of Texas while simultaneously protecting their right to privacy.

TEXAS EXAMPLES

The **Texas Department of Public Safety** utilizes UAS for a variety of missions including traffic accident reconstruction, infrastructure inspections, border security, fire mapping, and disaster response. In 2023, the department conducted over 50,000 UAS flights resulting in 11,464 suspects located, 3,387 border patrol assists, and $4.37 million in drug and asset seizures.

AAM USES > DRONE-RELATED USES (CONTINUED)

Agriculture

Drones can be used to increase efficiency in the agriculture industry. For example, they can be used to monitor crop health, quickly inspect fields or livestock, and to apply pesticides, herbicides, or fertilizers (23, 24).

TEXAS EXAMPLES

Hylio, a Houston-based company started by University of Texas students, makes and sells drones built specifically for agricultural spray operations. They currently offer four drone products, ranging in size from 25 pounds to 117 pounds.

In February 2024, Hylio became the first company to receive FAA approval for swarming their heavier drones (over 55 pounds), allowing the use of up to three heavy-duty drones at a time with a single pilot (25). This approval helps pave the way for larger-scale farming operations using drones, and it illustrates that there are still regulatory changes being made in this rapidly evolving industry.

Other Services

Drone technology has continued to evolve since its initial implementation, leading to many widely varied use cases. In addition to the applications for different industries as described above, there are countless others. For example, drones can be used in wildlife conservation to collect samples and monitor species, and their ability to capture images and videos can apply to multiple industries, such as real estate and sports (26, 27).

TEXAS EXAMPLES

Galaxy Unmanned Systems LLC, based in Fort Worth, provides advanced drone and autonomous airship solutions for diverse applications. Their airships, used in sports broadcasting, are also being adapted for military use. Galaxy offers turnkey flight services and Systems Engineering and Technical Assistance support for Department of Defense and AAM stakeholders, with expertise in fixed-wing, multicopter, and Lighter-Than-Air (LTA) UAS for various use cases, such as autonomous collaborative teaming, automated airspace management, and nearshore/UAM corridor integration.

The **Texas Drone Company**, based in Denton, conducts drone inspections and creates visual deliverables for several industries. For example, they use drones to aid in golf course maintenance, as well as to capture imagery to create interactive 3D models of the course for audience engagement.

AAM USES > DRONE-RELATED USES (CONTINUED)

Research and Testing

In addition to the existing applications of drones, there are also research centers with ongoing efforts to expand drone testing in the State.

TEXAS EXAMPLES

The **UAS Traffic Management (UTM) Key Site** in the DFW area is a collaborative effort that aims to gather data on uncrewed aircraft operations to help inform the FAA's policy decisions around BVLOS operations. UTM services allow companies to share data and flight routes with each other, enabling a safer shared airspace. Because of increased UAS activity in the North Texas area, several operators noted the need to be able to communicate with each other, leading to the establishment of the Key Site. The Metroplex area is considered one of the most progressive in the research and use of drone deliveries.

The **AllianceTexas Mobility Innovation Zone (MIZ)** is a 27,000-acre industrial and residential development in Fort Worth that allows for innovation and collaboration on multi-modal mobility platforms, including AAM. With its residential areas, the MIZ can support real-world testing for operations like drone deliveries. Many companies, including some highlighted in this report, have used the MIZ to increase efficiency in their technology and operations.

The **University of North Texas (UNT) Center of Integrated Intelligent Mobility Systems** recently opened the **UNT Advanced Air Mobility** test facility at their Discovery Park. At 80 feet tall, 120 feet long and 300 feet wide, this facility is the largest of its kind in all of Texas and focuses on solutions for Unmanned Aerial Vehicles (UAV) ranging from programming to policy.

The **Texas A&M University-Corpus Christi's Autonomy Research Institute** is one of seven FAA UAS test sites in the US and includes a 12.9-mile (12-nautical-mile) BVLOS corridor. The Institute has seven existing and three pending test ranges throughout the state. The Institute contributes to UAS research and innovation, including through demonstrations and evaluations. They also provide operational data to the FAA to help with regulation and standards development. Past operations include damage assessments following hurricanes and searches for injured sea turtles, both of which provided information for faster response times.

The **RELLIS Campus** at Texas A&M, an applied research campus outside of Bryan, has an established Proving Grounds consisting of 2,300 acres. Assets include five runways, taxiways, an apron, hangar space, and a number of unique facilities and capabilities to support AAM, UAS, counter-UAS, and air to ground integration research. RELLIS has established an FAA approved 12-mile (10.4-nautical-mile) BVLOS corridor that facilitates increased testing and use in the AAM environment. Additionally, seven state agencies with a stake in the unmanned industry are located on the RELLIS Campus.

The **North Central Texas Council of Governments** is leading an airspace awareness pilot program through a partnership with three drone service providers. With 20 participating cities in the Dallas area, the pilot program aims to provide live data to aid in safe UAS flights. The program started in November 2023 and will conclude in November 2025.

AAM USES (CONTINUED)

eVTOL-related uses

Initial AAM eVTOL services are predicted to start in 2025. Expected initial uses mostly involve cargo and passenger transport.

Different elements of passenger transport can be utilized in different areas. For example, in urban areas eVTOLs can be used for commuting, airport transfers, business travel, or tourism (28). In rural areas, they can be used to improve accessibility and affordability of regional travel, particularly in underserved areas, through the use of underutilized public use airports (2). One initial use case for both urban and rural areas is emergency response, such as to transport first responders to a scene faster than an ambulance or helicopter (29).

This section describes some of the known AAM-related activities occurring or planned in Texas.

Cargo Transport

Similar to drone deliveries, cargo deliveries using eVTOLs have the capability to greatly improve efficiency.

TEXAS EXAMPLES

Bristow Group, a longstanding global helicopter operator headquartered in Houston, specializes in offshore energy transportation and search and rescue services. They are planning to introduce both crewed and uncrewed AAM aircraft and services into the region to support cargo movement initially for their energy customer base, as well as entering new markets. This strategic initiative aims to leverage advanced AAM technology to enhance operational efficiency, safety, and service reach, particularly in the demanding environments where Bristow operates.

AAM USES > EVTOL-RELATED USES (CONTINUED)

Passenger Transport

There are currently no companies conducting passenger transport via air taxis in Texas, but several are planning to.

TEXAS EXAMPLES

Wisk Aero LLC "Wisk", headquartered in California, is planning for autonomous air taxi services in the Houston area by 2030. Through a partnership with the City of Sugarland and the Houston Airport System (HAS), Wisk will start by assessing vertiport infrastructure needs at the Sugarland Regional Airport and the HAS airports, with the ultimate goal of establishing a larger network across the region. Wisk's Generation 6 passenger air taxi, which is currently awaiting FAA approval, is designed to hold four passengers and use an autonomy platform that builds upon proven aviation systems—such as autopilots, precision navigation, and data links—to create a more advanced autonomy platform that delivers a new level of safety and unlocks the scale needed for commercial success.

The **City of Arlington** is working with the NCTCOG and DFW International Airport to plan for the installation of a temporary vertiport location at the Arlington Municipal Airport for eVTOLs to use during the FIFA World Cup in the summer of 2026.

DFW International Airport is moving forward with its strategic plan to support eVTOL limited operations by 2026. The airport will work with interested Offices of Emergency Management (OEMs) and industry experts to cooperatively explore the operational and infrastructure requirements to support an eVTOL program.

The **Houston Airport System**, which includes Bush, Hobby, and Ellington airports, is planning to integrate cargo AAM operations in the near-term and passenger AAM operations to enhance regional mobility within the next 10 years. Together with Archer Aviation and Eve Air Mobility, United Airlines is among the companies planning for AAM operations at Houston airports, in addition to the Wisk activity previously mentioned.

AAM USES > EVTOL-RELATED USES (CONTINUED)

Research and Testing

AAM is a new and emerging industry, so there is a lot of research and innovation happening nationally and globally. This section provides examples of just two research efforts in Texas. However, almost all eVTOL activity previously mentioned also involves an element of research and testing.

TEXAS EXAMPLES

Joby and **NASA** partnered to conduct air traffic control simulations in the DFW area to evaluate the capability of eVTOLs to integrate into the Class B airspace around busy airports. Simulations were done from the fall of 2022 to 2023, proving that dozens of aircraft per hour could operate to and from existing airport terminals.

The **City of Fort Worth** was the only SMART (Strengthening Mobility and Revolutionizing Transportation) grant recipient in Texas in 2023. The City, in partnership with NCTCOG, will use the $2M grant funds to pilot low altitude weather sensors on freight routes used by autonomous vehicles. The program's objective is to demonstrate how weather sensors can be integrated into weather models, ultimately providing more consistent data on air and road conditions.

Skygrid LLC, based in Austin, is developing a sophisticated software platform designed to ensure the safe and secure integration of autonomous cargo and passenger air vehicles in global airspace by addressing and eliminating gaps in traditional UTM solutions.

Port San Antonio, located in San Antonio, is a 1,900-acre technology and innovation campus whose 80 tenant customers have a combined workforce of 18,000 employees. On the campus, leading names in aerospace, such as Boeing and StandardAero, work alongside top private- and public-sector entities making significant advancements in cybersecurity, artificial intelligence, national defense, industrial robotics, and an array of other applied technologies. As such, in combination with other regional, state and national partners, the Port has fostered a special community of collaborators to further refine, test, and validate eVTOL systems. The Port is also advancing construction of one of the nation's first vertiports at its industrial airport at Kelly Field. This facility will be able to accommodate traditional fixed-wing aircraft and eVTOLs.

Furthermore, the campus presents a unique testbed. For example, several Port customers operate multiple facilities, oftentimes non-contiguous to one another, and would stand to benefit by transporting spare parts and other components within the Port footprint by air. Additionally, the Port foresees adding thousands of on-campus jobs by the end of the decade. Incorporating eVTOLs as a mass transit commuting option for employees who reside throughout Bexar Country would significantly reduce the need to build multi-million dollar parking garages and related infrastructure.

WHAT ARE THE BENEFITS TO TEXANS?

AAM has the potential to transform transportation and logistics in Texas, bringing significant economic, societal, and environmental benefits.

ECONOMIC

The AAM industry and drones can provide economic benefits by creating new jobs, stimulating economic activity, and by increasing business efficiency.

TEXAS SURVEY RESULT

Respondents were more favorable to the use of AAM to transport cargo and things (70 points on a scale of 0 – 100) rather than people (60 points).

Based on a national study done by Deloitte in 2021, the AAM industry (not including drones) is expected to reach $115 billion by 2035—$57 billion for the AAM passenger market and $58 billion for the cargo market—creating over 280,000 high-paying jobs nationwide (30). Recently, the AAM industry has seen rapid progression, receiving nearly $10B in disclosed funding in 2022 and 2023 in the US (31). In Texas, this could translate into thousands of jobs in research, aircraft development, infrastructure development, and airspace management.

While Texas does not currently have any statewide economic impact studies for AAM, a couple of other states do, illustrating the future economic benefits of the industry at the state level.

An AAM economic impact study (including drones) done for the state of Ohio found that in a 25-year forecast period, the industry would bring the following benefits:

- $13 billion in economic impact
- 15,000 high-paying, full-time jobs
- $2.5 billion in federal, state, and local tax revenues (32)

An AAM report (including drones) done in 2023 for the state of Virginia found that AAM would have the following economic impacts through the year 2045:

- $16 billion in business activity
- 17,000 full-time jobs
- $2.8 billion in federal, state, and local tax revenues (33)

Some AAM-related economic impact studies have also been done regionally in other states. For example, a study for Urban Air Mobility's (UAM) impact in Long Beach, California and the greater Los-Angeles-Orange County area estimated the economic benefit created by a 20-vertiport system during construction and a 10-year operation phase.

Construction phase:

- 2,130 jobs
- $173.9 million in labor income
- $423.6 million in economic output
- $57.4 million in federal, state, and local tax revenues

10-year operations phase (recurring annual impact of operation):

- 940 jobs
- $90.3 million in labor income
- $173.3 in economic output
- $29.4 million in federal, state, and local tax revenues (34)

ECONOMIC (CONTINUED)

For drone deliveries alone, businesses across Texas stand to benefit from increased time efficiency. A study done by Virginia Tech in 2020 analyzed the potential impact of drone deliveries over five years based on varying population densities in three cities (35). They analyzed Christiansburg, Virgina for lower density, Austin, Texas for medium, and Columbus, Ohio for higher density. Using Census data, we found cities in Texas with similar population densities for each category to give an idea of the impacts that could come to different parts of the state.

Table 2 shows the potential economic benefits from drone deliveries to consumers and businesses (35).

A 2021 study prepared for Wing estimated the benefits of drone deliveries in the Dallas-Fort Worth Metroplex after 5 years of implementation at scale. The study estimated $305M in total value of time saved by consumers and $197M in increased sales for businesses (39).

Table 2. Potential economic benefits from drone deliveries after 5 years

	Lower density (Christiansburg, VA)	Medium density (Austin, TX)	Higher density (Columbus, OH)
TX cities with comparable population densities (36, 37, 38)	Big Spring, Kingsville, Stephenville	Eagle Pass, Laredo, San Antonio	Dallas, Houston
Time savings for consumers using drone delivery over 5 years	$23 - 45.9M	$323.6 - 582.5M	$219.8 - 403.8M
Additional sales for participating businesses over 5 years	$25,000 - 73,000	$72,000 - 208,000	$34,000 - 97,000
Additional sales for participating full-service restaurants over 5 years	$38,000 – 71,000	$79,000 – 145,000	$54,000 – 99,000

SOCIETAL

AAM can also bring about societal benefits by enhancing access to emergency and healthcare services, improving access to goods, reducing traffic, and increasing efficiency in other industries.

TEXAS SURVEY RESULT

Respondents in rural, urban, and suburban environments were most supportive of the use of AAM for humanitarian and disaster relief. Texans supported the use of AAM for humanitarian and disaster relief (4.2 on an agreement scale of 1-5), medical emergencies (4.1) and to send and receive labs, vaccines and other services (4.0).

Drones can be used in emergency response and medication delivery, contributing to public safety. For example, the response time for emergency Automated External Defibrillator (AED) delivery is reduced by an average of 78.8% when operations are conducted with a drone (40). In Austin specifically, drone delivery could assist up to 20,000 mobility-impaired residents by delivering their prescription medication, providing anywhere from $18.7–$892 million in healthcare benefits (35).

Drone deliveries are already being conducted in parts of Texas, positively impacting access to goods. Drone delivery also has the potential to serve a significant portion of city populations, with Virginia Tech estimating that after five years of drone delivery implementation, about 54% of the population in the Austin metro area would be served (35).

Increased drone use can contribute to fewer cars being on the road and reduce the need for some trips. Table 3 shows the potential traffic-related benefits from drone deliveries in cities of differing population densities (35). Avoiding traffic on roads also reduces infrastructure wear and tear.

Lastly, as explained in the AAM Uses section, drones can be used to increase efficiency and safety in a variety of industries. For example, using a drone to inspect a bridge or a wind turbine instead of a person automatically prevents any human-related accidents. This not only increases safety but also allows for quicker and more efficient inspections.

Table 3. Potential societal benefits from drone deliveries after 5 years

	Lower density (Christiansburg, VA)	Medium density (Austin, TX)	Higher density (Columbus, OH)
TX cities with comparable population densities (36, 37, 38)	Big Spring, Kingsville, Stephenville	Eagle Pass, Laredo, San Antonio	Dallas, Houston
Car crashes avoided per year over 5 years	28 - 46	287 - 580	244 - 466
Miles saved from avoided travel per year over 5 years	18.7 – 30.5M	145.2 – 294M	95.8 – 183.2M

SOCIETAL (CONTINUED)

Each year, INRIX releases a Global Traffic Scorecard that ranks traffic congestion in urban areas. In the 2023 scorecard, four Texas cities are in the top 25 for worst congestion in the US (41). Table 4 shows the yearly hours lost from being in traffic, as well as the costs for individual drivers and the cities.

A report by the Texas Transportation Institute at Texas A&M University showed similar results for 2022, with urban areas across Texas experiencing delays and excess fuel consumption (42). UAM, the subset of AAM focused on urban areas, is not likely to significantly reduce the volume of surface traffic, but it is likely to reduce traffic congestion during peak times (3). Reduced traffic could ultimately save city residents time and money.

Table 4. Impact of traffic congestion in four Texas cities in one year (41)

	Houston	Dallas	Austin	San Antonio
2023 US Rank	8	17	21	25
Delay (hours lost)	62	38	38	35
Cost per Driver	$1,082	$658	$663	$607
Cost per City	$3.2B	$2.2B	$632M	$625M

ENVIRONMENTAL

AAM aircraft are predominantly electric, which could significantly reduce greenhouse gas emissions from the transportation sector.

Delivery drones can have up to a 94% lower energy consumption than diesel-powered delivery vehicles and can reduce greenhouse gas emissions by up to 84% (43). In the DFW Metroplex, replacing traditional delivery vehicles with drones for just 2% of deliveries could eliminate 49,000 tons of CO^2 emissions each year (39). Table 5 shows the potential CO^2 emissions saved by using drone deliveries in cities of differing population densities (35).

Table 5. Potential environmental benefits from drone deliveries after 5 years

	Lower density (Christiansburg, VA)	Medium density (Austin, TX)	Higher density (Columbus, OH)
TX cities with comparable population densities (36, 37, 38)	Big Spring, Kingsville, Stephenville	Eagle Pass, Laredo, San Antonio	Dallas, Houston
Tons of CO2 saved per year over 5 years	28 - 46	287 - 580	244 - 466

WHAT ARE THE CHALLENGES?

COMMUNICATION

There is a lack of public understanding about AAM, as well as concerns about privacy and noise. To gain public support, the AAM industry needs to effectively communicate the benefits of AAM and address public concerns. Committee members stressed the importance of communicating in the right places at the right time to ensure the public does not feel misled when these new technologies are not in their communities right away.

For electric Vertical Take-Off and Landing aircraft (eVTOLs), the primary public concern is around safety. Public perception of the safety of flying in an automated vehicle is a roadblock due to the lack of full-scale operations. According to an Urban Air Mobility (UAM) Market Study done by Booz Allen Hamilton, 53% of individuals would be willing to fly in a piloted UAM aircraft with other passengers, while only 22% of individuals would be willing to fly on a fully automated UAM aircraft without a pilot or flight attendant on board (44).

For drones, the public is primarily concerned with privacy and noise. An additional communication challenge is related to the use of private or recreational drones in areas where there are permanent or temporary flight restrictions, such as around an active wildfire. The use of recreational drones in such a scenario can interfere with emergency response drones and negatively impact response efforts.

The development of general communication resources will help improve public awareness of AAM and mitigate some of these issues. In addition to communicating to the public, it is also important for the State to communicate internally. One crucial aspect of this is communication during disaster response. As drones continue to play an increasing role in disaster management, and with eVTOLs playing a future role, it is important to reestablish the information sharing work group (HB 2340 2019, Sec. 418.055) and include eVTOL and drone representation.

Appendix E offers some potential communication strategies.

TEXAS SURVEY RESULT

Respondents showed a lack of awareness about AAM. Half of the respondents had never seen or heard of it and that is emphasized in rural residents (57% never heard or seen), women (58%), and those with lower education attainment. While awareness was quite low, Texans in general presented somewhat positive feelings toward AAM once it was explained.

While AAM is set to transform transportation and logistics in Texas, it also presents several challenges. Overcoming these challenges through leadership, planning, and innovation will best position Texas to fully realize the many potential benefits of AAM.

ELECTRICITY

The widespread development of AAM aircraft may cause significant strain on the electric grid in Texas, managed by The Electric Reliability Council of Texas (ERCOT). Most AAM aircraft are currently powered by electricity, potentially introducing a significant demand for increased capacity, especially once the industry reaches fully-scaled operations, which is expected in the 2030s or 2040s. Future-proofing the AAM infrastructure design could lead to outsized electrical demands at vertiports, ranging from less than 1 MW to 20 MW per project (45). For reference, 1 megawatt-hour (MWh) of electricity is enough to provide electricity for up to 1,000 homes (46).

A 2023 study by the US National Renewable Energy Laboratory recommends that each vertiport should plan to have at least 1 MW available. To ensure this capacity, they suggest that vertiport sites should engage with the local utility as early as possible, with utility providers most likely being interested in "understanding the power capacity, number of charging stations, and any potential future expansion from the electrification point of view" (47). Additionally, upgrading electrical infrastructure can require years of lead time, highlighting the importance of early engagement with utility providers. The study concluded that installing eVTOL charging capabilities is likely to increase the future electrical load at a site by six-to-seven times. This increase in load would likely overload most existing systems that are typically designed to allow a maximum of only two-to-three times the demand.

This increased future demand for electricity for AAM comes on top of significant growing demand from other industries. The accelerated growth of data centers, mining of cryptocurrencies, electrification of vehicles, and the return of manufacturing to Texas is significantly impacting Texas' overall electrical demand.

As AAM grows, it will be critical for the industry to provide accurate estimates of the necessary electrical infrastructure to utility providers and ERCOT to ensure adequate capacity or provide adequate time to generate the additional capacity needed.

SAFETY

The safety of both AAM passengers and people on the ground is paramount. With drones and eVTOLs operating simultaneously at lower altitudes, regulating air traffic management becomes a challenge. This scenario is particularly challenging in urban settings due to buildings, cranes, and other obstructions, besides other aircraft that could be in a shared airspace with AAM aircraft. Without thoughtful integration with the current airspace, there could be a potential increase in accidents both in the air and on the ground.

Additionally, the highly automated nature of the aircraft introduces risks related to cybersecurity. Vulnerabilities in these automated systems could lead to data leaks (48). The potential negative effects of data breaches highlight the obstacles that exist for first responders who may be expected to utilize AAM aircraft in the field or respond to AAM related emergencies. Also, since AAM is an emerging industry, first responders may not know how to safely and effectively respond if an AAM aircraft or its batteries malfunction.

These are important issues that are already being discussed at the federal level, in other states, and across the industry. The Federal Aviation Administration (FAA) has exclusive management of the airspace, and their current approach is to evolve traffic management along with the growth and evolution of AAM, with safety being a key element of the integration of these technologies. The US Department of Transportation also has an AAM Interagency Working Group, with security and air traffic being two of its primary areas of focus (49). Still, there is space for Texas to contribute to the understanding and research for AAM integration into the airspace, including considerations of safety. Texas' contributions should not conflict with the FAA but should help capture and share data to help maintain safety and address any Texas-specific needs. A collaborative, multidisciplinary approach can help ensure safety in Texas and the US.

TEXAS SURVEY RESULT

Texans expressed concerns towards cyberthreat (3.5 on an agreement scale of 1 – 5), safety when automated, in comparison to piloted planes (3.3), and dangers towards those who are on land under AAM aircraft (3.1). There was also concern about the adoption of the technology worsening air traffic (3.2).

WORKFORCE

Piloting eVTOLs differs from piloting traditional aviation vehicles because it requires a mixture of helicopter and airplane flying styles. Further, initial implementation will take place in urban areas, creating the challenge of navigating densely built environments. Operations in urban areas will also be characterized by short flight times, meaning that a larger percentage of total flight time will be devoted to complex takeoff and landing maneuvers compared to traditional aviation. These short flights and higher volume of takeoffs and landings will require different training, especially because takeoff and landing technology for piloted aircraft is not fully automated yet (50). As eVTOL use increases over the next decade, these different aspects of AAM flight will create a need for a highly trained AAM pilot workforce. At the same time, more AAM aircraft are expected to become increasingly autonomous in the future, meaning that initial pilot recruitment may be more challenging in the short-term (28).

A study done by McKinsey & Company in 2022 estimated that 60,000 eVTOL pilots would be needed nationwide for the AAM industry by 2028 (28). In addition to highly trained pilots, there will be an increased need for engineers, mechanics, avionics technicians, drone operators, loaders, manufacturing personnel, educators, line staff, and hospitality staff to meet these increased demands. Many of these positions do not require a college degree. A coordinated approach among Texas education providers will help meet these workforce needs.

STANDARDS

Standards are important for any industry, especially aviation, to help ensure safety, streamlined operations, and consumer trust (51). While the FAA is the primary regulatory authority for AAM in the US, Texas can still play a role by promoting uniformity in two areas. One is encouraging consistent standards for vertiports and other infrastructure, and the other is encouraging consistency in zoning regulations and processes. Without the State's encouragement of uniformity, Texas could end up with a patchwork of different AAM regulations, ultimately stifling the industry. Additionally, some existing infrastructure will need to be upgraded and retrofitted moving forward, such as arrival and departure areas, charging stations, and safety features. The State can help ensure these upgrades are consistent and safe.

RESEARCH & DEVELOPMENT

The AAM industry faces significant research and development (R&D) challenges stemming from the nascent nature of its technologies and operational frameworks. Key unknowns include optimizing battery technology for longer flight ranges and the reliable integration of AAM systems within existing air traffic management systems. Further complexities arise in ensuring robust safety and security measures that can adapt to AAM's highly dynamic operational environments. The intricacies of vertiport infrastructure development, particularly in urban settings where space and environmental impact are significant concerns, also present considerable challenges. These technological and infrastructural gaps necessitate focused R&D efforts to innovate solutions.

There are many unknowns in the industry and numerous entities involved. The State needs to coordinate R&D efforts to increase efficiency, avoid duplicating work, and maximize collaboration.

HOW ARE OTHER STATES ADDRESSING THESE CHALLENGES?

Several other states have started preparing for the AAM industry. Based on the expert opinions of the Committee, this section will focus on the actions taken by the transportation departments in Florida, Georgia, Ohio, and Virginia, which are states currently viewed as leaders in AAM.

FLORIDA

The Florida Department of Transportation has a robust AAM growth strategy, much of which is captured on the dedicated AAM section of their Aviation Office website. This section includes completed AAM reports such as a state AAM Roadmap (June 2022), an AAM Working Group Report and Recommendations (August 2023), and an Implementation and Public Outreach Plan (September 2023) (52). Florida's AAM Roadmap mentions AAM-related research happening at universities in the state, including research labs.

GEORGIA

The Georgia Department of Transportation also has an AAM expansion plan captured on their website. They commissioned an AAM Blueprint in April 2024 to assess AAM activities in the state, inventory existing infrastructure, develop tools for communities, and create a statewide action plan (53). Georgia's statewide technical report covers ongoing AAM-related research efforts at university research centers in the state, as well as research by the Georgia Center of Innovation, which is part of the state Department of Economic Development.

OHIO

The Ohio Department of Transportation also has an AAM development strategy. A statewide AAM Framework was completed in July 2022, detailing many aspects of AAM in Ohio and its potential in the state. Additionally, in June 2021 a consulting firm completed an economic impact study for AAM in Ohio (54). Ohio's AAM Framework report describes research efforts in the state, like the Ohio/Indiana Unmanned Aerial System (UAS) Test Center and an airspace management research project led by a state university.

VIRGINIA

The Virginia Department of Aviation has an AAM section on their website that provides basic information and resources about the industry. The Virginia Innovation Partnership Corporation, a non-profit arm of the state's Innovation Partnership Authority, has published reports related to AAM such as a UAS activity study and a report about Virginia's AAM future (55). Virginia's AAM Future report mentions AAM-related research activities occurring at several institutions in the state, including Virginia Tech's Federal Aviation Administration (FAA) UAS Test Site.

When looking across these states and the various activities they are doing, all the efforts can be grouped into three major strategies: **leadership**, **planning**, and **innovation**. Texas would be well served by taking similar approach.

RECOMMENDATIONS

To maximize the significant potential benefits of AAM and capitalize on Texas' natural advantages, the State needs to overcome key challenges by providing leadership, planning, and innovation.

Texas has many qualities which make it a likely home for AAM services and activity. It has good weather, a large population, a vast landmass, a vibrant economy, a business-friendly regulatory environment, and a tradition of innovation in the flight and aerospace industries. There are also significant rural and urban populations, providing opportunities to capture the benefits of both aspects of AAM—Urban Air Mobility and Regional Air Mobility.

AAM activity is already happening in Texas without any direct intervention from the State. However, if Texas wants to fully realize the benefits of the industry, it is imperative that State leaders implement the following key recommendations.

HOW CAN THE STATE HELP?

RECOMMENDATION 1.

LEADERSHIP

Designate key industry and state points of contact to lead and coordinate the development of AAM in Texas.

1.1. AAM Advisory Committee
1.2. AAM Office (TxDOT)
1.3. AAM Position (OOG)
1.4. State Agency Information Sharing
1.5. AAM Pubic Awareness

RECOMMENDATION 2.

PLANNING

Create a series of coordinated statewide plans and working groups to help shape the future of AAM in Texas.

2.1. Statewide Strategic Plan
2.2. Statewide Economic Impact
2.3. Cybersecurity Risk Mitigation
2.4. First Responder Training
2.5. Statewide Airspace Infrastructure
2.6. Uniform Infrastructure Standards
2.7. Electrical Infrastructure
2.8. Workforce Development

RECOMMENDATION 3.

INNOVATION

Provide funding to TxDOT to create a program for state universities to support research and development for AAM technologies, products, and services in Texas by providing matching funds for federal grants and requiring a minimum percentage of community or industry match.

Recommendation 1. Leadership

Designate key industry and state points of contact to lead and coordinate the development of AAM in Texas.

Leadership is crucial for success and is essential for proper planning and strategic innovation. Without strong leadership, Texas will fail to capitalize on its natural advantages and reap the full benefits the AAM industry can bring, thereby falling behind other states.

1.1. AAM Advisory Committee. Direct TxDOT to continue and expand the AAM Advisory Committee, in part to support the development of the Statewide AAM plan.

Rationale: Continuation of the AAM Advisory Committee will allow members of the industry to share their contemporary and critical knowledge with policymakers and state leaders. Expanding Committee membership will also ensure all aspects of this wide-ranging emerging industry are represented. Additionally, Committee input on future AAM plans will be critical. Their contribution to planning ensures that the State and industry work together on critical issues to produce comprehensive plans.

AAM leadership in Texas will require a combination of appointing key leadership roles and coordinating communication, as detailed in action steps 1.1 – 1.5.

1.2. AAM Office (TxDOT). Create an office at TxDOT to provide technical support for AAM infrastructure at Texas airports, with a particular focus on electric and autonomous AAM aircraft needs.

Rationale: TxDOT coordinates the funding and management of capital improvement projects at the State's nearly three hundred General Aviation airports, which will play an important role in AAM implementation. TxDOT needs a focused office dedicated to AAM to foster expertise and allow for the efficient integration of AAM infrastructure into the existing transportation network. Combining the knowledge and understanding of AAM with traditional aviation will accelerate the efficient adoption of AAM technology into cargo and passenger mobility operations.

1.3. AAM Position (OOG). Create a position at the Office of the Governor to increase adoption and awareness of Texas on the national and international stage to attract investment in autonomous vehicles including AAM technologies (for example, through demonstration day coordination, conference booths and presentations). Additionally, this position could provide guidance and resources to public safety agencies across the state to assist in the awareness of AAM technologies and how to safely interact with these services.

Rationale: The AAM industry has only recently emerged and faces issues related to public perception and understanding. A representative at the Office of the Governor (OOG) will raise awareness of Texas as a welcoming environment for AAM among industry leaders. The position will also serve as an AAM single point of contact for industry interests and public awareness.

1.4. State Agency Information Sharing. Reestablish the working group from HB 2340 (2019) and include members of the AAM community in the group.

> Sec. 418.055. The work group shall develop recommendations for improving the manner in which electronic information is stored by and shared among state agencies and between state agencies and federal agencies to improve the capacity of the agencies to:
>
> (1) respond to a disaster; and
> (2) coordinate the agencies' responses to a disaster.

Rationale: AAM aircraft can provide timely and critical information during disasters. Close coordination between agencies during a disaster is critical and inclusion of AAM information sharing protocols will maximize response efforts and ensure safe operations.

1.5. AAM Public Awareness. Develop communication materials to be posted on TxDOT's website to inform decision makers, the public, the aviation community, and recreational drone users about AAM.

Rationale: Other AAM leader states have addressed communication in part by having webpages dedicated to AAM on their Department of Transportation websites. These pages act as AAM information hubs, providing basic knowledge about the industry and linking to other authoritative sources. TxDOT should have space on their website allocated to AAM to help inform decision makers and the general public about AAM in Texas.

Recommendation 2: Planning

Create a series of coordinated statewide plans and working groups to help shape the future of AAM in Texas.

Planning will help ensure coordinated action at the state and local levels, bringing diverse opinions from a variety of players together. Planning will help maximize benefits and minimize risks and challenges. Without proper planning, Texas will fail to maximize the benefits of AAM for its residents and businesses.

2.1. Statewide Strategic Plan. Develop a statewide strategic plan which establishes a vision and direction for AAM including near-term, medium, and long-range goals in conjunction with industry and community representatives. This plan should include topics like AAM use cases; evaluation of existing infrastructure and necessary infrastructure upgrades, including ones allowing for autonomous operations; potential route planning; regulatory best practices; next steps; and other pertinent information.

Rationale: Other AAM leader states have statewide strategic plans which provide information about AAM and lay out future steps. Developing a consensus based strategic plan for AAM in Texas will provide industry and state and local policymakers with an idea of how AAM can function in Texas.

2.2. Statewide Economic Impact. Estimate the economic impact of AAM in Texas, similar to other AAM leader states, with a particular focus on electric and autonomous aircraft.

Rationale: The AAM industry has the potential to generate significant economic benefits. Currently, Texas must rely on national estimates and is at a disadvantage competing against states that have already completed state-specific economic impact assessments. A statewide economic impact study for Texas will quantify the potential economic impact of the AAM industry for state leaders and help generate private investment to act as a building block for long-term planning.

2.3. Cybersecurity Risk Mitigation. Establish a statewide working group to evaluate cybersecurity and data risks posed by AAM technologies and develop strategies to minimize risks. The working group shall include representatives from state and local public safety agencies, National Institute of Standards and Technology (NIST), Cybersecurity and Infrastructure Security Agency (CISA), and industry.

Rationale: The highly automated nature of AAM aircraft introduces potential cybersecurity issues, which could lead to data leaks or other problems. With a collaborative multi-disciplinary effort between state, federal, and industry representatives, these cybersecurity risks to autonomous vehicles can be thoroughly investigated and minimized. This working group could also collaborate with other established groups that are evaluating autonomous vehicles more broadly.

2.4. First Responder Training. Create a Texas Division of Emergency Management-led industry and agency working group to develop curriculum and a resource repository to assist first responders in dealing with AAM-related emergencies.

Rationale: AAM aircraft are new and continually evolving, and first responders are not fully prepared to deal with them should they malfunction. With the proper training and resources, first responders will be able to more effectively respond to AAM-related emergencies, keeping themselves and the public safe. To ensure the optimal design of training materials and resources, there should be a collaborative effort between experienced members of both private industry and agency.

2.5. Statewide Airspace Infrastructure. Develop a plan for an AAM Airspace Integration System to provide airspace awareness that includes:

i. Proposed operator
ii. System capabilities and architecture
iii. Phased implementation
iv. Data exchange mechanisms between public and private third-party system operators
v. Support for public safety to integrate into airspace infrastructure

Rationale: AAM aircraft and traditional aircraft will share the airspace regardless of their function. With an increase in these technologies populating the airspace, a system designed to safely integrate these aircraft and improve communication between operators will be critical in ensuring the safety and security of cargo and passengers in the air.

Successful AAM planning in Texas will require a coordinated effort from multiple expert stakeholders, as detailed in action steps 2.1 – 2.8.

Recommendation 2. Planning (continued)

2.6. Uniform Infrastructure Standards. Identify ways to encourage the use of consensus-based vertiport standards (e.g., templates) and support uniform planning and zoning enabling language related to powered-lift aircraft, autonomous aircraft, electric aviation, and other advances in aviation technology across the state.

Rationale: Consistency, predictability, and interoperability will be important in establishing this industry throughout Texas. There are two areas where uniformity is especially important: infrastructure standards, and planning and zoning. Encouraging the use of AAM standards, such as for vertiport infrastructure, will allow industry partners to function in a consistent manner across the state, create a predictable operating environment, and enable the entrance and competition of multiple AAM Offices of Emergency Management (OEMs) and operators. Without statewide best practice guidelines relating to planning and zoning, the development of the AAM industry in Texas and its related benefits could face a patchwork of conflicting rules.

2.7. Electrical Infrastructure. Estimate the required electrical generation and transmission capacity in conjunction with the major state utilities, ERCOT, etc. for the different implementation phases of AAM in Texas and evaluate the use of other fuel sources.

Rationale: The potential electrical demand of the AAM industry is one of the most pressing issues in its full-scale implementation. To support the burgeoning field of AAM in Texas, it is imperative to develop a comprehensive electrical capacity plan that addresses the anticipated demands of this transformative technology. Long lead times for establishing additional electrical capacity necessitate planning for the establishment of vertiports and associated infrastructure. By proactively planning, Texas can ensure the reliability and efficiency of its electrical grid for AAM and understand how to leverage and augment planned ground EVs infrastructure development for more efficient development.

2.8. Workforce Development. Direct the Texas Workforce Commission, the Higher Education Coordinating Board, Texas State Technical College, and the Texas Education Agency to develop an action plan to educate the workforce required to support a robust AAM industry in Texas, with a particular focus on electric and autonomous aircraft.

Rationale: This industry is expected to create thousands of high-paying jobs, and because AAM aircraft function differently than traditional aircraft, these jobs will require specialized training. Training programs for aviation-related occupations, such as mechanics, technicians, line staff, hospitality staff, eVTOL pilots, drone operators, engineers, and other workers who understand the nuances of the technology and operating system will be crucial to meet future workforce needs.

Recommendation 3. Innovation

Provide funding to TxDOT to create a program for state universities to support research and development for AAM technologies, products, and services in Texas by providing matching funds for federal grants and requiring a minimum percentage of community or industry match.

Example topics include autonomous aviation integration into the National Airspace System, improved batteries, fuel cell technology, alternative fuels, and AAM use cases for various markets.

Although there are ongoing AAM research efforts in the state, a cohesive and coordinated structured research initiative is needed to avoid redundant research, increase efficiency, and accelerate results. An organized and flexible approach would accelerate the development of viable AAM solutions and promote rapid innovation. This would make Texas and its universities a focal point for AAM technology research and potentially improve its appeal for students across the country.

An approach similar to the National Science Foundation's AI research institutes could be used, establishing dedicated R&D centers within Texas university systems (56). Each center would focus on specific R&D themes and promote interdisciplinary collaboration in engineering, technology, urban planning, and regulatory affairs, focusing on themes like battery technology, system integration, safety protocols, and infrastructure design. Collaboration with industry leaders and government agencies would ensure applicable research outcomes for the AAM industry.

CONCLUSION

AAM has the potential to bring economic, societal, and environmental benefits to Texas. These benefits include, for example, the creation of new jobs and revenue streams, improved access to goods and services, and reduced greenhouse gas emissions.

AAM is coming to Texas. To maximize the potential significant economic, societal, and environmental benefits it can bring, the State should invest in leadership, planning, and innovation for AAM.

APPENDIX A:

ADVISORY COMMITTEE BIOGRAPHIES

Dan Dalton, Wisk Aero LLC (Chair)

As the Vice President of Global Partnerships, Dan leads Wisk's global commercial and regulatory partnerships. Working with industry partners, regulators, policy-makers, Dan is a key contributor to driving Wisk's strategic efforts to bring Wisk's self-flying air taxi to the sky. Prior to joining Wisk, Dan served as Executive Vice President of Strategic Partnerships at Airspace Systems, Inc. and as a visiting scientist at Lawrence Livermore National Laboratory. Dan has also held a variety of engineering and leadership roles at General Atomics Aeronautical Systems and the US Department of Energy. As a commercially-rated pilot, Dan has a passion for innovation in the aerospace industry and enjoys flying land and seaplanes, as well as teaching the next generations about the wonders of flight. Dan holds a Master of Arts in International Relations from the Johns Hopkins School of Advanced International Studies and a Bachelor of Science in Aerospace Engineering from the University of California, San Diego.

Michael Sanders, Texas A&M University Corpus Christi Autonomy Research Institute (Vice Chair)

Mike Sanders leads TAMU-CC's Autonomy Research Institute (ARI). ARI is dedicated to pioneering the development of safe, reliable, and innovative autonomous systems. As one of seven Federal Aviation Administration (FAA) designated Unmanned Aircraft System (UAS) Test Sites, ARI conducts cutting edge research to advance the science and application of autonomy.

ARI is a leader in advancing the integration of small and large UAS and Autonomous Aviation (AAV) technologies across educational, public, and commercial agency interests; seamlessly integrating AAV systems that support Advanced Air Mobility (AAM) concepts; and supporting evaluations and demonstrations supporting the FAA's Next Generation (NextGen) office.

From 2014 to 2019, LSUASC participated in NASA's UAS Traffic Management (UTM) developmental efforts, culminating in the most complex UTM evaluation in an urban environment, including 216 live and 644 simulated flights, and 233 separate test events.

Since April 2020, Mike has led ARI's support to 6 separate NextGen evaluations and demonstrations implementing AAM concepts in Texas, California, and Virginia.

Ahsan Choudhuri, The University of Texas at El Paso

Dr. Ahsan Choudhuri is a Professor of Aerospace Engineering at the University of Texas at El Paso (UTEP). He holds the Mr. and Mrs. MacIntosh Murchison Distinguished Chair Professor in Engineering. Dr. Ahsan Choudhuri's academic career has evolved within UTEP's access and excellence mission paradigm. He is a part of UTEP's strategic vision to create abundant educational and career opportunities to ensure social mobility for the residents of the Paso Del Norte region. Dr. Ahsan Choudhuri is an internationally renowned expert in aerospace and defense systems. Dr. Choudhuri founded the UTEP Aerospace Center and led the growth of the UTEP aerospace and defense education and research program from infancy to a nationally recognized program. UTEP Aerospace Center, with an extensive research portfolio in space systems, missile systems, digital engineering, and uncrewed aerial systems, employs nearly 250 faculty, staff, and student researchers.

Amanda Nelson, Bristow Group, Inc.

Mandy Nelson has been with Bristow for 14 years and currently leads strategic relationships and business development for Bristow's Advanced Air Mobility segment. In this role she supports the Company's global AAM efforts by collaborating with manufacturers, industry partners, government, and other key global stakeholders to develop and support the successful launch of AAM aircraft within Bristow's fleet.

Prior to Bristow's merger with Era Group in 2020, she served in various commercial and managerial functions supporting the Company's traditional helicopter business segments, including offshore energy, tours, leasing, and firefighting. Mandy is also a commercial fixed wing pilot.

Andrew Chang, United Airlines

Andrew Chang is a Managing Director and leads United Airlines' Corporate Development team and United Airlines Ventures, a corporate venture capital fund created to invest in emerging companies and technologies that have potential to influence the future of travel, with a focus on decarbonizing aviation and improving the United customer experience.

Based in Houston, TX, Andrew also leads investments from UAV's Sustainable Flight Fund (SFF). Launched in February 2023 and now with more than $200 million of committed capital, the SFF deploys the financial and strategic capital of 22 total corporate Limited Partners (LPs) to accelerate research, production and technologies supporting sustainable aviation fuel (SAF).

Prior to joining United, Andrew was an investment banker advising Boards of Directors and management teams on evaluating strategic alternatives, including transaction execution for M&A, restructuring and capital raises.

During his 15 years at Lazard, Andrew advised airline and energy (downstream and oilfield services) clients, and he co-led the launch of Intrepid Financial Partners' Sustainability and Energy Innovation initiative to support clients' investments in energy transition.

Andrew started his career at Credit Suisse as an Analyst after graduating summa cum laude with a Bachelor of Science in Economics and Managerial Studies from Rice University.

Angel Newhart, Texas State Technical College (TSTC), MDIV, Commercial License, CFI, CFII, MEI, AGI

Angel has been part of the aviation workforce for almost 30 years. She served for several years on active duty as a navigator in the Army, and continues to serve as a Chaplain in the TXARNG. She has airline experience, as well as multiple leadership positions. Angel has been part of TSTC for 19 years, and now currently leads the Aircraft Pilot Training and UAV program as the Director of Alignment. She seeks to expand TSTC's knowledge and participation in AAM, through expanded curriculum, flight training, manufacturing, TSTC's Airport expansion and many facets of workforce development. (TSTC Waco Campus/Airport over 2000 acres). Angel and her team started a Drone Certificate program at TSTC in 2021. She currently serves as a member of the Greater Waco Chamber of Commerce. Angel collaborates with dozens of industry partners, and government entities as well as being actively involved in the expansion of the aviation programs throughout the state and the flight operations on the Waco Campus. She holds three degrees. An AAS, Aircraft Pilot Training from TSTC. Second a BS, Aviation Science from Tarleton State University. Third, Masters of Divinity from Liberty University.

Ben Ivers, Boeing

Ben Ivers is the Director of Autonomous Systems for Global Safety & Regulatory Affairs leading enterprise-wide safety, regulatory affairs and advocacy for AAM, UAS and Autonomous Systems. In this role, Ben leads his team to work closely with regulators and other industry stakeholders. Ben serves as the Chair of the AUVSI Air Advocacy Committee, Vice-Chair of the AIA Emerging Technologies Committee and Vice-Chair for the ICCAIA AAM Working Group. He also actively supports Boeing's involvement in the FAA's NextGen Advisory Committee, industry groups including GAMA, US Chamber of Commerce, NAM and BRT as well as standards organizations including ICAO, RTCA and more.

Prior to this role, Ben led Commercial Airplanes Product Development for Systems and Autonomy. There his team was responsible for research and development of new and derivative airplane systems as well as advanced technologies.

Other past Boeing assignments include leadership roles in Electronic Systems, Airspace Design / Air Traffic Management, Certification and Electrical Design. Ben joined Boeing in 2004.

Brent Klavon, ANRA Technologies

Brent Klavon serves as the Chief Strategy Officer at ANRA Technologies, headquartered in Washington DC. ANRA specializes in digital solutions facilitating the seamless operation and management of autonomous systems. Brent brings a wealth of expertise at the intersection of policy, regulations, technology, and social integration, actively contributing to both private and public initiatives aimed at propelling future mobility and transportation ecosystems forward. With a background as a retired US Navy pilot, Brent holds FAA certifications as both a Commercial Pilot and Remote Pilot.

Brent Skorup, Cato Institute

Brent Skorup is an attorney and research fellow at Cato Institute and he has developed expertise in the areas of property rights, airspace management, and wireless technology. He is often consulted by policy makers, including White House policy staff, state aviation regulators, and an FAA Drone Advisory Committee (DAC) working group, about drone and AAM technology and policy. Mr. Skorup's airspace management recommendations have been featured in the DAC Working Group 3 final report, GAO reports to Congress, and NASA UAM airspace research. He has published research about drones and AAM in law journals, popular media, and trade publications, including the Wall Street Journal, USA Today, GovTech, and Air Traffic Management magazine.

Mr. Skorup was previously a senior research fellow at the Mercatus Center at George Mason University. He has been appointed to serve on several federal and state advisory positions, including on TxDOT's Connected and Autonomous Vehicle Task Force, on the FCC's Broadband Deployment Advisory Committee, and as a drone law adviser to the Virginia Department of Aviation.

Cade Clark, Vertical Aviation International

Cade Clark, Chief Government Affairs Officer, runs the government affairs program for Vertical Aviation International (VAI) to promote and defend the global vertical aviation industry. VAI is the professional trade association for the international civil vertical flight industry and represents more than 1,100 global companies and over 16,000 industry professionals in more than 65 countries.

Prior to his time at VAI, Cade served as the Vice President of Government Affairs for the Air-Conditioning, Heating, and Refrigeration Institute (AHRI), which represents more than 300 manufacturers of HVACR and water heating equipment.

Previously Cade served as the Director of Regulatory and Government Affairs for the National Association of Water Companies (NAWC). Cade was responsible for developing regulatory and legislative policy and representing the Association's members before State Public Utility Commissioners and Congress.

Cade holds a private pilot license, a BA in Political Science from Brigham Young University, and an MBA from Colorado State University.

Cameron Walker, AICP, Permian Basin Metropolitan Planning Organization

Cameron Walker has practiced municipal, regional, and transportation planning for over 40 years. He has worked in Victoria, TX, and Midland, TX for 32 years. He is currently serving as the Executive Director of the Permian Basin Metropolitan Planning Organization (since 2013).

Mr. Walker is an effective leader with proven successful endeavors with the City of Midland and the Permian Basin Metropolitan Planning Organization as well as in non-work-related settings. He serves as a member of the Midland Chamber of Commerce. He also serves on the Permian Road Safety Coalition, an agency with direct connections to the oil and gas industry and the trucking industry. The coalition exists to educate and ultimately to improve road safety in the Permian Basin. He serves on the Texas Border Trade Advisory Committee. He also served on the Ports-to-Plains Advisory Committee (I-27), the I-20 Corridor Committee, and a regional Freight Advisory Committee.

Mr. Walker holds bachelor's and master's degrees from Texas A&M University. He is a member of the American Institute of Certified Planners (1985).

David Fields, FAICP, Downtown Houston+

David Fields, FAICP, is the Director of Transportation for Downtown Houston+. Prior to this role, he was the City of Houston's first chief transportation planner. He believes a great community provides safe transportation choice for all. He is experienced planning and implementing multiple modes (walking, biking, heavy rail, light rail, on-street bus services, and transportation network companies), parking and curb management, and policy (transit-oriented development and transportation demand management)—all based on meaningful community participation.

Ernest Huffman, North Central Texas Council of Governments

Ernest was born and raised in Syracuse, New York and received his Bachelors in Aeronautical Science from Dowling College and his Master's in Aviation from Florida Institute of Technology. With over 23 years in the industry, Mr. Huffman has worked all over the country as an Aviation Consultant. Included in that is his work as an Airline Technical Representative and managing the building of the Chicago O'Hare Airport. His current role is the Aviation Planning and Education Program Manager for the North Central Texas Council of Governments. There he has different duties that include managing the Aviation Education Initiative, Regional Aviation System Plan and the North Texas UAS Safety and Integration Initiative. Ernest is also leading the region's efforts at integrating Advanced Air Mobility.

George Kivork, Joby Aviation

George Kivork is Head of US State and Local Policy at Joby Aviation. He is an attorney with extensive experience in legislative affairs and communications, having advised public advocacy campaigns, business executives, and policymakers. Most recently, he was Senior Policy Manager at Lyft overseeing California and the Southwest. Previously he served the City of Los Angeles in numerous capacities on behalf of Mayor Eric Garcetti. First, managing the City of Los Angeles's federal affairs office in Washington DC, then as press secretary, and ultimately as associate counsel advancing the City's strategic initiatives. Prior to that, George worked in the Office of the General Counsel at the US Department of Commerce, and as an attorney at O'Melveny & Myers. He is a graduate of University of Southern California and Georgetown Law School.

Grant Guillot, DroneUp

Grant Guillot is the Vice President for Regulatory Affairs at DroneUp, where he oversees federal, state, and local regulatory matters impacting the company's UAS operations. Prior to his position with DroneUp, Grant spent 12 years in private legal practice as a constitutional, telecommunications, and transportation attorney. During that time, he advised drone manufacturers and companies that provide UAS services, as well as companies operating in industries using drones. He has been featured on Fox Business and Fox News to discuss the opportunities and challenges arising from drone use. Grant has served as the host of "Drones in America, a video podcast produced by MarketScale, which explores how drones are improving lives and impacting various end-user industries.

Gus Khankarli, PHD, PE, PMP, CLTD, City of Dallas

Dr. Ghassan "Gus" Khankarli currently serves as the director of the City of Dallas Department of Transportation. In his current position, he leads the department's multimodal strategic vision including the integration of transportation assets with emerging technology needs. Dr. Khankarli has over 30 years of professional experience including 24 years in various capacities with TxDOT. He is a former member of Transportation Research Board Standing Committees on Aviation Administration and Policy (AV 010) and current member of the Intermodal Freight Transport (AT 045), and serves on several North Central Texas Council of Governments committees. Dr. Khankarli holds a doctoral degree in public affairs from The University of Texas at Dallas, an MBA from the University of Dallas, a master of engineering and a bachelor of science in civil engineering from The University of Texas at Arlington. He is a licensed engineer and certified project management professional, and is certified in logistics, transportation, and distribution.

Jason Day, Texas Department of Public Safety

Jason Day is the Director of Unmanned Aircraft at the Texas Department of Public Safety, bringing with him a wealth of experience from his 27-year tenure military, civilian, & public safety aviation. Mr. Day specializes in public safety UAS operations & administration and oversees one of the largest public safety UAS program in the nation with over 300 remote pilots & unmanned aircraft. His primary responsibilities include ensuring compliance with FAA regulations & maintaining the highest standards of safety in the department's UAS program. Texas DPS stands out as one of the most active UAS programs in the United States conducting 50,000 flights in 2023 & a remarkable 12,000 flight hours. Mr. Day operates with the Aircraft Operations Division of Texas DPS, Texas Air Operations Center, Texas HB2340 Committee, and other organizations developing policies, procedures, & training standards for UAS use by public safety agencies during disasters. Mr. Day developed & implemented the UAS Remote Pilot in Command training program for the department and is a member of UAS & cUAS working groups.

Jeff Bilyeu, AAE, Texas Gulf Coast Regional Airport (Brazoria County)

Jeff Bilyeu currently serves as the director of the Texas Gulf Coast Regional Airport in Brazoria County. He oversees a staff of 13 along with the day-to-day operations, maintenance, and fixed-base operator functions of an FAR 139 certificated reliever airport for the Houston metropolitan area and Gulf Coast.

Mr. Bilyeu is a licensed flight instructor and commercial pilot with instrument and multiengine ratings. He is an accredited airport executive and a past president of the South-Central Chapter of the American Association of Airport Executives. He has served on the Board of Directors of the American Association of Airport Executives and remains active in both regional and national affairs including currently serving on the AAAE Policy Review Committee. Locally, he is involved and serves on airport and transportation committees with various chambers of commerce and is a past chairman of the board for the Angleton Chamber of Commerce.

Jim Perschbach, Port San Antonio

Perschbach leads the team developing the 1,900-acre Tech Port innovation campus as a national destination for advanced technologies, including aerospace, cybersecurity, critical infrastructure resiliency, defense, manufacturing and global trade. The Port is one of South Texas' fastest-growing economic engines—home to over 80 tenant customers with 18,000 employees—with an annual economic impact of over $5.6 billion.

Perschbach also serves his community in other leadership roles. He's on the board of Our Lady of the Lake University (OLLU) and is a member of the Texas Advanced Air Mobility Committee—a body supporting the development of legislation and policies to implement emerging air transportation technologies statewide.

He has been named by the American Business Journals as one of the country's top 100 executives to watch. Perschbach holds an undergraduate degree in business administration from The George Washington University and a law degree from The University of Houston Law Center.

Kendal Prosack, Wing

Kendal Prosack is the US Lead for Local Policy and Community Affairs at Wing, focusing on building programs for successful community integration and grassroots mobilization. She works at the state and local level on legislative efforts to educate on the UAS industry and Wing's emerging drone technology. Before Wing, she was a Community Strategist for Postmates powered by Uber, focusing on relationship building and analyzing how AB5 would directly impact the gig economy. At Bird, she was a Community Relations Manager, where she helped codify rules and regulations for scooters and created outreach campaigns to secure community advocates. Kendal studied Political Science at Winona State and dove feet-first into the policy world after moving to Washington, D.C., where she worked on compliance and regulatory issues for several Political Action Committees.

Kimberly Williams, Metropolitan Transit Authority of Harris County

Kimberly J. Williams is a leading innovator and public transit leader of the Office of Innovation for the Metropolitan Transit Authority of Harris County in Houston, TX. Ms. Williams led implementation of Houston's first Autonomous Vehicle shuttle service and serves on the Steering Committee of the FHWA Center of Excellence on New Mobility and Automated Vehicles. She is active in the Texas Innovation Alliance and Rice University's Business Innovation Advisory Board. She authored the agency's first climate action plan and sits on the advisory board of the Houston Energy Transition Initiative (HETI). Ms. Williams was a member of the Urban Air Mobility Advisory Committee.

Kimberly is a member of the American Public Transit Association's (APTA) Board of Directors, Automated and Connected Vehicles Committee, and the Innovation Officer Peer Exchange Group. She is a member of Class 62 of the American Leadership Form, a graduate of Leadership APTA, ENO's Senior Transit Executive Program, and Transportation for America's Smart City Program. She serves on Transportation Research Board's (TRB) Transportation Research Analysis Committee (TRAC) and the Transportation Cooperative Research Program's (TCRP) Oversight & Project Selection (TOPS) Commission. Kimberly is a graduate of Leadership APTA, ENO's Senior Transit Executive and Transportation 4 America's Smart City Programs. Ms. Williams is a graduate of Howard University and Wayne State Law School, where she served as survey editor of the Wayne Law Review.

Mark Ozenick, Rotorcraft Newco Inc.

Mark is a respected industry veteran and pioneer in the helicopter regional transportation space as the founder and an owner of HeliFlite. HeliFlite is the industry acknowledged leader in this space and its brand is synonymous with safety, service and quality of aircraft.

He is the author of Lockheed Martin/Sikorsky's helicopter regional transportation business plan adopted by their subsidiary, Associated Aircraft Group. He orchestrated the sale of the business to Directional Aviation in 2022.

Among other C-level career achievements, Mark has been an advisor to Uber's Air Mobility initiative, American Airlines, Delta Airlines, JSX Airlines and Air Center Helicopters. Notably for Air Center, winning profitable government contracts and assisted in the deployment of rotorcraft operations in Afghanistan and Africa.

He has extensive experience partnering with family offices and private equity firms in deal sourcing, due diligence, strategy development and post-acquisition company integration and operations in business aviation Part 135 flight operations, MRO and FBO service spaces.

Mark is a highly sought-after aviation board advisor and is a current board member for Transcend Air, who is developing a game changing VTOL aircraft, Million Air, where he is an advisory board member on rotorcraft operations, and a member of the State of Texas' Advanced Air Mobility Advisory Committee.

Maruthi Akella, The University of Texas at Austin

Maruthi Akella is the founding director for the Center for Autonomous Air Mobility and the faculty lead for the control, autonomy, and robotics area within the Aerospace Engineering and Engineering Mechanics Department at The University of Texas at Austin. His research program encompasses coordinated control, adaptation and physics-based learning, guidance for hypersonic vehicles, and computationally lightweight vision-based perception solutions. For his high-impact research contributions, he was recognized by the American Institute of Aeronautics and Astronautics (AIAA) Mechanics and Control of Flight Award, the American Astronautical Society (AAS) Dirk Brouwer Award, the Institute of Electrical and Electronics Engineers (IEEE) Control Systems Society Award for Technical Excellence in Aerospace Control, and the IEEE Judith A. Resnik Space Award. He is currently Editor-in-Chief of the Journal of the Astronautical Sciences and serves on the AAS Board of Directors. He is a Fellow of IEEE, AIAA, and AAS, and holds academician rank with the International Academy of Astronautics.

Nathan Trail, Supernal

Nathan Trail is the Senior Director of International State & Local Policy at Supernal, a Hyundai company. He is responsible for working with international, state, and local legislators, regulators, community stakeholders, to develop policies and regulations that will foster the Advanced Air Mobility (AAM) industry and drive public acceptance. Nathan serves as an industry resource and expert for the AAM industry to governments and lawmakers throughout the US and internationally.

Nathan previously served as the Director of Technology Policy and State Legislative Affairs at the Consumer Technology Association (CTA). At CTA, Nathan grew the association's state and local government affairs presence and managed a portfolio of policy issues including unmanned aerial vehicles (UAS), sharing economy, micromobility, blockchain, and fintech.

Nathan has testified on behalf of the technology industry in over 30 state legislatures and municipalities and frequently speaks at industry panels and events.

Sergio Saenz, Rocinante Air LLC

Sergio Saenz has participated in the Angel Flight Program, providing free air transportation for medical and humanitarian purposes. He has been in aviation for the past 23 years and has logged over 3600 hours of flight time. Holding type ratings for various aircraft, including Citation CJ1, 2, 3, 3+, 4, M2 and Premier1. He is working on his Rotarcraft add on. Sergio is a board member on the Planning and Advisory Committee for the Weslaco Mid-valley International Airport and a Director on the Hidalgo County Regional Mobility Authority Board.

Mr. Saenz received his Bachelors in Criminal Justice and Masters in Business Administration from the University of Texas Pan American.

Thomas Swoyer, Jr., GrandSKY

Thomas Swoyer, Jr. brings over 30 years of real estate and site development experience including 12 years focused on Uncrewed Aircraft Systems (UAS) infrastructure development. Mr. Swoyer is the Founder and President of Infinity Development Partners (IDP). IDP invests in and works with communities to develop UAS facilities and infrastructure. Since 2015, Tom has led the development of GrandSKY, the nation's first commercial UAS Flight Operations Center (https://grandskynd.com/) in Grand Forks, ND. Since its inception, GrandSKY has secured $33m in public investment matched by nearly $200m in private sector investment. GrandSKY is home to UAS manufacturers and operators General Atomics and Northrop Grumman.

Mr. Swoyer recently began serving on the Texas Advanced Air Mobility Advisory Committee and soon to be formed North Dakota Air Mobility Working Group. In addition to GrandSKY, Mr. Swoyer also provides development planning services to Battle Creek Unlimited in Battle Creek, Michigan as they work to develop the Kellogg Executive Airport by adding UAS services.

APPENDIX B:

ADVANCED AIR MOBILITY SURVEY OF TRAVELING PUBLIC'S PERCEPTIONS – QUESTIONNAIRE

The survey questions are presented in a way that is consistent with how they would have been administered.

The list symbols used indicate how a question could be responded to:

- A list or series of questions

o Responses where only one response is allowed

□ Responses where multiple responses are possible

START DEMOGRAPHICS/FILTER QUESTIONS

Q1: How old are you?

o 0 – 17 (1)
o 18 – 24 (2)
o 25 – 29 (3)
o 30 – 39 (4)
o 40 – 54 (5)
o 55 – 64 (6)
o 65 – 74 (7)
o 75 – 89 (8)
o 90+ (9)

Skip to end if between 0 – 17.

Q36: What state do you live?

o Texas (1)
o A state in the United States other than Texas (2)
o A state in a country other than the United States (3)

Skip to end if not Texas.

Q2: How would you classify the community where you live?

o Urban (1)
o Rural (2)
o Suburban (3)
o Other (Please specify) (4)

Q35: What is your gender?

o Male (1)
o Female (2)
o Non-binary (3)

END DEMOGRAPHICS/FILTER QUESTIONS

START AWARENESS AND FEELINGS TOWARDS AAM

Please read the following description of a new type of air transportation and answer the following questions:

"Advanced Air Mobility (AAM) is a new concept of air transportation that moves people and cargo between places that lack convenient, sustainable or adequate access by automobiles or aviation. It uses aircrafts with new technologies in local, regional, intra-regional and urban locations.

AAM covers crewed and uncrewed aircrafts including:

- Sustainable electric Vertical Takeoff and Landing (eVTOL) aircraft
- Electric Short Takeoff and Landing aircraft (eSTOL)
- Small Uncrewed Aircraft Systems (sUAS), also known as drones."

Q3: Have you heard of the type of air transportation described above (Advanced Air Mobility)?

o Never heard of it nor seen it (1)
o Have heard a little about it but not seen it (2)
o Have heard a lot about it but never seen it (3)
o Have seen it in use (4)
o Have used it myself (5)
o I don't know/No answer (6)

Q4: What is the first word that comes to your mind when you hear about this type of air transportation described earlier (Advanced Air Mobility)?

Q5: Some states and countries have been using this type of air transportation (Advanced Air Mobility) in a wide range of situations. How much would you support this in your community under these situations?
(1=not at all; 5=support fully)

- To receive emergency medical service
- To receive humanitarian aid and disaster relief
- To send and receive lab samples, blood, vaccines and surgical equipment
- To receive medication refills
- To send and receive job site tools and equipment
- To aid in agricultural jobs, such as crop dusting or fertilizing
- To aid in park management jobs
- To monitor traffic
- To have safer transportation than my normal method
- To have a carbon neutral mode of transportation
- To help companies reduce their carbon emissions
- To send and receive inventory restock
- To receive mail
- To receive express courier
- To move goods around with a higher degree of automation
- To receive groceries
- To receive food and beverages
- To arrive at my destination faster
- To be more certain of my time of arrival at my destination
- To not have to drive to my destination
- To have an enjoyable travel experience

Q6: How would you rate your feelings towards this type of air transportation (Advanced Air Mobility) when used for the transport of:
(0=extremely negative; 100=extremely positive)

- Cargo/Things
- Passengers/People

END AWARENESS AND FEELINGS TOWARDS AAM

START ADVANTAGES AND BARRIERS TO AAM

Q7: In your view, what is the main advantage of using this type of transportation (Advanced Air Mobility)?

Q8: In your view, what concerns you the most about the use of this type of transportation (Advanced Air Mobility)?

Q9: Please state your level of agreement with the following statements about Advanced Air Mobility, as described earlier
(1=completely disagree; 5= completely agree)

- Moving of cargo via AAM will make our roads safer.
- Moving of people via AAM will make our roads safer.
- Moving of cargo via AAM will endanger those who are under it.
- Moving of people via AAM will be dangerous for those who are traveling.
- When it is flown with a pilot, AAM is as safe as airplanes.
- When it is automated, AAM is less safe than an airplane.
- AAM is more subject to cyberthreats than other modes of transportation.
- AAM is less subject to cyberthreats than other modes of transportation.
- When moving cargo, AAM will make it faster for goods to arrive at
  their destination.
- When moving people, AAM will make it faster for people to arrive at
  their destination.
- It is important to me to know how fast goods arrive at my residence.
- It is not important to me how fast I arrive at my destination.
- AAM will ease road traffic.
- AAM will worsen air traffic.
- AAM will help combat climate change.
- AAM will help the environment overall.
- AAM will help ease air pollution in general.
- AAM will create visual pollution.
- AAM will create sound pollution.
- AAM will disrupt the environment.
- AAM will connect communities.
- AAM will connect businesses.
- AAM will make it cheaper to get services.
- AAM will disrupt my privacy.
- AAM will easily integrate with other means of transportation.
- AAM will disrupt other means of transportation.

Q10: How likely are you to use Advanced Air Mobility transportation under the following scenarios (1= not likely at all; 5= very likely)

- To receive goods at home
- To receive goods at work
- To get to the airport
- To get places for work
- To get places for leisure
- To receive medical services
- To receive emergency services
- If I get a chance to see it in use first
- If I get a chance to try it myself

END ADVANTAGES AND BARRIERS TO AAM

START PATTERNS OF TRANSPORTATION AND DELIVERY

Q11: What is your current mode of transportation for school, work, errands, etc.? Please select the mode you use most often.

o Walking (1)
o Biking (2)
o Driving (3)
o Family member or acquaintance drives me (4)
o Taxi or ride-share (5)
o Public transportation (6)
o Other (Please specify) (7)

Q12: Do you or someone in your household drive an electric car or plan on purchasing an electric car as your next vehicle?

o Yes (1)
o No (2)
o I don't know/No answer (3)

Q13: How many minutes a day do you usually spend in a vehicle, such as car, truck, motorcycle, etc.?

o Specify a number (1)
o I don't know/No answer (2)

Q14: How many minutes do you think it would take you to get from your home/residence to a hospital or emergency room?

o Specify a number (1)
o I don't know/No answer (2)

Q15: How many times did you travel by air, airplane or helicopter, this past year (for work or leisure)?

o 0 (1)
o 1-3 (2)
o 4-6 (3)
o 7-9 (4)
o 10-12 (5)
o 13 or more (6)

Q16: How many minutes does it usually take you to get to an airport from your home or residence?

Q17: During the past week, how many times did you have goods delivered to your household?

o 0 (1)
o 1-3 (2)
o 4-6 (3)
o 7-9 (4)
o 10-12 (5)
o 13 or more (6)
o I don't know/No answer (7)

Q33: Do you or someone in your household own a drone?

o Yes (1)
o No (2)
o Don't Know/ No answer (3)

Q34: In your opinion, flying a drone during a disaster situation is usually:

o Helpful (1)
o Harmful (2)
o Doesn't impact the disaster (3)
o Don't Know/ No answer (4)

END PATTERNS OF TRANSPORTATION AND DELIVERY

START MEDIA AND SOCIAL MEDIA USE

Q18: Which of the following social media platforms have you used in the past week? (select all that apply)

☐ Facebook (1)
☐ X (Formerly Twitter) (2)
☐ Instagram (3)
☐ YouTube (4)
☐ TikTok (5)
☐ WhatsApp (6)
☐ Reddit (12)
☐ Telegram (7)
☐ WeChat (8)
☐ Snapchat (9)
☐ Twitch (10)
☐ Other (Please specify) (11)

Q19: Which of the following sources of news and information have you used in the past week? (select all that apply)

☐ Newspaper print (1)
☐ Newspaper online (2)
☐ Newspaper social media (3)
☐ News app (4)
☐ Magazine print (5)
☐ Magazine online (6)
☐ Magazine social media (7)
☐ Television on a TV (8)
☐ Television online (9)
☐ Television social media (10)
☐ Streaming services (Please specify) (11)
☐ Social media in general (Please specify) (12)
☐ Radio (13)
☐ Radio online (14)
☐ People I know (Friends, co-workers, relatives, etc.) (15)
☐ People I don't know (Celebrities or influencers) (16)
☐ Other (Please specify) (17)

Q20: Do you have a celebrity or personality who you like to follow on social media?

o No (1)
o Yes (Specify 3 that come to mind) (2)

Q21: Which of these sources do you usually use for information about transportation related issues? (select all that apply)

- ☐ Newspaper print (1)
- ☐ Newspaper online (2)
- ☐ Newspaper social media (3)
- ☐ News app (4)
- ☐ Magazine print (5)
- ☐ Magazine online (6)
- ☐ Magazine social media (7)
- ☐ Television on a TV (8)
- ☐ Television online (9)
- ☐ Television social media (10)
- ☐ Streaming services (Please specify) (11)
- ☐ Social media in general (Please specify) (12)
- ☐ Podcasts (18)
- ☐ Radio (13)
- ☐ Radio online (14)
- ☐ People I know (Friends, co-workers, relatives, etc.) (15)
- ☐ People I don't know (Celebrities or influencers) (16)
- ☐ Other (Please specify) (17)

END MEDIA AND SOCIAL MEDIA USE

START ADOPTION CATEGORIES, EXPERIENCES, AND CLIMATE CONCERN

Q22: Which of the below have you visited in the past year? (Select all that apply)

- ☐ Sporting event (1)
- ☐ Theme park (2)
- ☐ Education center (Ex: Science Mill, Discovery Center) (3)
- ☐ Concert hall (4)
- ☐ Movie theater (5)
- ☐ Fairs (Ex: State fair, stock show, car show, etc.) (6)
- ☐ Air show (7)
- ☐ Rodeo (8)
- ☐ Music festivals (9)
- ☐ Town festival (Ex: Mermaid Festival, Watermelon Thump, Fiesta) (10)

Q23: When thinking about technology, which, if any, of the statements below best describe you?

- o Other people seek my advice about technology devices and service. (7)
- o I'm always actively on the lookout to buy new technology devices and services. (1)
- o I'm always keen to use new technology products as soon as they enter the market. (2)
- o I like to get new technology products after they've been out for a while. (3)
- o I sometimes buy new technology products but only when I really like them. (4)
- o I only replace technology products when they go wrong or are broken. (5)
- o I don't know/No answer (6)

Q24: How worried are you about climate change? (1=not worried at all; 5= very worried).

- How worried are you about climate change?

Q25: Who is most responsible for reducing causes of climate change?

o Businesses (1)
o Government (2)
o Individual people (3)
o Non-government organizations (4)
o Scientists (5)
o No one (6)
o I don't know/No answer (7)

END ADOPTION CATEGORIES, EXPERIENCES, AND CLIMATE CONCERN

START DEMOGRAPHICS CONTINUED

Q26: What is the highest level of formal education you've received?

o No schooling completed (1)
o Some high school, no diploma (2)
o High school graduate, diploma or equivalent (3)
o Some college credit, no degree (4)
o Trade, technical, or vocational training (5)
o Associate degree (6)
o Bachelor's degree (7)
o Master's degree (8)
o Doctoral degree (9)

Q27: What best describes your current employment status?

o Full-time employment (1)
o Part-time employment (2)
o Self-employed (3)
o Out of work - not currently looking (4)
o Out of work - currently looking (5)
o Homemaker (6)
o Student (7)
o First responder (8)
o Local government (Ex: city or county school district) (9)
o State government (including state colleges and universities) (10)
o Active duty (U.S. Armed Forces or Commissioned Corps) (11)
o Federal government civilian employee (12)
o Retired (13)
o Unable to work (14)

Q28: Have you voted in any election in the past 5 years?

o Yes (1)
o No (2)
o I don't know/No answer (3)

Q29: What is your ZIP Code?

END DEMOGRAPHICS CONTINUED

APPENDIX C:

FEDERAL AAM DEFINITION

Excerpt from FAA Reauthorization Act of 2024
Subtitle B--Advanced Air Mobility
SEC. 951. DEFINITIONS.

In this subtitle:

(1) Advanced air mobility.--The terms “advanced air mobility” and “AAM” mean a transportation system that is comprised of urban air mobility and regional air mobility using manned or unmanned aircraft.
(2) Powered-lift aircraft.--The term “powered-lift aircraft” has the meaning given the term “powered-lift’’ in section 1.1 of title 14, Code of Federal Regulations.
(3) Regional air mobility.--The term “regional air mobility” means the movement of passengers or property by air between 2 points using an airworthy aircraft that--
    (A) has advanced technologies, such as distributed propulsion, vertical takeoff and landing, powered lift, nontraditional power systems, or autonomous technologies;
    (B) has a maximum takeoff weight of greater than 1,320 pounds; and
    (C) is not urban air mobility.
(4) Urban air mobility.--The term “urban air mobility” means the movement of passengers or property by air between 2 points in different cities or 2 points within the same city using an airworthy aircraft that--
    (A) has advanced technologies, such as distributed propulsion, vertical takeoff and landing, powered lift, nontraditional power systems, or autonomous technologies; and
    (B) has a maximum takeoff weight of greater than 1,320 pounds.

APPENDIX D:

TEXAS REGULATIONS

Table 6. Texas Legislation Related to AAM (57)

Year	Bill	Summary
1995	SB 971	This legislation requires a municipality to provide adequate soundproofing and noise reduction devices for each public building within the 65 or higher average day-night sound level contour as determined by the governing body in accordance with FAA Advisory Circulars for replacement airports (1995—recodification).
2013	HR 3035 SR 1084	Adopts two resolutions (House Resolution [HR] 3035 and Senate Resolution [SR] 1084) addressing legislative procedures needed to enact the new drone law.
2013	HB 912	Enumerates 19 lawful uses for unmanned aircraft. The law creates two new crimes, the illegal use of an unmanned aircraft to capture images and the offense of possessing or distributing the image. Image is defined in the law as any sound wave, thermal, ultraviolet, visible light, or other electromagnetic waves, odor, or other conditions existing on a property or an individual located on the property. **Note:** The previous provisions were impacted by NPPA v. McCraw. Additionally, the measure requires the Department of Public Safety to adopt rules for use of UASs by law enforcement and mandates that law enforcement agencies in communities of over 150,000 people make annual reports on UAS use. Texas House Concurrent Resolution (HCR) 217 altered reporting requirements from the original HB 912.
2015	HB 1481	Makes it a Class B misdemeanor to operate UASs over a critical infrastructure facility if the UAS is not more than 400 feet off the ground. **Note:** This provision was struck down by NPPA v. McCraw.
2015	HB 2167	Permits individuals in certain professions to capture images used in those professions using UASs as long as no individual is identifiable in the image. **Note:** This provision was impacted by NPPA v. McCraw.

Table 6. Texas Legislation Related to AAM (57) (continued)

Year	Bill	Summary
2015	HB 3628	Permits the creation of rules governing the use of UASs in the Capitol Complex and provides that a violation of those rules is a Class B misdemeanor.
2017	HB 1643	Adds structures used as part of telecommunications services, animal feeding operations, and a number of facilities related to oil and gas to the definition of critical infrastructure as it relates to UAS operation. **Note:** Portions of this legislation were struck down by NPPA v. McCraw except for the following provision: Prohibits localities from regulating UASs except during special events and when the UAS is used by the locality. The legislation defines special event.
2017	SB 840	Permits telecommunications providers to use UASs to capture images. Also specifies that only law enforcement may use UASs to capture images of real property that is within 25 miles of the U.S. border for border security purposes. The law also allows a UAS to be used to capture images by an insurance company for certain insurance purposes, as long as the operator is authorized by FAA. **Note:** These provisions were impacted by NPPA v. McCraw.
2017	HB 1424	Prohibits UAS operation over correctional and detention facilities. Also prohibits operation over a sports venue except in certain instances. The law defines sports venue as a location with a seating capacity of at least 30,000 people and that is used primarily for one or more professional or amateur sports or athletics events. An initial violation is a Class B misdemeanor, and subsequent violations are Class A misdemeanors. **Note:** This provision was struck down by NPPA v. McCraw.
2021	SB 1202	A retail electric provider does not include a person not otherwise a retail electric provider who owns or operates equipment used solely to provide electricity charging service for consumption by an alternatively fueled vehicle.

Table 7. Texas Legislation related to AAM (58). Summaries are from the enrolled bill summaries on Texas Legislature Online.

Year	Bill	Summary
2021	HB 1758	Amends the Code of Criminal Procedure and Penal Code to require each law enforcement agency that uses or intends to use a drone for law enforcement purposes to adopt and update as necessary a written policy regarding the agency's use of force by means of a drone and to submit the policy to the Texas Commission on Law Enforcement every two years. The bill also limits the circumstances under which the use of force, including deadly force, involving a drone is justified.
2021	SB 149	Amends the Government Code to designate as critical infrastructure facilities over which it is an offense to operate an unmanned aircraft a public or private airport depicted in any current aeronautical chart published by the Federal Aviation Administration and a military installation owned or operated by or for the federal government, the State of Texas, or another governmental entity. This designation applies only if the facility is completely enclosed by a fence or other physical barrier that is obviously designed to exclude intruders or if it is clearly marked with a sign or signs that are posted on the property, are reasonably likely to come to the attention of intruders, and indicate that entry is forbidden.
2023	HB 3075	Amends the Penal Code to create the stand-alone offense of operation of an unmanned aircraft over a correctional facility or detention facility, which consists of the same conduct as the Government Code offense of operation of an unmanned aircraft over a correctional facility, detention facility, or critical infrastructure facility with respect to a correctional or detention facility.

Table 7. Texas Legislation related to AAM (58). Summaries are from the enrolled bill summaries on Texas Legislature Online. (continued)

Year	Bill	Summary
2023	SB 1308	Restores protections for the security of military installations and airports by amending the Penal Code to create the standalone offense of operating an unmanned aircraft over an airport or military installation.
2023	SB 423	Amends the Government Code to provide that an image captured using an unmanned aircraft in Texas by the Texas military forces as part of an operation, exercise, or mission of such forces is a lawfully captured image.
2023	SB 2144	Amends the Transportation Code to set out provisions relating to advanced air mobility. The bill requires the Texas Department of Transportation to ensure state aviation standards and guidelines are applicable to advanced air mobility, support the development of federal and industry safety standards for advanced air mobility technology, develop a statewide infrastructure plan regarding the future operational environment of advanced air mobility, and provide resources and assistance on the use of the technology and infrastructure to appropriate entities.

APPENDIX E:

POTENTIAL AAM COMMUNICATION STRATEGIES

Texas State University's communication team understands the need to create awareness among Texans about Advanced Air Mobility (AAM). To build awareness, create trust, and position TxDOT as an expert in the field, the team offers several key communication strategies to be considered as the industry matures. The primary goal of these efforts should be to:

Develop and implement a bilingual strategic communication plan. This should be a multi-faceted campaign that utilizes paid, earned, shared, and owned media.

A. Educate and build awareness of AAM.

A.1. Collaborate and coordinate on communication strategies and outreach, including industry leaders, and TxDOT and the Office of the Governor.

A.2. Create a definition of AAM that the public can understand. The definition of AAM is confusing – trust is an issue with the unfamiliar. Make sure to eliminate industry jargon or acronyms in messaging.

A.3. Create messaging that reflects the needs of the people in different regions. Utilize a storytelling strategy to create authenticity and build trust by including testimonials from businesses and customers that have used these services.

EXAMPLES

- Rural Texans could benefit from quick and easy access to prescriptions.
- Urban Texans could benefit from local deliveries of food.

A.4. Create marketing assets or events that will allow the distribution of information and position the state as an expert in AAM.

EXAMPLES

- Develop an informative website.
  The State of Ohio is an example of best practice
  https://drive.ohio.gov/programs/aam/flyohio/flyohio

- Develop Toolkits for local, city, and state governmental agencies or organizations like chambers of commerce to use to educate their communities in a grassroots effort that is personalized.

  End the Streak is an example (https://txdot.app.box.com/s/crnrrep8v8pbn8rxg0n526wi9xp5kg44/folder/124749661469)

- Develop a Social Media Strategy and Plan including:

  - Visual content (mostly video) on TxDOT social media channels (Instagram, Facebook, and LinkedIn) would help establish Texas and TxDOT as leaders in this area.

  - Short-form, vertical videos on Instagram and Facebook content would help the public see how AAM technology and integration will help their daily lives.

  - Testimonial-like content on LinkedIn would be geared toward attracting more companies to invest in AAM efforts and industry here in Texas.

- Create and host a yearly conference about AAM. Coordinate with state industry leaders on content and funding.
  The Ohio Air Mobility Symposium is an example
  https://u.osu.edu/ohiouamsymposium/

B. Build Trust through Transparency and Authenticity.

B.1. Communicate cyber security best practices and regulations to build trust and establish an assurance of safety.

B.2. Develop risk management assessments to prevent or deal with potential crisis communication issues.

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