Advanced Air Mobility (AAM) Transportation Plan

Transportation and Environmental Considerations and Opportunities Report

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Executive Summary

The purpose of the Advanced Air Mobility (AAM) Transportation Plan is for the City of Orlando to be able to plan for the anticipated impacts associated with AAM through a regional connectivity framework. AAM is an emerging transportation technology that envisions a network of electric Vertical Takeoff and Landing (eVTOL) vehicles transporting passengers and cargo at low altitudes. These vehicles have the potential to fly +/-150 miles on a single charge, traveling faster than vehicle travel on roadways would allow. Upon maturity, the AAM network will consist of vertiports located on rooftops in urban settings, hospitals, airports, and other major multimodal transportation hubs throughout the Central Florida region.

The purpose of this technical memorandum is to identify the initial transportation and environmental considerations, and the opportunities that may occur because of passenger AAM operations in Central Florida. The memorandum provides technical information regarding airspace regulations, state and federal policies and regulations, and vertiport design considerations.

The City convened two stakeholder engagement meetings with regional transportation and local government partners to discuss a future vision for regional AAM service. Through collaborative visioning exercises, the following concerns and opportunities were identified:

- Vertiport locations, airspace, and safety were the major concerns shared by stakeholders
- Noise, equity, and connectivity were also concerns identified by stakeholders
- Opportunities for AAM in Central Florida include a new future form of Transit Oriented Development (TOD), enhanced sustainability, economic development potential, and transportation improvements

This memorandum does not include a specific operations or capital plan for AAM service in the City; this will be defined in future phases, in collaboration with public sector partners and private industry. Through the land development code, the City controls zoning and land use approvals of proposed vertiport sites. Coordination with other agencies (FDOT, FAA) will be necessary to permit the airspace rights necessary for AAM operations. While the City will not operate or own eVTOL vehicles, it can show regional leadership and cultivate a business-friendly location for this emerging industry to develop within.

Next steps include a network demand analysis to identify potential vertiport target locations throughout the region, economic impact assessment of a conceptual urban garage vertiport, community workshops to inform and educate the public about potential benefits of future AAM service, a review of the current land development code regulations for Vertiports, and ongoing stakeholder coordination.

A list of commonly used acronyms is found in Appendix A.

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Introduction

The purpose of the Advanced Air Mobility (AAM) Transportation Plan is for the City of Orlando to be able to plan for the anticipated impacts associated with AAM through a regional connectivity framework. The development of the AAM Transportation Plan aligns with Orlando's vision to become America's premier Future-Ready City by staying ahead of the City's opportunities, ensuring the City Beautiful remains a global destination where everyone can thrive. This AAM Transportation Plan will position the City with additional future-ready mobility options by identifying potential areas that are suitable for vertiports to support the movement of residents, businesses and visitors, while avoiding community impacts.

The purpose of this technical memorandum is to identify the initial transportation and environmental considerations, and the opportunities that may occur because of passenger AAM operations in Central Florida. This report does not address freight or drone use.

What is Advanced Air Mobility?

Advanced Air Mobility (AAM) is an emerging transportation technology that envisions a network of electric Vertical Takeoff and Landing (eVTOL) vehicles transporting passengers and cargo at low altitudes. In addition to electric power, future vehicles may be powered by hydrogen cells. The Federal Aviation Administration (FAA) defines AAM as an evolution of the Urban Air Mobility (UAM) concept, which "*envisions a safe and efficient aviation transportation system that will use highly automated aircraft to operate and transport passengers or cargo at lower altitudes within urban and suburban areas. UAM is composed of an ecosystem that considers the evolution and safety of the aircraft, the framework for operation, access to airspace, infrastructure development, and community engagement*."[1] AAM will incorporate use cases outside of urban environments, such as:

- Commercial Intercity (Longer Range/Thin Haul)
- Cargo Delivery (last mile)
- Public Services
- Private / Recreational Vehicles

For the purposes of this report, the term AAM will be used consistently throughout to refer to both advanced air mobility and urban air mobility, unless a reference source specifically uses the term UAM. A list of commonly used acronyms is found in Appendix A.

The AAM industry is rapidly taking shape around the world and is quickly becoming a realized goal with multiple eVTOL aircraft manufacturers and operators competing to be the first to commercially launch. There are over 300 aircraft designs in development, each with various business models. Many are in the design testing phase, with over 30 companies engaging in certification with the FAA and several in the process of certification with EASA (European Union Aviation Safety Agency).

At the time of this report, two AAM stakeholder engagement meetings were held where the Project Team documented considerations and opportunities identified by each agency partner. This assessment provided an organized means to assess strengths and weaknesses, as well as the competitive short- and long-term posture relative to a vision of AAM within the region.

[1] https://www.faa.gov/uas/advanced_operations/urban_air_mobility/

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Transportation Considerations and Opportunities

Achieving the City of Orlando's vision requires extensive collaboration with various regional partners and identification of potential challenges associated with AAM. This effort will provide the City a list of considerations for private AAM service providers to consider to gain approval for providing the service within the City and identifying the desired vertiport locations for City approval. This will require input and effort from other various stakeholder such as neighboring cities, counties, state and national agencies, AAM manufacturers & operators, federal regulators and other AAM related service providers.

Transportation Considerations

Policy Alignment

The City believes that local and State government will continue to be involved in the regulations regarding takeoff and landing facilities, permitting such facilities, and potentially companies taking off and landing within the city. The FAA will continue to regulate the airspace and any safety related items but may allow local government to dictate specific flight paths for low flying aircraft based on ordinances. The City plans to develop the local regulations with an iterative approach by engaging various partners along the way as part of a AAM pilot project.

Orlando is a future-ready city that positions itself to take advantage of the innovative and technological advances, including AAM. The City brings a history of partnerships and innovation along

with the necessary infrastructure and 75 million visitors annually to the region. The City of Orlando envisions real-life eVTOL operations on or before 2025 assuming FAA approval. The City has experience planning for and issuing permits for vertiports for traditional helicopter use and will determine if revisions are necessary for modern aircraft in a future project phase..

Additionally, the City of Orlando is one of five government entities (and the only municipality) selected to participate in National Aeronautics and Space Administration's (NASA's) new AAM aero-research partnership, an initiative that allows NASA's aeronautical innovators to work with participating governments to define what it means to be a sustainable, resilient community with AAM as a significant new mode of public transportation. The NASA partnership includes a series of workshops where the City and stakeholders from across the state work with NASA's AAM team to identify areas of opportunity and concern regarding AAM integration and discuss strategies for future engagement and planning. Workshop participants include partners from local governments, airport authorities and operators, universities, vehicle and subsystem manufacturers, infrastructure providers, workforce development organizations and others. This initiative will help the City align with both state and federal guidelines. The City will continue to work with public and private stakeholders to set up the necessary regulatory and public co-creation frameworks that will ensure AAM continues to meet all required state and federal guidelines.

State Guidance and Policies

State and local governments may impose local restrictions on environmental impacts, noise, timing of operations, energy usage, zoning, or land use to include vertiport locations and uses, or other locally regulated issues. Vertiport are currently being treated like heliports and have to go through rigorous permitting processes with FDOT, consistent with Section 330.30, Florida Statutes.

Federal laws and regulations generally preempt state and local legal authorities that purport to regulate aviation. However, laws traditionally related to state and local police power, including land use, zoning, privacy, trespass, and law enforcement operations – which indirectly impact the use of airspace - are generally not subject to federal regulation.

However, states and municipalities do have some indirect regulation over aviation such as:

- Use zoning laws to restrict the placement of helipads and airports
- Impose landing fees or taxes
- Require business licenses
- Restrict flight access at police and emergency scenes
- Control much of the AAM infrastructure such as buildings, power sources and equipment, landside facilities, and intermodal connections

There is more federal preemption for AAM than for Unmanned Aircraft Systems (UAS)[2], and more FAA certification oversight for eVTOLs. All UAS that weigh more than 0.55 lbs. (250 grams) must

[2] Unammed Aircraft Systems (UAS) is a Department of Defense definition, and separate from UAM (Urban Air Mobility), an FAA definition. https://dod.defense.gov/UAS/

be registered. However, UAS that are operated exclusively in compliance with Public Law 112-95 Section 336 (Special rule for model aircraft), are not required to register at this time.

Larger infrastructure needs for AAM provide a greater opportunity for community influence through land use permitting than for UAS.

- State and local regulations – e.g., land use, zoning, transportation regulation
- State common law – liability, property rights, nuisance

Public Aircraft Operations

Public entities, like police and fire departments, have another operational path available to them. Known as Public Aircraft Operations (PAO), it is defined in 49 U.S.C. §40102(a)(41) and §40125. FAA Advisory Circular AC 00-1.1A provides additional information. PAO allows aircraft that may not meet conventional requirements to be operated by, or under the direct supervision of, a public or government entity for the public good. To be considered a PAO, the entity must be qualified as such by the FAA and must make a determination for each flight that it is a qualified operation. Only crew can fly on a PAO flight and they cannot be flown for compensation. This could be a good path forward for local emergency response organizations that want to start getting experience with eVTOL and AAM operations before commercial operations are mature.

Florida Transportation Plan

The Florida Transportation Plan (FTP) vision for Florida in 2045 is for a safe, secure, agile, resilient, quality, connected, efficient, and reliable transportation system that provides affordable and convenient choices and strengthens our economy, communities, and environment. Their goals in supporting and working towards this vision include the following AAM strategies:

- Develop targeted initiatives to position Florida as a global talent leader for transportation innovations such as automated and connected vehicles, urban air mobility, commercial space transportation, and advanced logistics.
- Adapt and accommodate emerging air and space technologies such as next-generation air traffic control systems, urban air mobility, unmanned aerial systems, and space-based communication networks.

Space Florida

Florida is a leader nationally and internationally in the global aerospace industry. Florida consistently ranks in the top five U.S. states for aerospace industry employment, with more than 130,000 employees in 2017, with additional space-based industries locating to Cape Canaveral since then. More than 17,144 aerospace-related companies call Florida home, contributing $19 billion in revenues to Florida's economy.

Space Florida's storied Launch and Landing Facility (LLF) formerly known as the Shuttle Landing Facility (SLF), is one of the longest runways in the world at an impressive 15,000-feet long. The LLF

and accompanying facilities are currently available for use by external customers and are operated and managed by Space Florida under a 30-year property agreement with NASA. In 2013, NASA announced the selection of Space Florida to maintain and operate the LLF. Space Florida was selected because its proposal for potential use of the facility is closely aligned with Kennedy's vision for creating a multiuser spaceport.

Space Florida President Frank DiBello has shown support for AAM as he has stated the LLF provides a unique capability for new and expanding suborbital launch providers, unmanned aerial vehicle operators and other aerospace-related businesses to thrive in a location that maximizes the resources of the Space Center and Eastern Range operations at the time.

The 15,000-foot runway is set in a secure location providing year-round access to restricted airspace that is well away from populated areas. With an air traffic control tower and all the supporting services and equipment necessary for horizontal launch and landing, the LLF can support all types and sizes of aircraft and spacecraft vehicles. It is ideal for horizontal flights, suborbital flight training and research, weightless flights, and aviation and aerodynamic flight testing.

The Florida Department of Transportation

In additional to local government zoning approval, Chapter 330.30 Florida Statutes (Regulation of Aircraft, Pilots, and Airports) requires FDOT approval for new airports (including vertiports) in Florida. The statute states any proposed airport shall, prior to site acquisition or construction or establishment of the proposed airport, obtain approval of the airport site from the department. More information on the state statue can be found at the following website: http://www.leg.state.fl.us/statutes/index.cfm?App_mode=Display_Statute&URL=0300-0399/0330/Sections/0330.30.html

Federal Guidance and Policies

Commercial Operations

The U.S. Code sets forth the operational requirements for aviation. Commercial AAM providers will most likely fall within the requirements of 14 C.F.R. Part 135, which covers commercial on-demand and certain scheduled commuter operations, as limited by number of passengers and maximum payload capacity. Pilots who are paid to fly passengers must hold a Commercial Pilot Certificate. Typical Part 135 operators include charter operations, air ambulance, tour operators, and air taxis. Among other things, Part 135 covers requirements for training, maintenance, insurance, and the safety-related processes that the operator uses to manage their business. While Part 135 operations have been in widespread use for conventional general aviation for decades, these requirements were not designed for AAM applications. In some cases they may be overly restrictive; in others they may not be restrictive enough. The FAA and the AAM community will need to develop meaningful and effective regulations for these operations.

The Department of Transportation (DOT)

U.S. Congress Senate Bill 516 AAM Coordination and Leadership would require DOT to establish an interagency working group on AAM consisting of representatives from at least 10 federal agencies. The working group would evaluate the policies and infrastructure necessary to advance AAM operations, coordinate with state and local governments and the private sector, develop an AAM national strategy, and report to the Congress. Within 30 days of issuing that report, DOT would determine whether to continue or terminate the working group. In addition, the bill would require the Government Accountability Office to report on the authority of various levels of government over AAM operations.

Using information from USDOT and based on the cost of similar activities, the Congressional Budget Office (CBO) estimates that implementing Senate Bill 516 would cost $1 million over the 2021-2026 period; such spending would be subject to the availability of appropriated funds.

National Aeronautics and Space Administration (NASA)

The NASA vision for AAM includes UAM – a concept involving vertical takeoff and landing (VTOL) aircraft, decentralized (or federated) traffic management, and new infrastructure to support urban, suburban, and rural flight operations. High-density performance-based routes or corridors enable prompt transportation of people and goods from node to node, where each node represents a vertiport, defined as an identifiable ground or elevated area used for the takeoff and landing of VTOL aircraft. In the presence of uncertainty surrounding aircraft turnaround time on the ground, vertiports are the critical end points in scheduling, sequencing, and spacing (SSS) of aircraft in dense metropolitan environments. NASA continues to support research and development of AAM operations through collaborative partnership opportunities[3] and cooperative agreements with local governments[4]. The City of Orlando is currently participating in a NASA aero-research partnership, in association with the Massachusetts Department of Transportation; Minnesota Department of Transportation; the North Central Texas Council of Governments Department of Transportation; and the Ohio Unmanned Aircraft Systems Center of the Ohio Department of Transportation.

The Federal Aviation Administration (FAA)

The FAA performs regulatory, Air Traffic Control (ATC), and National Airspace System (NAS) data exchange roles for UAM. The FAA is the federal authority over aircraft operations in all airspace and the regulatory and oversight authority for civil operations in the NAS. The FAA maintains an operating environment that ensures airspace users have access to the resources needed to meet specific operational objectives and that shared use of the airspace can be achieved safely and equitably. The FAA develops or modifies regulations to support UAM operations. In collaboration with industry stakeholders, the FAA may also provide guidelines for Community-Based Rules (CBR)s. Due to the nature of AAM innovation, it is anticipated that CBR guidelines will evolve over time as new technology

[3] https://www.nasa.gov/aeroresearch/aam-collaborative-opportunities/

[4] https://www.nasa.gov/aeroresearch/programs/iasp/aam/nasa-to-help-local-governments-plan-for-advanced-air-mobility

is developed, with the intent to ensure that the FAA authority is maintained (e.g., NAS safety, equal access to airspace, and security).

On June 26, 2020, FAA released the ConOpsv1.0 of the FAA UAM Concept of Operations[5] (ConOps) which states that FAA expects to expand UAM operations through the use of defined "UAM Corridors". This will identify which aircraft will operate without direct involvement from air traffic control (ATC). The document provides an initial roadmap for how the U.S. might achieve high-volume urban air taxi operations while maintaining the safety of the national airspace system. The FAA will define, maintain, and make publicly available UAM Corridor definitions and will manage the performance requirements of UAM Corridors.

Developed with input from NASA, which also developed the UAM Vision Concept of Operations (ConOps) UAM Maturity Level (UML)-4v1.0[6] , and industry and community stakeholders, the document outlines a "crawl-walk-run" approach. It assumes that initial UAM operations will use eVTOL aircraft that are certified to fly within the current regulatory and operational environment with an onboard pilot. As UAM operations increase, the FAA will establish performance-based airspace structures with defined dimensions, called UAM corridors. Aircraft operating within the corridors will still have pilots onboard but will also be equipped to exchange information with other users of the corridor in order to deconflict traffic without relying on ATC. The FAA anticipates the system evolving to the point where UAM corridors form a complex, high-volume network through which UAM aircraft may eventually fly autonomously.

A key element of the ConOps is the existence of providers of services (PSUs) for UAM. These PSUs will provide services to support operations planning, flight intent sharing, strategic and tactical deconfliction, airspace management functions, and off-nominal operations. They will exchange information with other PSUs via a network that enables safe, efficient operation within the UAM corridors without involvement by ATC.

The AAM concept will continue to mature and be modified through ongoing government and industry stakeholder collaboration. The results of those collaborative efforts will be integrated into future editions of UAM ConOps.

Vertiport Considerations

Vertiport is a new airport concept that is designed for use by the eVTOL aircraft. Currently there are no operational vertiports yet in the U.S.[7] As envisioned by the AAM industry, the vertiport generally will leverage the existing infrastructure such as traditional airports, heliports, helipads, or even

[5] https://assets.evtol.com/wp-content/uploads/2020/07/UAM_ConOps_v1.0.pdf

[6] https://ntrs.nasa.gov/api/citations/20205011091/downloads/UAM%20Vision%20Concept%20of%20Operations%20UML-4%20v1.0.pdf

[7] Chapter 58, Part 4 of the City of Orlando Land Development Code provides specifications and standards for approval of "Vertiports". However, this chapter was adopted in 1991 and refers to traditional helicopter aircraft and operations. A future phase of this project will review and determine if amendments are required to this section consistent with anticipated AAM operations. https://library.municode.com/fl/orlando/codes/code_of_ordinances?nodeId=TITIICICO_CH58ZODIUS_PT4OTSPUSST_4PVE

building tops (e.g. parking garages or warehouses). It can also be brand-new construction located in the passenger and logistic hubs in urban or suburban areas.

Given the great market potential for AAM, many vertiport concepts have been planned and designed for implementation. For example, the VoloPort, a vertiport concept designed by a Germany based company Volocopter, is designed to be a testing ground for supporting a pilot AAM operation in Singapore. The VoloPort concept consists of modularized facility design for customer service and ground charging and maintenance services. It is scalable and able to fit into a wide range of urban environments including rooftops, parking lots and existing helipads. Another major player Lilium, who was engaged as a project stakeholder, designs their own eVTOL vehicles and vertiport modules. They partnered with two major German airport hubs, Düsseldorf and Cologne/Bonn Airports, to develop their regional air mobility modes. In November of 2020, Lilium partnered with the Tavistock Development Company and the City of Orlando to launch the first US network of vertiports in the Lake Nona area. This will be America's first high-speed, electric air mobility hub for a state-wide urban and regional air mobility network and is expected to connect more than 20 million Floridians within a 186-mile radius. Lilium anticipates that the network and operations will create more than 100 jobs in the Orlando area. They created a concept for new vertiport architecture for its hub location and a variety of standardized vertiport designs that can be incorporated into existing transportation infrastructure in both urban and suburban areas.

The technology giants Amazon and Uber have also planned similar vertiport concepts. For example, Amazon has strategically designed helipads for its new headquarter building in New York. Although Amazon has not specifically called it a "vertiport", the new helipad concept for the HQ2 building would work well for future eVTOL operation. Uber's Skyport concept for their future flying taxi business is another typical vertiport. Uber is considering test markets in major cities throughout the world and has plans for new eVTOL vehicles capable of autonomous takeoff and landing. Their envisioned vertiport is to be able to handle 1000 takeoffs and landings per hour for a single port. Overseas, Chinese company Ehang has proposed plans to open eco-sustainable vertiports shaped like trees in Italy.[8]

Existing Standards and Regulations

As a relatively new concept, vertiports are currently still in the planning or concept development phase. There are no mandatory governing regulations, design or operation standards and codes that specifically apply to vertiports. One of the reasons for this regulatory void is the lack of eVTOL vehicles that have been fully flight tested and certified to provide sufficient data for FAA evaluation[13]. The most analogous model of the vertiport is the heliport. Therefore, the existing regulations or industrial standards for the heliport design can be informative and potentially useful for vertiports. Those mainly include the FAA regulations related to policy guidance, obstruction avoidance, safety, and relevant fire and building codes, and other local regulations or requirements. It is worth noting that currently only heliports that receive federal Airport Improvement Program (AIP) funding are subject to the FAA regulations and standards. However, the vast majority of the existing heliports are private

[8] https://www.ehang.com/news/746.html

use, which is also known as Prior Permission Required (PPR) facilities. Those private owners who didn't receive AIP funding have considerable flexibility in the heliport design and operation but must still receive approval and a permit to operate from the FDOT. The future vertiports, most of which are expected to be private owned PPR facilities as well, will most likely face the similar regulatory situation as the existing heliports.

The National Airspace Transportation Association (NATA) released a white paper "Urban Air Mobility: Considerations for Vertiport Operation." (https://insideunmannedsystems.com/vertiport-infrastructure-new-tech-old-regulations/). The existing standards and regulations were summarized in the report and are in Table 1 below.

Table 1: Vertiport Operation Standards and Regulations for Vertiport Operation

Subject Area	Existing Regulations* / Policy Guidance	Best Practices / Industry Solutions
Passenger Facilitation	N/A	NATA Safety 1st Training Program
Ground Handling	FAA Advisory Circulars 00-34A, 00-65A, 150/5210-5D, 150/5210-20A	Audit Standard: International Standard for Business Aircraft Handling (IBAC) NATA Safety 1st Training Program
Security	49 CFR 1550.7, as applicable	CrewID® (NATACS)
Signage, Marking, Lighting	Advisory Circular 150/5340-1M, 150/5340-30J, 150/5210-5D, 150/5345-53D, 150/5345-12F	N/A
Design and Planning	Advisory Circular 150/5390-2C	AAMS Heliport Risk Assessment Tool and Liability Toolkit. NEMSPA Hospital Helipad Safety.
First Response	Advisory Circular 150/5200-31C, 150/5210-17C, 150/5220-10E, 150/5210-14B, 150/5210-6D	NFPA 418 – Standard for Heliports. GAMA & FAA First Responder Safety at a Small Aircraft or Helicopter Accident
*In general, FAA Advisory Circular guidance is only compulsory at public-use facilities		

Depending on the exact siting of the vertiport, other applicable state or local regulations and ordinances may also apply, including the local land use and zoning regulations. Many other states or local agencies also adopt national building and fire protection codes. For example, the National Fire Protection Association (NFPA) Standard 418, Standard for Heliports, specifically states in Section 4.2.2 that "the design of the heliport, including all the aeronautical components, shall be in accordance with FAA AC 150/5390-2C, Heliport Design Advisory Circular." Another example, the 2018 International Building Code (IBC), a modern building code under the purview of the International Code Council, has been adopted by 15 states, including Florida. Those non-FAA codes or requirements that the local counties or cities may have adopted can include

- National Fire Protection Association (NFPA) Standards.
- International Building Code (IBC).
- Occupational Safety and Health Administration.
- National Electrical Code (NEC).

Vertiport Planning and Design Considerations

Vertiport Elements

A typical vertiport includes ground facilities and airspace. The ground facilities consist of flying pad(s) for take-off/touchdown, ground passenger terminal, ground maneuver area, aircraft staging area, power charging area, and maintenance area. Depending on the available surface space or complexity of the vertiport, some elements can be optional or be simplified and combined. The airspace required for vertiport includes the Final Approach and Take-off (FATO) area in the air and a safety area surrounding the FATO, the Touchdown and Liftoff (TLOF) area, and the approach surfaces of regulated airspace.

Typical Configurations

The vertiport can be configured into various layouts depending on the functionality requirements and constraints (e.g., available surface or air spaces, the aircraft dimensions and weights, etc.). There are a few typical configurations for designers' consideration[9], as shown in **Figure 1**:

- Vertihub: A vertiport with infrastructure for maintenance, repair, and overhaul (MRO) operations for the fleet, parking spaces for longer-haul vertical takeoff and landing (VTOL) aircraft, and a centralized operations control system.
- Vertiport: An identifiable ground or elevated area, including any buildings or facilities thereon, used for the takeoff and landing of VTOL aircraft and rotorcraft.
- Vertistop: A vertiport intended solely for takeoff and landing of VTOL aircraft and rotorcraft to drop off or pick-up passengers or cargo.

[9] https://ntrs.nasa.gov/api/citations/20210016168/downloads/20210016168_MJohnson_VertiportAtmtnConOpsRprt_final_corrected.pdf

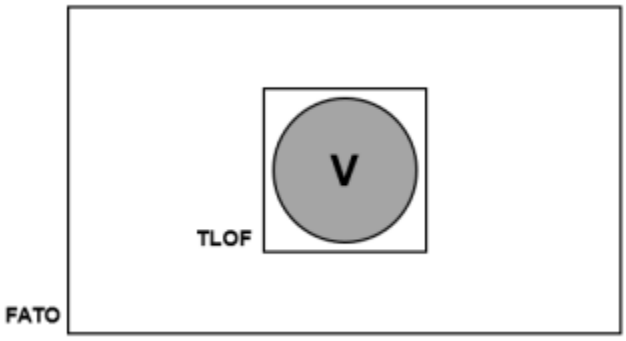
Figure 1: Typical Configurations for Vertiports

Airspace[10]

FATO is a defined area clear of obstacles on the ground for the aircraft to approach to a hover or a landing and/or to take off from the flying pad. The minimum width and length of a FATO is at least 2 times the maximum dimension of the aircraft, but the width can't be less than 100 feet (30.5 m), and the length can't be less than 200 feet (61 m). A vertiport with multiple touchdown/lift-off pads that support simultaneous approach/departure operations needs to have a minimum 200 feet (61 m) separation distance between its FATO areas. Figure 2 below illustrates a typical configuration of the FATO TLOF for a single pad surface vertiport design.

[10] https://catsr.vse.gmu.edu/pubs/IEEEConferencePaper_AnalysisAlternateVertiportDesignsICNS.pdf

Figure 2: Typical Single Pad Surface Configuration[11]



Safety Area is a defined contingency area surrounding the FATO intended for aircraft accidentally diverging from the FATO. The safety area extends on all sides of the FATO for a distance of ½ aircraft maximum dimension but not less than 30 feet (9 m). All fixed objects in a safety area projecting above the FATO elevation except for lighting fixtures must be removed. Any flammable materials, loose stones and any other flying debris caused by rotor wash must be cleared. In addition, three-dimensional Approach Surfaces (defined by FAA) are regulated airspaces that must be considered during vertiport design and siting.

Community Integration

The community's perception and acceptance of vertiports are critical for the planning and design of the vertiport. The safety concern resulting from the public's mistrust of the aircraft autonomy could be one of the major hurdles especially for vertiports located in urban areas. Noise is another major concern from neighborhoods near vertiports. These issues together with other public concerns need to be addressed during the planning and design of the vertiports. The success of vertiports also requires integration with supporting infrastructure such as the existing building structures utilized for the vertiports, connectivity with the existing transportation network, and existing airport facilities to be used for vertiports.[12]

The visual concern for high frequency operations of these eVTOLs has also been known as an issue in the airport industry where residents of particular neighborhood see the vehicles themselves as disturbances to their usual clear sky views.

Other considerations

There are many other elements or factors to be considered for the vertiport design and operation, including electric supply equipment and infrastructure, safety, security, fire protection, signing and marking, lighting, emergency response etc. depending on the complexity and functional needs of the vertiport[13].

[11] High-Density Automated Vertiport Concept of Operations – Northeast UAS Airspace Integration Research Alliance

[12] https://ntrs.nasa.gov/api/citations/20205001587/downloads/UAM%20Passenger-carrying%20OpsCon%20-%20v14%20GP%20accept.pdf

[13] https://www.nata.aero/assets/Site_18/files/GIA/NATA%20UAM%20White%20Paper%20-%20FINAL%20cb.pdf

The existing design and operation standards and regulations for traditional airports and heliports will most likely need to be reviewed and tailored for vertiports by the policymakers.

Vertiport Future Evolution

AAM and associated vertiport concepts represent a revolutionary trend in the transportation and engineering industries. New technologies and challenges will emerge, and demands will also change. AAM and vertiports will also evolve to adopt to the changing environment[12].

The initial stage of vertiports will leverage and expand the existing infrastructure including airports and heliports and existing aviation services and procedures. The vertiports will be localized with low passenger and cargo volumes and limited aircraft choices. The existing standards and regulations related to airport/heliport design and operation will be reviewed and gradually tailored for vertiports. New vertiports, such as the Lilium project at Lake Nona, may be built on green fields through partnerships with landowners, developers, and AAM operators. Other vertiports are envisioned in urban settings, including the retrofit of existing building and garage rooftops

In the intermediate state with the technology advances in vehicle autonomy and increased vehicle payloads and range, the vertiport operation can be further enhanced and expanded to support a broader network and greater traffic volumes. Business models will gradually mature and be proven. New standards and regulations for AAM and vertiports will come into form and be codified.

In the long run (the mature state), the technologies and operations will have matured across all aspects of AAM and vertiports. Demands and market will also have grown to a large scale such that the AAM and vertiports become a safe and affordable transportation mode with significant market share. Stable and widespread implementation and public acceptance of AAM and vertiports will make them safer and more efficient and affordable. The integrated vehicles, ports and control and supporting facilities for AAM will be further integrated into the broader transportation network and multimodal operations.

Transportation Opportunities

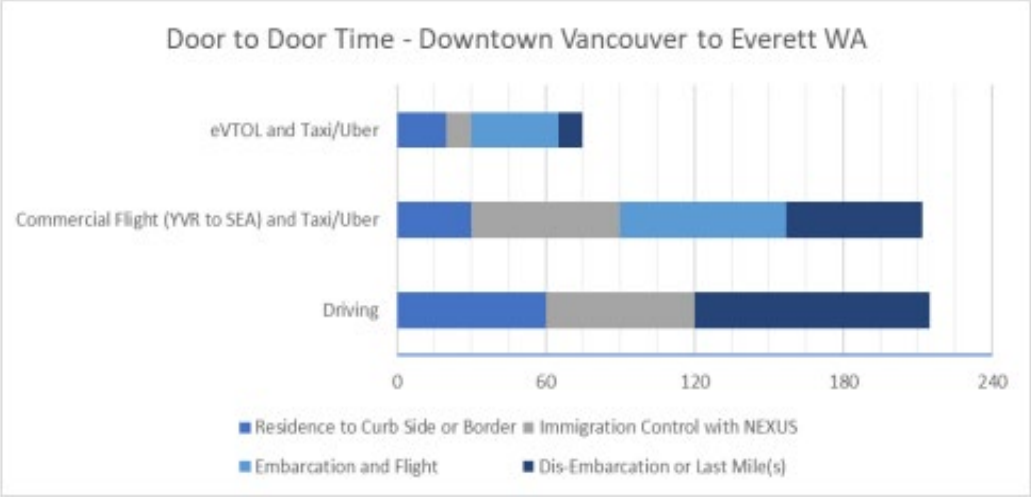
AAM is not intended to replace current transportation modes but rather will complement them, especially where the expansion of the SunRail Commuter Train, Brightline or bus service such as Lynx is simply not economical or feasible. EVTOL aircraft may take commuters into further-out communities where housing is more affordable, opening up more areas for development and alleviating the real estate crunch closer to downtown. If widely adopted, AAM may have an unintended consequence of encouraging commuters to live farther from the City and central business district.

Travel Time Improvements

One key aspect of AAM is to evaluate the travel time impacts associated with implementing eVTOLs within the City of Orlando and its surrounding areas. To analyze this, the project team looked at previous research that was performed by the Greater Vancouver region in Canada which estimates travel time from downtown Vancouver directly to Washington State. **Figure 3** on the following page illustrates one-way travel time between a residence in downtown Vancouver, Canada to Everett,

Washington, and applying modes of travel: car, commercial flight (YVR to SEA), and eVTOL from Vancouver Harbour Heliport. Driving will take more than three hours, while an eVTOL flight will be a third of that in total. Imagine finding a means with which to shrink the distance between Vancouver and Seattle by 50 miles and the positive effect of this on trade[14].

Figure 3: Door-to-door travel comparisons along the Cascadia Corridor (Vancouver, Canada)



Multimodal Choices

Multimodal transportation includes public transportation, rail and waterways, bicycle and pedestrian and air. Multimodal access supports the needs of all users whether they choose to walk, bike, use transit, eVTOLs or drive. It means more connections, more choices and is designed to be affordable and efficient.

Multimodal transportation opportunities provide more freedom in how people get around, especially for people who cannot or choose not to drive a car and is a good strategy for economic and community development. Providing regional transportation of passengers and delivery of goods between city pairs such as downtown Orlando to Miami or Tampa is a key in providing users more options for mobility between central business districts. AAM may become part of the hospitality and themed entertainment experience for tourism destinations, such as the theme park attractions in Central Florida.

AAM will also open up opportunities to the regions residents and workforce who live too far from the city center to have a feasible commute by complementing and diversifying public transportation operations and would provide greater access to better-paying jobs. For example, by providing

[14] https://assets.evtol.com/wp-content/uploads/2020/09/Vancouver-AAM-White-Paper-Fall-2020.pdf

metropolitan transportation options for commuters between heavily populated suburban communities.

Congestion Reduction

Pre-COVID, commuters in Orlando spent an average of 57 hours a year stuck in traffic, costing the region a total of $1.1 billion per year, an average congestion cost of $1,007 per commuter[15], according to the 2019 Urban Mobility Report published by the Texas A&M Transportation Institute. This figure does not take into account that due to congestion, many workers forego jobs that would bring in higher salaries and greater satisfaction. Companies, too, lose out when the best qualified workers don't bother to apply. Businesses then in turn also lose customers. The 2021 Urban Mobility Report shows an average of 22 hours a year in commuter delay for 2020 during the COVID-19 pandemic.

AAM vehicles promise to be able to move people and cargo more quickly, safely and quietly than helicopters, and at a reduced cost. Furthermore, proponents predict AAMs could alleviate ground congestion with a relatively low carbon footprint.

Last Mile Connections

The term "last mile" is commonly used when describing transportation infrastructure. In a very literal sense, it refers to the "last mile" of a route. With AAM expected to move cargo and people it is quite reasonable to think about how the various transportation modes will all connect and how that last mile connection will be assessed when considering the entire infrastructure.

Through researching various studies, it was suggested that the AAM demand could be influenced by the quality of first- and last-mile connections because of their impacts on total travel time, cost, and convenience (i.e., number of connections).[16] These connections will open up opportunities to those who live too far from the city center to have a feasible commute and is expected to provide easier, more rapid, and inexpensive transportation solutions for the general population. In addition to transporting people, last mile transport of goods and freight by drone is being tested by companies like Walmart and Amazon.

The process of defining operational assumptions should include consideration of the complete trip concept, such as ground transportation and first- and last-mile connections to a vertiport, transfers, ease of use by passenger, and the air taxi flights. While determining the best approach for these connections, there are some key factors that should be taken into consideration for operational metrics, such as number of flights, potential revenue, operating costs, passenger volumes and distribution, and infrastructure availability (e.g., number, location, and capacity of a hypothetical vertiport network). It should be noted that AAM markets are defined by range, demand,

[15] https://static.tti.tamu.edu/tti.tamu.edu/documents/mobility-report-2021.pdf

[16] https://www.mdpi.com/search?q=Advanced+Air+Mobility%3A+Demand+Analysis+and+Market+Potential+of+the+Airport+Shuttle+and+Air+Taxi+Markets

infrastructure availability, aircraft capabilities, and ability to provide comparable multimodal last mile service to vertiports.

3

Environmental Considerations and Opportunities

This section looks at the various natural, social, and physical resources which could be impacted, and therefore create challenges associated with use of AAM technology, and the development of infrastructure needed for its use. Challenges associated with the movement of the vehicles through airspace and those associated with specific vertiport locations are considered.

If sites selected for the proposed vertiport locations have been previously disturbed or developed such that only redevelopment is required, various environmental issues could be avoided. However, if any natural areas or sites for vertiport facilities are selected which require new development, environmental assessments typical of any land alteration or land use change would be required.

Natural Resource Considerations

Natural resources have the potential to be affected by any development and/or new technology that exists within the environment. Protected species, wetlands should all be considered as part of an assessment into the challenges associated with development and use of eVTOL technology use and infrastructure. In addition, the use of finite natural resources, such as earth materials, for eVTOL development and use should be assessed.

Threatened and Endangered Species

Currently there is limited assessment of threatened and endangered species for airborne projects, however aircraft wildlife strikes/hazards are well documented and regulated by the Federal Aviation Authority (FAA). The FAA National Wildlife Strike Database (NWSD) contains about 245,000 records of bird and other wildlife collisions with aircraft, 1990 to July 2020. This total consists of about 231,800 strikes with civil aircraft in the USA, 4,300 strikes with U.S.-registered civil aircraft at foreign airports, and 8,900 strikes with military aircraft at U.S. civil airports. Through interagency agreements, the U.S. Department of Agriculture Wildlife Services (WS) program and the Smithsonian Institution Feather Lab provide support for maintaining the NWSD. In July 2020, the NWSD reached a milestone with the identification of the 600th species of bird struck by aircraft, 1990 – July 2020. Most native birds in the USA are covered under the Migratory Bird Treaty Act (MBTA) which gives legal protection to over 1,000 species of birds that migrate among Canada, Russia, USA, Mexico, and Japan (U.S. Fish and Wildlife Service 2020). Thus, the management of birds at airports in the USA is biologically and legally complex, requiring accurate identification of

the species involved; an understanding of each species behavior, feeding habits, and migratory patterns; and compliance with federal (MBTA), state, and local regulations. Of the 600 species now in the NWSD, 509 (84.8%) are protected by the MBTA; these species comprised 89.9% of the 108,142 strikes in which the bird was identified to species level.

Impacts to avian, bat, and insect species may occur from interactions with eVTOL aircraft. Assessment of impacts to these species may be required as regulations surrounding eVTOL technologies or wildlife airborne migration patterns are developed. For example, the legal requirements for a wide range of species, other environmental restrictions, and the widespread public interest in birds and other wildlife species necessitate that wildlife management programs at airports are overseen by professional "qualified airport biologists".

Terrestrial impacts to threatened and endangered species would need to be considered on a site-by-site basis for locations considered for vertiports. Species specific surveys, relocations, permitting, and mitigation may be required following initial assessments, prior to development of the facilities.

Following development, a wildlife hazard assessment program should be implemented for the proposed vertiport locations to assess and manage wildlife hazards. Wildlife Hazard Assessments ensure the safety of operating aircraft and wildlife, with which they may interact.

Wetlands

If wetlands are present within sites selected for vertiport development, these natural systems will need to be delineated and evaluated based on their functional value prior to development in accordance with the current methodologies of the relevant water management district and the Florida Department of Environmental Protection (FDEP) or the US Army Corps of Engineers (USACE). Any unavoidable impacts to wetlands will have to be permitted with the appropriate regulatory agencies.

In addition, wetlands are associated with a higher risk of adverse aircraft and wildlife interactions, so proximity to wetland areas may also be a key consideration when siting the vertiport facilities.

Earth Material Resources / Life Cycle Assessment

Earth materials used for construction of aircraft such as eVTOL vehicles and its associated infrastructure are finite. The scarcity of certain resources, such as rarer earth metals, is becoming apparent as demands on global supplies increase. It is also important to consider the decommissioning and recycling of materials at the end of vehicle and infrastructure design. Recycling is now a widely accepted practice, however there are certain materials that are difficult to recycle, some of which may contain toxins that, if not disposed of properly, could adversely affect water quality and wildlife. Life cycle assessment would evaluate the burden development of an eVTOL network would have on material use, energy, and waste generation, while evaluating potential opportunities for improvements.

Social Resource Considerations

Social considerations which may be affected by potential eVTOL vehicle use and development of vertiport locations include those which should be considered in relation to the wider use of this technology, such as public nuisance issues and environmental justice, and site-specific issues, such as cultural resources and public lands.

Cultural Resources

Cultural resources (such as archaeological and historic resources) should be considered during the site selection process for development of vertiport facilities. As such, challenges associated with cultural resources could be avoided if selected sites have been previously evaluated and found to contain no cultural resources. Cultural Resource Assessment Surveys (CRAS) may be required, dependent on the nature of any location selected for vertiport siting in order to adhere to federal regulation requirements pertaining to, and complying with, Section 106 of the National Historic Preservation Act. The results of the CRAS may indicate the need for further assessment, mitigative measures, or require changes to the project design.

Public Lands

Proximity to public lands in the landscape should be considered when selecting sites for vertiport development. While airborne aircraft flying at typical flight altitudes are unlikely to cause disturbance to these areas, development and operation of vertiport facilities, along with consideration of takeoff and landing flight paths adjacent, or in close proximity, to existing public lands should be avoided to obviate potential impacts to these resources which may house wildlife species, sensitive habitats, or in the case of parks/trails, may disturb user experiences.

Environmental Justice / Accessibility

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Environmental Justice (EJ) should be considered to ensure that certain populations do not suffer disproportionate adverse impacts from noise or other associated issues owing to proximity to development of vertiport facilities and flight paths. As such, public involvement will be key to ensure that all voices are heard with respect to project concerns.

Access to eVTOL technology should also be considered. The target populations for use of such systems will likely exclude certain income groups from the benefits associated with use of this technology, at least in the near term. The extent and depth of this issue should be explored.

Physical Resource Considerations

eVTOL vehicle flights and associated infrastructure may have an effect on physical resources. These should be assessed to determine the nature and extent of such impacts. Considerations could include noise, air quality, greenhouse gas emissions, life cycle assessment, visual/aesthetics, and contamination.

Noise

In the transportation industry, noise related issues are assessed to determine their overall impact on surrounding land uses and occupants, as well as their impacts to biological considerations such as wildlife. eVTOL vehicles are known to operate at a considerably quieter decibel (dB) than traditional helicopters. However, potential noise impacts will need to be assessed to ensure compliance with relevant regulations. A detailed noise impact assessment will be required for each vertiport location. Where relevant, noise mitigation measures can be considered to further reduce any potential noise impacts to surrounding noise sensitive receptors (NSRs). Measures for consideration include the potential siting of each vertiport, proximity to known NSRs, vehicle propulsion configuration, aircraft lift and flight path adjustments, flight altitude adjustments, and inclusion of noise barriers and noise reducers within the vertiport design.

Air Quality

Potential contributors to impacts on air quality associated with eVTOL vehicle vertiports would include fugitive dust from ground disturbance by aircraft operations and potential combustion particulate matter byproducts from associated infrastructure, in addition to the gaseous emissions which are discussed below.

Given the lack of scientific studies related to eVTOL vehicle usage, an air quality impact assessment may be deemed necessary. Currently, it is unclear whether or not there is a difference in fugitive dust created by eVTOL vehicles versus traditional helicopters. However, the implementation of dust and debris suppression methods on the vertiport takeoff and landing area, and equipment maintenance could minimize fugitive dust and byproduct emissions to maintain air quality.

Greenhouse Gases (GHGs) / Air Emissions

Greenhouse gases are those which trap heat in the atmosphere when released. Carbon dioxide is the principal gas of concern, emitted by fossil fuel driven transportation methods, energy generation, and other industry, commercial, and residential sources. A greenhouse gas assessment could be undertaken to fully understand and document the resultant greenhouse gas emissions associated with the project. Conversely, greenhouse gas baseline studies could be conducted to study benefits over time. eVTOL technology should result in a reduction of greenhouses gases when compared with traditional non-renewable fuel source transportation methods. However, the source of energy generation with which vehicles are powered will be key to ensure the potential

reductions in greenhouse gas emissions are achieved. The lack of information and data available for this new technology may present a challenge when assessing this issue. However, reviewing data related to electric cars and buses may provide insight into the potential benefits provided by eVTOL vehicles.

It is unlikely that the eVTOL vehicles will have an adverse impact on air quality related to exhaust given that they are electric vehicles and would have fewer emissions than traditional gasoline and diesel fueled vehicles. Therefore, eVTOL vehicles will not emit carbon dioxide, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter (soot), benzene, formaldehyde, or polycyclic hydrocarbons which are expelled with traditionally fueled engines. In this instance, emissions would be related to the method of electricity produced by the utility provider. However, should a combination of electricity and other non-renewable energy sources be used by these vehicles there may be low level emissions. There also may be emissions associated with other vertiport infrastructure.

Visual / Aesthetics

The visual and aesthetic implications for the new vertiport facilities will require assessment to ensure the facilities are designed in keeping with the surrounding area and in compliance with local specifications for land use and development.

Floodlights are likely required to meet design and safety considerations, and these may need to be assessed for impacts to surrounding land uses as well as nocturnal wildlife species.

Visual annoyance may result from introduction of eVTOL aircraft in the airspace above some areas, such as residential neighborhoods, schools, and other land uses which are unlikely to be receptive to visual and noise intrusion. This is especially true in the immediate vicinity of the vertiport facilities.

Contamination

Depending on current and past uses of the properties selected for vertiport siting, Phase I Environmental Site Assessments (ESA) may be warranted to ensure there are no contamination risks associated with development and/or use of the sites. The Phase I ESA may be required as part of a local government site plan or rezoning application and should be carried out in accordance with the processes prescribed by the American Society for Testing and Materials (ASTM), Standard Practice for ESAs, Phase I ESA Process (E1527-13) and EPA's All Appropriate Inquiries (AAI) Final Rule as set forth in 40 CFR Part 312 and 33 CFR Part 137. The results of the Phase I ESAs may indicate the need for further assessments or remedial activities prior to use of any chosen site.

Environmental Opportunities

Noise Reduction

To ensure that proposed AAM visions are realized, a comprehensive approach to understanding the impact of noise on urban, suburban, and rural communities is paramount. A challenge unique to AAM is that one aircraft design may have an entirely different acoustic signature from another design. This variability may limit the utility of simple sound level metrics. Additional metrics may be needed to compare the acoustic impact of these new vehicles because their sound differs in more ways than just amplitude. The City of Orlando may adopt new noise regulations in its land development code, associated with updates to the current Vertiport permitting process.

AAM is expected to routinely expose new populations to aircraft noise. Historically, changes in noise over inhabited areas have been met with resistance and can potentially lead to more strict local noise ordinances that can restrict vertiport siting. To address the need for quiet design and operation of eVTOL vehicles, NASA expanded their Acoustics Technical Working Group (TWG) to include UAM and formed the "UAM Noise Working Group (UNWG)." The first exploratory meeting was held at the NASA Langley Research Center in April 2018, and the group meets semiannually, alternating between the NASA Langley and NASA Glenn Research Centers. Community outreach will be crucial to keep the public informed and help mitigate noise complaints.

In 2020 NASA established noise reduction prediction tools based on gaps found in current practices. Some of these recommendations are as follows:

- System noise prediction tools be further developed for application to UAM vehicles and made available to the research and industrial communities.
- Research be performed to develop conventions on how to handle control redundancies to obtain preferred low-noise trim conditions and to further develop the acoustic tools to handle aperiodic sources.
- Prediction models for the highest amplitude noise sources be validated with experimental data for isolated and installed configurations, and that flight test data be acquired to better understand variations under realistic operating conditions, particularly unsteady conditions (e.g., maneuvers and transition).
- Continued development of auralization tools be performed to allow realization of flight operations (including takeoff, forward flight, landing, and transition) for a representative range of vehicle configurations.
- A dedicated technology maturation effort be performed on the most promising noise mitigation technologies and that opportunities be sought to evaluate their efficacy in flight.
- Surrogate or other reduced order model methods be developed so that designers can quickly determine the effects of design changes on noise early in the design process, and that sensitivities be fully implemented to enable optimization of low-noise vehicle designs and operations.
- Research be conducted to more fully explore limitations in methods for assessing community noise impact of UAM vehicles in their operational environments, and to generate a software development plan that addresses the limitations of current models over time.
- Manufacturers work with appropriate organizations to develop low noise guidance for piloted

operations and automated low-noise procedures for autonomous operations that are specific to their products.[17]

Noise Reduction Technologies

Noise mitigation strategies are unique to each eVTOL and are based on design. Items that strongly affect thickness noise include blade geometry (thickness noise increases by 6 dB for every doubling of blade thickness) and quantities such as surface acceleration and surface Mach number (due to motion). Exacerbation of these effects occurs when the direction of these components is oriented toward the observer. Items that strongly affect loading noise (tonal and broadband) are quantities such as surface pressure (loading) and how fast this surface pressure (loading) changes, and surface Mach number (due to motion). The largest effect comes when the directions of the surface components (due to motion) are oriented toward the observer. Faster changes in surface pressure (loading) tend to increase loading noise, as does higher mean surface pressure (loading).[17]

Below are current noise reduction strategies established by NASA that are applicable to AAM:

- For isolated rotors and propellers, increasing the number of blades, optimizing the blade airfoil shapes, optimizing the blade planform shape, reducing the rotational rate, avoiding blunt trailing edges, avoiding gaps if there are flaps, etc.
- For rotor-airframe interactional noise effects, increasing the rotor/airframe separation distances, placing rotors above the airframe supports rather than below them, and avoiding pusher propeller configurations that are in proximity to a fuselage, rotor wake, or wing wake.
- For rotor-rotor interactional noise effects, adjusting the rotor blade rotational speed or phase relative to other rotors, adjusting the relative rotation direction between rotors, and placing the rotors at appropriate distances from one another.
- Configurations that utilize sound absorptive surfaces (e.g., ducted props with liners), and that exploit beneficial propulsion airframe aeroacoustic (PAA) effects including diffraction and reflection of acoustic waves around vehicle surfaces, and refraction of acoustic waves (e.g., by flow velocity gradients).

EVTOL Classes and Designs

The field of aeroacoustics focuses on the generation of sound by unsteady air flow. The sound could be generated by jets, fans, rotor blades, and any devices that force the air into unsteady motion, which is the primary acoustic source for aircraft. The aircraft envisioned to operate in the eVTOL market are radically new aircraft designs that are as varied and diverse as the hundreds of companies developing these aircraft. The aircraft are expected to range from small cargo deliveries to four-to-six passenger to larger regional passenger and cargo transportation. The noise of these aircraft will be unique to each design.

[17] https://ntrs.nasa.gov/api/citations/20205007433/downloads/NASA-TP-2020-5007433.pdf

Lower Altitude Flights

AAM is expected to increase aircraft operations at low altitudes (500–3,000 ft ASL)[18] while achieving market viability. To do this, hundreds to thousands of daily flight operations in the metropolitan area have been projected. This outpaces current aircraft operations and, in terms of noise, eVTOL aircraft will need to be unnoticeable at cruising conditions to gain widespread acceptance. The aircraft noise emission will also have to achieve inaudibility on the ground which will vary by location based on the landscape and background noise.

Vertiport Noise in Populated Environments

Noise levels in and around vertiports and areas for takeoff and landing of AAM aircraft will be critical for ensuring acceptance of AAM operations. The design of structures and surrounding landscaping for sound mitigation are some ideas for reducing the acoustic footprint of a vertiport. However, it should be noted that there would be areas where vertiports will be in located in environments where the primary need is to be focused on minimizing the noise while operating at low altitudes prior to takeoff or landing.

A unique hurdle for assessing and predicting the noise impact of eVTOL aircraft is that most of these aircraft are very early in their development, many existing only as concepts or prototypes, particularly the larger-scale aircraft for transporting passengers. For AAM aircraft that are further along in the development cycle, the acoustic signatures are held as proprietary information with the company. There are some publicly known data sharing agreements between companies and federal agencies such as NASA and the FAA, but the data is not widely available to the community.

Even though the FAA sets the limits for aircraft noise during certification, there is no guarantee that the limits set will be acceptable for any given community. It should be noted that noise ordinances are controlled at a local level, which poses the risk that AAM operations could be constrained by local ordinances. Currently, NASA and Joby Aviation Inc are testing noise impacts using NASA Mobile Acoustics Facilities and pressure ground-plate microphones to measure Joby aircraft sound emissions.[19] This will allow NASA and Joby to generate noise hemispheres for aircraft, to capture the intensity and character of sound emitted in comparison to traditional helicopters, drones, and other aircraft.

Emissions Reduction

The steady growth in global population, and the strong desire of people in rural areas to migrate to cities for improved economic outcomes, are important factors. In turn, cities are becoming more densely populated, their streets congested, with local economies adversely impacted. At the same time, advances in vertical-lift aircraft design, electric propulsion, higher energy-density batteries, and hydrogen fuel cells, as well as flight automation, are converging to solve technical challenges and will enable new uses to emerge. eVTOL promises to address the primary limitations of today's turbine-

[18] https://www.dot.state.oh.us/Divisions/Planning/SPR/Research/reportsandplans/Reports/Final%20Reports/136144%20Final%20Report.pdf

[19] https://www.jobyaviation.com/news/joby-nasa-measure-noise-footprint-electric-air-taxi/

powered helicopters, namely: cost, safety, noise, and carbon emissions. Urban Air Mobility, in general, aims to improve the efficiency of transportation in urban and inter-urban areas while reducing the environmental impact.

Air Transport Association (IATA) Emission Target

In 2009, the International Air Transport Association (IATA) put in place strategic targets for aviation, including carbon-neutral growth from 2020 and a reduction in net aviation CO_2 emissions of 50% by 2050, relative to 2005 levels. However, without decarbonization, aviation emissions could grow 3.6 times the emissions generated in 2005 and be responsible for 22% of the planet's total emissions by 2050. See below graph released by Deloitte Insights[20].

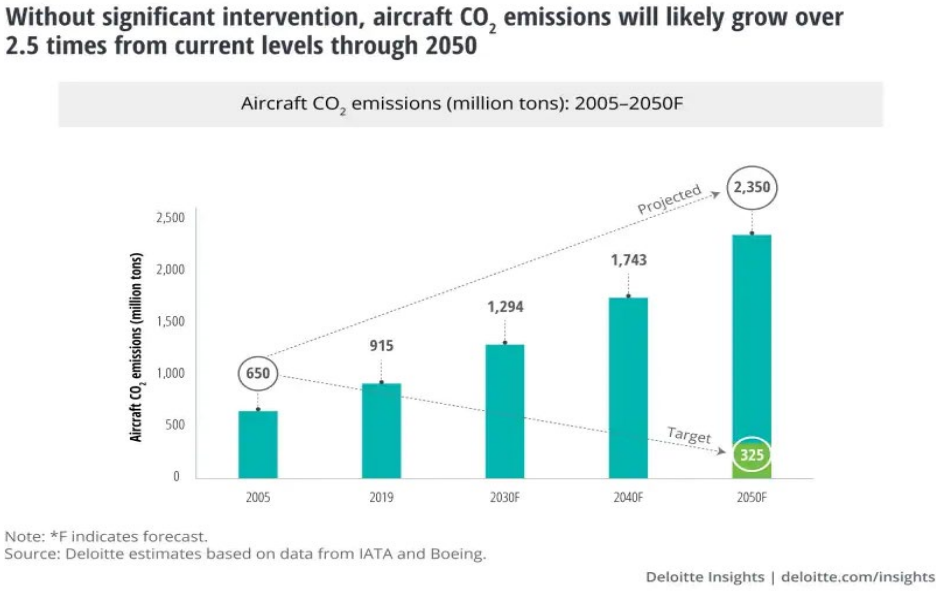


Figure 2: Estimated future CO_2 emissions

The aerospace industry's revenue models could be at risk if decarbonization is not adequately addressed. Globally, the aerospace industry continues to be a strong driver of mobility, economic growth, jobs, and trade. At the same time, the industry is one of many that has a heavy impact on global emissions as beyond CO_2, aircraft have an impact on global warming through the emissions of nitrogen oxides (NOx).

Transitioning to a low-carbon future requires the industry to decarbonize urgently as its business models, revenues, and costs will otherwise be at risk, impacting not just aircraft manufacturers but also the entire supply chain. A recent study from the Aerospace Industries Association and Deloitte was also performed which stated that AAM may represent a $115 billion annual market

[20] https://www2.deloitte.com/xe/en/insights/industry/aerospace-defense/decarbonizing-aerospace.html

by 2035, creating at least 280,000 jobs if regulations pricing carbon emissions, reducing short flights, and promoting the use of more sustainable alternate modes of transportation, such as electric trains, come into force. Electric propulsion could be a potential zero-emission propulsion solution for decarbonization in the long term, particularly for short-haul flights and urban air mobility.

Hydrogen

An important pathway to emission reduction is hydrogen. First, hydrogen offers the possibility to significantly reduce and potentially eliminate all of aviation's greenhouse gas emissions. In other words, a potential "true zero" solution: no CO_2, NOx, SOx, and soot emissions. That's astounding progress compared to today's conventional jet engines. Water vapor is still emitted via hydrogen, but by eliminating soot, persistent contrails can be significantly reduced or eliminated.

Second, "green hydrogen" (i.e. produced by renewable sources) is expected to ramp up at a large scale over the next decade, which will make hydrogen increasingly cost-competitive with existing options, such as jet fuel. It would also essentially allow aviation to be powered by renewable energy.

Third, a major advantage with hydrogen is that it can complement existing refueling options at most major airports, thereby facilitating wide-scale adoption.

Societal Acceptance

According to the Committee on Enhancing Air Mobility[21], in a report published by The National Academies of Sciences, Engineering, & Medicine, societal acceptance is a crucial factor in determining how AAM could augment the overall quality of life, and variables such as noise pollution and the amount of greenhouse gas emissions would play a pivotal role in AAM's successfully adoption. With an increasing public awareness of the impacts of climate change, emissions are becoming increasingly important in the role of AAM.

The City of Orlando is committed to equity and inclusiveness in the AAM planning process. This will include community workshops (in each Commissioner district) to hear the viewpoints of a diversity of residents, businesses, and other stakeholders, as well as screening potential vertiport locations against environmental justice and equity criteria to ensure that vulnerable populations do not bear a disproportionate share of impacts.

A wide range of social benefits are derived from the implementation of AAM which include the following:

- Decarbonizing, over time, transportation with zero emission aviation using clean electric and

[21] https://www.nap.edu/catalog/25646/advancing-aerial-mobility-a-national-blueprint

hydrogen fuel cell technology.

- Monitoring wildfires, marine life, forests, and coastal health.
- Improvement in agriculture and minimizing fertilizer and pesticide use through prescriptive farming techniques.
- Delivering retail goods to residences, thereby reducing the number of trucks—including their noise and polluting exhaust—from neighborhoods.
- Eliminating other pollutants such as volatile organic compounds, particulate matter, sulphur dioxide, nitrous oxides, and unburned fuel.
- Expanding commuter transit options.

4

Stakeholder Engagement

The Project Team convened and facilitated two stakeholder meetings to discuss the potential impacts of AAM service in Central Florida.

The first meeting provided a brief overview on AAM and the purpose of the AAM Transportation Plan before engaging in discussions about potential concerns and opportunities to consider as the planning effort gets underway. Key takeaways from the first meeting included the following:

- Vertiport locations, airspace, and safety were the major concerns shared by stakeholders
- Noise, equity, and connectivity were also concerns identified by stakeholders
- Opportunities for AAM in Central Florida include a new future form of Transit Oriented Development (TOD), enhanced sustainability, economic development potential, and transportation improvements

The second meeting provided a brief summary on the key takeaways from Meeting #1, airspace considerations and permitting process, and a regional visioning exercise. Key takeaways from the second meeting included the following:

- Identification of potential vertiport locations at major employment areas, tourism destinations, multimodal transportation hubs, and regional airports.
- Identification of desired AAM service corridors to connect Central Florida with regional destinations.

Meeting summaries are included in Appendix B.

The following section summarizes Stakeholder comments from both meetings:

Central Florida Expressway Authority (CFX)

Transportation

- Considerations: Safety and Operations

Other Comments

- Potential AAM Corridors: Considerations for AAM pathways should include anticipated driver response on our freeways and expressways. Distracted Driving is a problem on our roadways in which we should be mindful of and attempt to avoid exacerbating.

City of Orlando

Environmental

- Considerations: life cycle of the battery and what to do with those.

Transportation

- Considerations: equity, Integration of Multi-modal planning, Policy/Regulatory Framework

Other Comments

- Potential Vertiport Locations: A landing spot at Disney's transportation and ticket hub might allow tourists to avoid needing a rental car on our highways. Tampa might be a good landing pad, for the regional connection between Orlando and Tampa. Lynx central station has SunRail, Lynx, Lymmo and scooter share available. So it might be a good landing spot, so riders can finish the last mile of their trip on another form of transit. If downtown Orlando is too congested for a landing pad, having a pad at another Sunrail station like in Altamonte or Longwood might be a good landing spot. Then the rider can use Sunrail to get downtown, to Winter Park, etc.
- Potential AAM Corridors: The I-4 corridor would allow connections to Tampa, Orlando, Disney, etc. A corridor from the space coast thru the GOAA and Lake Nona areas and into downtown Orlando (or a nearby Sunrail station) could allow for regional travel between all those locations. Access to Gulf Coast and family, typically a very congested path.
- There are a few ways equity will need to be addressed, echoing the potential impacts to those in neighborhoods around AAM facilities, as well as the ability for different income levels to use this service. The Project Team has not created a definition for “equity in AAM” yet.

Community Air Mobility Initiative (CAMI)

Transportation

- Considerations: potential impacts this new technology would have on other modes. For instance, if this draws riders away from buses so much as that the buses cannot get funded, that could disproportionately affect low-income users.
- Opportunities: A new mode that contributes to a multimodal regional transportation system

Federal Aviation Authority (FAA)

Transportation

- Considerations: One item to consider about the I4 corridor. There's a high volume of helicopter tour operators (7 I believe) that operate along I4 during VFR conditions.
- Lack of guidelines

Florida Department of Transportation

Transportation

- Considerations: Peripheral infrastructure needs. Site approval for new vertiport sites and design standards applied. Pursuant to CH 330, FS. new airport sites must receive site approval before a license or registration to operate can be obtained. Also, what sort of design guide or state licensing standards do we apply to these new sites to ensure safety. Statewide planning and coordination; airspace integration; local zoning.

- Opportunities: Decrease in roadway congestion with an increase in acceptance. Greater mobility. vertiports could be potentially added as an additional landing area at all public-use airports state wide. There are a number of airports in the state that have a helipad as an additional landing area. There are currently 130 public-use airports in the State.

Other Comments

- Potential AAM Corridors: Access back and forth to State Capital. Access between Miami International (MIA) and cruise ports. Access between Miami International (MIA) to Key West, FL. From future Brightline station in Cocoa to Port Canaveral. Would be a good connection since rail does not currently go out to the port. From future Brightline station in Cocoa to Kennedy Space Center Visitor Center. Would be a good connection.

- Potential Vertiport Locations: Kissimmee Gateway Airport (KISM) is an existing public-use airport and a vertiport could be added as an additional landing area to this airport. Adding this as an additional landing area would not require FDOT site approval, but would require the landing area to be inspected annually for licensing if it would be intended to be used as a public-use landing area. Could also be added as a PPR landing area at KISM. Parcel located next to LYNX HQ in downtown Orlando. Roof Vertiport, Automated vehicles on ground level.

Florida Turnpike Enterprise (FTE)

Other Comments

- Potential Vertiport Locations: FTE has a number of service plazas throughout the roadways under our authority. Due to the size and location of most plazas they could be potential candidates for eVTOL pads.

Greater Orlando Aviation Authority (GOAA)

Transportation

- Considerations: Challenges understanding how this new technology impacts both airspace and airport operations. Primary concern/role is to make sure AAM and vertiports do not adversely impact airport from operations (safe, navigable airspace). Long term, what do

vertiports and AAM mean long term for an airport (business perspective). How do we treat it at air service provider? Is it ground transportation? Is it air service?
- Will vertiports be considering aviation facility? These facilities are under purview of GOAA per the charter that established GOAA. Would this be regulated by GOAA?
- Don't want exclusive use facility (e.g. only for Lilium). If this is the case, who is operating this?
- Lack of standards for AAM
- Opportunities: Having a vertiport at airport would be important for network connectivity. A location in Tavistock still requires connection to get there (If someone flies into OIA, are there going to take an Uber to Lilium then fly somewhere else)

Other Comments

- On the NASA side, seems similar to discussion with Skyway (How do AAM vehicles interact with traditional aircrafts? Is it a rethink of air corridors/routes? On discussions with NASA are there any representations from FAA (federal) because NASA's ideas (re: corridors in the air) have been controversial in DC.

Lilium

Transportation

- Opportunities: Find locations & service opportunities that benefit the community

Luftcar LLC

Other Comments

- Potential Vertiport Locations: Has plenty of open spaces, closer access to Sanford and downtown Orlando; covers rural areas and UCF neighborhoods for urban air travel.
- Potential AAM Corridors: Potential personal vehicle owners (Windermere/Isleworth area) to downtown work/business/entertainment. Orlando metro area to New Smyrna Beach (popular local coastal destination). Popular exurb (Clermont) to Orlando metro. Tourist attractions in Tampa and Miami to attractions in Orlando.

LYNX

Transportation

- Considerations: locations are a challenge, explaining that connecting vertiports to transportation hubs to connect to multimodal options will be important. Airspace and community acceptance, were also challenges noted, specifying that it is not only the people using the vertiports, but how do people living by these facilities interact with the vertiports and the aircraft that is important. How does an emergency landing affect a neighborhood?

- Limited local funding to support transportation initiatives. when weather precludes service, bus support / bridges…intermodal connectivity.

Other Comments

- Potential Vertiport Locations: Orange County Convention Center. LYNX, universal. Brightline in the future, LYNX, Disney, ride share. LYNX, SunRail, Ride Share

MetroPlan Orlando

Transportation

- Considerations: MetroPlan Orlando is responsible for the 20-year plan for transportation in the region, and that safety is a concern is along with testing. It is not just the passengers on the vehicles, but the homes they are flying over which have safety concerns. Last mile, first mile.
- Equity, equity, integration and range.
- How has the term “equity” been defined for this project?
- Opportunities: Innovation

NASA

Transportation

- Opportunities: Another opportunity is for locality/agency to shift how current services are provided to using AAM where the AAM mode provides better performance, is more sustainable/equitable and a lower cost.

Orange County

Transportation

- Considerations: safety, land use/community compatibility, transportation system integration, equity

Orlando-Sanford Airport

Transportation

- Considerations: Neighbors. Airspace

Sebring Airport

Other Comments

- Potential Vertiport Locations: Sebring Airport is an important link to south central Florida
- Potential AAM Corridors: Sebring Airport is an important link to rural Florida

University of Central Florida (UCF)

Transportation

- Considerations: would like to understand ridership and demand, saying that this follows data on modal split, equity, costs, etc. Typically these type of new technology projects starts in limited locations and then we can use lessons learned as the technology expands. Public acceptance is a concern considering these vehicles are flying over houses. It is probably a very small section of population that will use this service. AAM sharing many similar concerns to autonomous vehicles and asks the team to consider same issues we are already addressing with AV, such as cyber security.
- Opportunities: attract high end businesses/companies, boost the perception that Orlando is a futuristic smart city

Other Comments

- Potential Vertiport Locations: UCF / Research Parkway. I believe there is enough available space. UCF and research Park receives a lot of visitors that would benefit from a Vertiport. Also the location is close to major employment at Lockheed, Siemens, etc.

5

Next Steps

- The Project Team will review the results of a test case Economic Impact Study to determine if a conceptual plan for converting an existing garage into a downtown Vertiport location should be considered.
- The City will continue to participate in the NASA Community Partnership Annex and share best practices and lessons learned with the other cohort members.
- The City will continue to coordination with Tavistock Development Group, Lilium, and transportation agency partners regarding the permitting and construction of the proposed vertiport at Lake Nona.
- Phase Two of the AAM Transportation Plan is anticipated include the following scope of work:

  2.1 Review of Local, State and Federal Policy and Code Impacts to identify the potential modifications needed to support AAM, including:

  - Land Development Codes
  - State policies and statutes
  - Growth Management Plans / Comprehensive Plans
  - State and Regional Transportation Plans
  - Transit Agency Plans
  - Aviation Plans

  2.2 Network Demand Analysis to assess the network connectivity demand between major geographic areas throughout the Central Florida area. The demand assessment will be based on the accepted the regional travel demand model and verified for reasonability with the stakeholder engagement participants.

  2.3 Identification of Target Locations to an evaluate the minimum restrictions for AAM, FAA restrictions (government buildings, airspace, etc.) and connectivity with other modes of transportation. The modal connections will be considered in the evaluation of targeted

location including, but not limited to, TNC drop-off locations, taxi staging areas, Amtrak commuter stops, SunRail stations, potential Brightline stations, Port connection, MCO Airport connection, and respective transit agencies (Lynx, LakeXpress, SCAT, SunTran, VOTRAN).

2.4 Target Location Economic Impact Analysis to evaluate the potential economic development impacts associated with the target locations. The analysis will estimate direct and indirect economic order of magnitude impacts for properties and businesses in the general target locations

2.5 Stakeholder Engagement Meetings to discuss the ongoing development of the AAM Transportation Plan. The recurring monthly meetings will comprise of Stakeholders that will serve as the advisory team in the development of the AAM Transportation Plan.

2.6 Community Engagement Workshop to educate the public about AAM and gather input and comments from residents and business owners.

2.7 Central Florida Automated Vehicle Partnership (CFAVP) Meeting Update to solicit input from the partnership and provide an additional forum to gather comments.

2.8 AAM Transportation Plan to summarize previous efforts and provide recommendations for a regional AAM transportation plan.

Appendix A: Acronyms

AAM	Advanced Air Mobility	**MIA**	Miami International Airport
AAI	All Appropriate Inquiries	**MRO**	Maintenance, Repair, and Overhaul
ASL	Above Sea Level	**NAS**	National Airspace System
ASTM	American Society for Testing and Materials	**NASA**	National Aeronautics and Space Administration
ATC	Air Traffic Control	**NATA**	National Airspace Transportation Association
CAMI	Community Air Mobility Initiative	**NEC**	National Electric Code
CBO	Congressional Budget Office	**NFPA**	National Fire Protection Association
CBR	Community Based Rules	**NOx**	Nitrogen Oxides
CFAVP	Central Florida Automated Vehicle Partnership	**NSR**	Noise Sensitive Receptors
CFX	Central Florida Expressway Authority	**NWSD**	National Wildlife Strike Database
CO_2	Carbon Dioxide	**OSHA**	Occupational Safety and Health Administration
ConOps	Concept of Operations	**PAA**	Propulsion Airframe Aeroacoustic
CRAS	Cultural Resource Assessment Surveys	**PAO**	Public Aircraft Operations
dB	Decibel	**PSUs**	Providers of Services
DOT	Department of Transportation	**SEA**	Seattle International Airport
EASA	European Union Aviation Safety Agency	**SLF**	Shuttle Landing Facility
EJ	Environmental Justice	**SOx**	Sulfur Oxides
EPA	Environmental Protection Agency	**SSS**	scheduling, sequencing, and spacing
ESA	Environmental Site Assessments	**TLOF**	Touchdown and Liftoff area
eVTOL	Electric Vertical Takeoff and Landing	**TOD**	Transit Oriented Development
FAA	Federal Aviation Administration	**TWG**	Technical Working Group
FATO	Final Approach and Takeoff area	**UAM**	Urban Air Mobility
FDEP	Florida Department of Environmental Protection	**UAS**	Unmanned Aircraft Systems
FDOT	Florida Department of Transportation	**UCF**	University of Central Florida
FTE	Florida Turnpike Enterprise	**UML**	UAM Maturity Level
FTP	Florida Transportation Plan	**UNWG**	UAM Noise Working Group
GHGs	Green House Gasses	**USACE**	US Army Corps of Engineers
GOAA	Greater Orlando Aviation Authority	**VTOL**	Vertical Takeoff and Landing
IATA	International Air Transport Association	**WS**	US Department of Agriculture Wildlife Services
IBAC	International Standard for Business Aircraft Handling	**YVR**	Vancouver International Airport
IBC	International Building Code		
KISM	Kissimmee Gateway Airport		
LLF	Launch and Landing Facility		
MBTA	Migratory Bird Treaty Act		
MCO	Orlando International Airport		

Appendix B: Stakeholder Engagement Meeting Summaries

Meeting Notes

Place: Microsoft Teams Meeting
Date: September 24, 2021
Project #: 63588.02

Re: City of City of Orlando Advanced Air Mobility Transportation Plan:
Stakeholder Meeting #1 Summary

INTRODUCTION

This meeting was the first external stakeholder meeting session focusing on the City of Orlando's Advanced Air Mobility (AAM) Transportation Plan. It was held as a virtual Microsoft Teams meeting. Attendees were provided a brief presentation on AAM and the purpose of the Plan before engaging in discussions about potential challenges and opportunities for the project team to consider as the planning effort gets underway. A full list of attendees is provided as **Attachment A**.

MEETING SUMMARY

The meeting began at 10:00AM. Participants were able to provide comments and questions during the meeting through the chat feature in Teams. Comments provided in the chat are included as **Attachment B**.

- Tanya Wilder welcomed and thanked the attendees for participating.
- Jacques Coulon also thanked the attendees for joining today and provided an overall background of the planning effort, as well as on previous City investments and partnerships.
- Mike Hess provided an overview of the City's Future Ready Plan and how this AAM Plan came from the Future Plan, indicating the importance of equity being a critical component of this planning effort.
- Dave Mulholland provided information on what advanced air mobility means, provided examples of what others are doing in this field. He then explained why it is important that the City of Orlando is looking at AAM now and the potential benefits, as well as how it relates to what is being done at the federal, state, and local levels, as well as within the private sector.
- Dave M. then explained the purpose of the Plan for the City of Orlando to plan for the anticipated impacts associated with AAM through a regional connectivity plan. He also explained this is the first phase of the project and looking at AAM in a broad overall focus, adding that the second phase will involve more specific detail, such as travel demand modeling, and potential vertiport sites.
- Jacques C. provided a list of the stakeholder organizations and explained that the City has invited the stakeholders to provide their insight to help inform the City as the planning effort continues. He specified that this meeting is primarily about potential challenges and constraints.
- Curt Ostrodka explained how attendees can provide interactive feedback. He then led the question and discussion session with the following questions. The discussions and main takeaways are included below. A full summary of the PollEV questions and responses is provide in **Attachment C**.

- *Question 1: What do you think the biggest challenges are for AAM?*
    - 25% vertiport locations; 21% airspace; 14% regional coordination; 12% equity; 11% community acceptance

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Meeting Notes

- John Slot, LYNX, said that locations are a challenge, explaining that connecting vertiports to transportation hubs to connect to multimodal options will be important. Airspace and community acceptance, were also challenges he noted, specifying that it is not only the people using the vertiports, but how do people living by these facilities interact with the vertiports and the aircraft that is important. He understands this is important and gave an example of if an emergency landing is required, how does this affect the neighborhood.
- Kevin Thompson, GOAA, explained the challenges understanding how this new technology impacts both airspace and airport operations. He provided follow up comments in the chat box that is included in **Attachment B**.
- Eric Hill, MetroPlan Orlando, said that MetroPlan Orlando is responsible for the 20-year plan for transportation in the region, and that safety is a concern is along with testing. He added that it is not just the passengers on the vehicles, but the homes they are flying over which have safety concerns. He asked how the team has defined "equity" of this project. Curt O. said that the City has a Chief Equity Official, who will be included in the planning process. Jacques C. added that there are a few ways equity will need to be addressed, echoing the potential impacts to those in neighborhoods around AAM facilities, as well as the ability for different income levels to use this service. He added that the team has not created a definition for "equity in AAM" yet.
- Dr. Aty, UCF, thanked the project team for the invitation and said he was happy that the University was included. He said he would like to understand ridership and demand, saying that this follows data on modal split, equity, costs, etc. He asked if anyone looked into this, even primarily? Dr. Aty also said that typically these type of new technology projects starts in limited locations and then we can use lessons learned as the technology expands. He agreed with previous comments that public acceptance is a concern considering these vehicles are flying over houses. He continued by stating that it is probably a very small section of population that will use this service. Dave M. agreed that public acceptance side is critical. He answered that understanding the travel demand is important, acknowledging that it will not be everyone who uses this service. He said that the team has reached out to partners and experts and some initial mode splits from other area is typically around 1-3%. He added the team has continued to reach out to partners around the world to get more information and welcomes any input stakeholders on this meeting may have on this.

- *Question 2: What are the biggest environmental challenges?*
  - Noise was the most common response.
  - Issues regarding birds, visual impacts, and airspace were also responses provided by multiple people.
  - Jacques C. said that one thing he noticed in the responses that hasn't really come up before is the life cycle of the battery and what to do with those. He added that the team has considered these as vertical takeoff facilities and is considering at electric opposed to gas.

- *Question 3: What are the biggest transportation challenges?*

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Meeting Notes

- Safety, Integration/Connectivity, Cost/Funding, Equity, locations, and similarly intended responses were all issues mentioned multiple times.
- Curt asked attendees to explain a little more on what was meant by "integration." John Slot, LYNX, said his idea was that riders don't need multiple mobile systems or ticketing systems to switch modes. Yolanka Wulff, CAMI, noted she agreed with John and added that the potential impacts this new technology would have on other modes. For instance, if this draws riders away from buses so much as that the buses cannot get funded, that could disproportionately affect low-income users. Curt asked Yolanka to introduce herself. Yolanka said she is the Executive Director of the Community Air Mobility Initiative (CAMI), and they work with municipalities of what Air Mobility is and what they can do and how they can help. CAMI works with NASA on workshops and emerging practices playbook.
- Eric Hill noted last mile, first mile.
- Dr. Aty said that he sees AAM sharing many similar concerns to autonomous vehicles and asks the team to consider same issues we are already addressing with AV, such as cyber security.

- *Question 4: What are challenges specific to your agency?*
  - The responses are summarized below. A full list of responses in included in **Attachment C**.
    - Guidelines, regulations, and permitting
    - Infrastructure Needs
    - Costs and Funding
    - Equity
    - Safety
    - Integration of planning and regional coordination
    - Public education and acceptance and the potential impact of ridership
    - Land Use compatibility and potential impact to adjacent neighborhoods
    - Operations, such as impacts of weather of service
    - Protection of airspace
    - Locating vertiport locations
  - Jacques C. noted that a lot of grouped into policy and questions, such as making sure it is clear who is responsible for what.

- *Question 5: What opportunities do you see in AAM?*
  - The responses are summarized below. A full list of responses in included in **Attachment C**.
    - Prestige and Orlando being recognized as a leader in innovation and future-ready transportation
    - Connectivity and providing a multimodal regional transportation system
    - Sustainability
    - Providing more choices and the potential to relieve congestion on roadways
    - Economic Development both in attracting new businesses and employees, and in potential for new TOD sites around vertiports

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Meeting Notes

    - Reduction in emissions
    - Noise reduction
  - John Slot, LYNX, said that this technology really opens up the ability for smaller cities to invest in this type of technology beyond just helipads and provide mobility options for their residents. He added that one thing we didn't talk about is price point because that impacts the decisions of people whether to use the service or not.

- Jacques C. spoke about next steps, including providing a summary of this meeting and a follow up survey if attendees have more thoughts to provide. The team is looking at the last week of October for the next stakeholder meeting.
- Curt O. said that during the time until the next meeting, VHB will work on providing technical memorandums of regional transportation and environmental challenges and opportunities. He said the team is working on an economic impact study for a vertiport at the Geico Garage as a prototype. He noted this is being used as an example for the study to understand potential impacts, but it is not approved.
- Curt O. then summarized the phase two scope of work, saying that the results of the phase one work and stakeholder input may revise some of the items
- Curt O. and Tanya W. thanked the attendees.
- Meeting ended at 11:10 AM.

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ATTACHMENT A

LIST OF ATTENDEES

Name	Organization
Alissa Torres	Orange County
Anna Dietrich	CAMI
Amy Reed	FAA
April Rowe	FAA
Bart Vernace	FAA
Bill Wharton	Seminole County
Brian Creasy	FAA
Bryan Homayouni	CFX
Charles Ramdatt	City of Orlando
Chris Wilson	
Curt Ostrodka	VHB
Dana Chester	CFX
David Mulholland	VHB
Doug Jamison	LYNX
Durre Cowan	FAA
Eric Gordin	FTE
Eric Hill	MetroPlan Orlando
Fin Bonset	VHB
George Speake	Orlando-Sanford Airport
Jacques Coulon	City of Orlando
Jake Polumbo	FPU
John Slot	LYNX
Jonathan Torres	
Judith-Ann Jarrette	GOAA
Julie Salvo	Tavistock

Name	Organization
Kathy Devault	City of Orlando
Kelvin Miller	VOTRAN
Kevin Panik	NASA
Kevin Thompson	GOAA
Lara Bouck	MetroPlan Orlando
Lorie Matejowski	VHB
Matthew Broffman	Lilium
Michael DeGaspri	VHB
Mike Hess	City of Orlando
Nancy Mendonca	NASA
Mohammed Abdel-Aty	UCF
Nick Lepp	MetroPlan Orlando
Melissa Rivera	
Robert Bassey	FAA
Ryan Waterbury	
Paul Schoelzel	FDOT
Scott Gore	FAA
Shellby Rivas	Metric
Sherrell Lall	Metric
David Smith	FDOT
Tanya Wilder	City of Orlando
Tom Draper	GOAA
Tyler Johnson	VHB
Trish Smith	Volusia County
Vicky Bellissimo	City of Orlando
Yolanka Wulff	CAMI

ATTACHMENT B

COMMENTS FROM TEAMS CHAT

Scott Gore, FAA: We're currently working to update the FAA's UAM/AAM webpage where some of that content came from

Nancy Mendonca, NASA: The multi-modal aspect will be challenging both to integrate across transportation infrastructure so there is a "seamless" passenger experience, but also because aviation planning and planning for other modes have typically not been integrated so there's going to be a learning curve there.

Kevin Thompson, GOAA: sorry for the audio issues. as an airport operator, we are concerned about vertiport locations, impacts to airspace (TCAS event concerns), impacts to throughput/ capacity, and airport arrival/ departure procedures.

Nancy Mendonca, NASA: One other challenge will be competition for resources. The use cases being suggested for Orlando will likely have to be evaluated for their potential benefit against other uses for those same resources.

David Smith, FDOT: For the good of the order: FDOT's concerns with location, airspace, and coordination is from a site approval standpoint. These locations/sites will need site approval from FDOT and be registered and/or licensed prior to operating.

Nancy Mendonca, NASA: NASA will be hosting a meeting to overview NASA sponsored AAM demand analysis and network analysis studies as part of the agreement we signed with the 5 localities. Oct 26th 1-2 EDT. Jacques is on the invite and we don't have any objections to it being forwarded.

Nancy Mendonca, NASA: Sustainability - transportation solutions have exceptionally long lives and accurately predicting future needs/events that will impact these plans is tough.

Yolanka Wulff, CAMI: CAMI's website for more resources and information: communityairmobility.org

Bryan Homayouni, CFX: Safety transportation considerations as it relates to our roadway system - how will the motoring public react to AAM? Operationally how will we respond to AAM related incidents that may occur on our roadways?

ATTACHMENT C

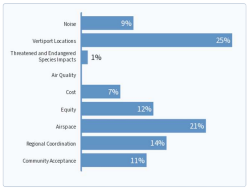
PollEV RESPONSE SUMMARY REPORT

Untitled

Current run (last updated Sep 24, 2021 11:21am)

5	41	60	67%
Activities	Participants	Average responses	Average engagement

What do you think the biggest challenges are for AAM? (Select Up to 3)

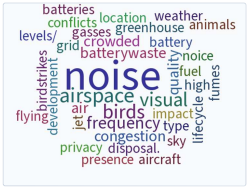


Response options	Correct	Count	Percentage
Noise	✓	8	9%
Vertiport Locations	✓	23	25%
Threatened and Endangered Species Impacts	✓	1	1%
Air Quality	✓	0	0%
Cost	✓	6	7%
Equity	✓	11	12%
Airspace	✓	19	21%
Regional Coordination	✓	13	14%
Community Acceptance	✓	10	11%

76% Engagement

91 Responses

What are the biggest environmental challenges? (One Word; Up to 3 Responses)



Responses

Noise	lifecycle	Noise	Noise	noise	air	Birds	Noise	noise	noise	Visual	no
Airspace	Fumes	noise	birds	noise	quality	Noise	renewable	airspace conflicts			
weather	birds	Wetlands	grid	Birdstrikes	Noise	frequency	noise	Airspace			
Frequency	Community	Congestion	Batterywaste	impact on airspace	batterywaste						
airspace	crowded	Noise	Greenhouse gasses from Jet fuel	noise levels/ presence of aircraft							
noise	Privacy	visual	visual	crowded sky	location	batteries	Birds	Noise Visual			
Air Quality	Noise	Noise	birds	Development	visual noise	Noise					
the high frequency of this type of noise	Noise	Airspace	Vertiport-impacts-on-location								
flying animals	Congestion	Operations	Battery disposal.								

73% Engagement

65 Responses

What are the biggest transportation challenges? (One Word; Up to 3 Responses)

Responses

regulations	adoption	Affordable	Convenience	Priorities	accessibility	Equity	Equity
access to eVTOL site	multimodal	integration	Congestion	Safety			
Infrastructure needed for scale	Sustainability	Safety	Locations	accessibility	cost	Safety	
Funding	Connectivity	airspace	funding	Safety	Locations	multimodal	Integration
acceptance	Airspace	price	Cost	Connectivity	Regulatory	safety	Equity	integration
routing	Cost	cyber security	Acceptance	ridership	Weather	accessibility	Cost
Congestion	Public Benefit vs. Profitability	safety	integration	safety	regulations	Safety	
capacity	Operations	Cost	NIMBY	size	corruption	Safety	Resiliency	Equity
incorporation into current airspace	SiteApproval	Money	Access_management	Equity			
Seamless integration	Integration	connectivity	Connectivity	Cost	connectivity		
congestion	Funding	airspace					

80% Engagement

75 Responses

What are the challenges specific to your agency/locality?

" Safety "

" Protection of airspace "

" Airport land use compatibility "

" FDOT Guidelines "

" Regional commitment "

Responses

FDOT - Statewide planning and coordination; airspace integration; local zoning | Regional commitment | MetroPlan Orlando, safety, equity, integration and range. | CFX - Safety and Operations | Lilium - Find locations & service opportunities that benefit the community | City of Orlando - equity | FDOT Guidelines | LYNX - Limited local funding to support transportation initiatives | GOAA - lack of standards | Volusia - Education | UCF - Expected Ridership - Public Acceptance | LYNX - intermodal connectivity | Orange County - safety, land use/community compatibility, transportation system integration, equity | MetroPlan-Equity of funding priorities | airspace | Orlando Sanford Intl - neighbors | Verification of safety control measures - Florida Poly AMI | FAA GUIDELINES | Protection of airspace | Airport land use compatibility | Safety | Orlando Sanford Intl - airspace | FDOT - Peripheral infrastructure needs | connectivity | Florida Department of Transportation - Site approval for new vertiport sites and design standards applied. Pursuant to CH 330, FS. new airport sites must receive site approval before a license or registration to operate can be obtained. Also, what sort of design guide or state licensing standards do we apply to these new sites to ensure safety. | LYNX - when weather precludes service, bus support / bridges… | Safety | City of Orlando - Policy/Regulatory Framework | Long-term integration policy -- being able to forecast future needs and developing policy. | City of Orlando - Integration of Multi-modal planning

54% Engagement

30 Responses

What opportunities do you see in AAM?

" Future of transit oriented development "

" Connecting previously hard-to-reach communities "

" center development around vertiports (smarter sprawl) "

Responses

quieter | Alternative transportation | sustainable transportation | Increased economic activity | Integrated Planning and Development | forward thinking policy decisions | less trucks on the highways | Fewer emissions, and the potential for reductions in noise pollution. | Connecting previously hard-to-reach communities | Economic development | Subsidized, large scale transportation solutions | Potential reduction in roadway congestion...long term | Making us the center of the state for regional transportation | CAMI - a new mode that contributes to a multimodal regional transportation system | MetroPlan Orlando, innovation. | Local transportation in 3 dimensions | Flexible and scalable transportation network | A boost in the perception of Central Florida as a leader in future-ready transportation. | more convenient than commercial service air travel | UCF - boost the perception that Orlando is a futuristic smart city | more choice in routes | Multimodal options on a constrained system | Meet our vision to be the premier future-ready / innovative city | center development around vertiports (smarter sprawl) | Avoid road congestion | meets a new, niche market | reduction of emissions | Reduction in congestion | UCF - attract high end businesses/companies | Way to leverage existing initiatives and investments | Improved efficiencies | FDOT - Decrease in roadway congestion with an increase in acceptance. Greater mobility. | Positive impact on economy | prestige | no emissions | Future of transit oriented development | the future | Connectivity within communities

51% Engagement

38 Responses

Meeting Notes

Place: Microsoft Teams Meeting
Date: October 27, 2021
Project #: 63588.02

Re: City of City of Orlando Advanced Air Mobility Transportation Plan:
Stakeholder Meeting #2 Summary

INTRODUCTION

This meeting was the second external stakeholder meeting session focusing on the City of Orlando's Advanced Air Mobility (AAM) Transportation Plan. It was held as a virtual Microsoft Teams meeting. Attendees were provided a brief presentation on the key takeaways from Meeting #1, airspace considerations and permitting process, and participated in a regional visioning exercise. A full list of attendees is provided as **Attachment A**.

MEETING SUMMARY

The meeting began at 9:30AM. Participants were able to provide comments and questions during the meeting through the chat feature in Teams. Comments provided in the chat are included as **Attachment B**.

- Jacques Coulon, City of Orlando, welcomed and thanked the attendees for participating and provided an overall background of the planning effort.
- A representative from each organization in attendance introduced themselves.
- Jacques C summarized key takeaways from the previous meeting.
    - Vertiport locations, airspace, and safety were the major concerns shared by stakeholders
    - Noise, equity, and connectivity were also concerns identified by stakeholders
- Fin Bonset, VHB provided an overview of airspace rules, regulations, and permitting, including:
    - Controlled and uncontrolled airspaces
    - FAR Part 77 Imaginary Surfaces
    - Airspace classifications (Class A through Class E)
    - Heliports vs vertiports
    - State of Florida permitting process (Sec 330.30, Florida Statutes)
- Curt Ostrodka, VHB, described the City of Orlando vertiport permitting process (Sec 58.850 of the Land Development Code). He noted that the City will re-examine and may revise its code as a result of the AAM Transportation Plan.
- Curt O then discussed the opportunities that were identified by stakeholders at the previous meeting, including:
    - Future of Transit Oriented Development
    - Sustainability
    - Economic Development
    - Transportation Improvements
- Curt O then invited stakeholders to participate in a regional visioning exercise. Participants used an online mapping tool to identify potential vertiport locations throughout Central Florida and provide comments on why it is a good location. Participants then used the same mapping tool to draw potential AAM corridors or pathways. Curt explained that this is a visioning exercise only, and that actual vertiport locations and

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Meeting Notes

corridors will depend on a variety of factors, including local government zoning approvals, a multimodal travel demand assessment (to be conducted in Phase Two of the AAM Transportation Plan), and FAA airspace permitting and regulations. The results of this exercise are included as Attachment C.

- Other Comments from participants
    - Sec. 330.30 F.S. appears flexible as naming convention changes
    - Several AAM pilot programs: UAS mitigation using geofencing
    - Rethink AAM approach as first/last ~10miles for freight
    - Not too early for corridor planning; airports have started looking at converting top floor of parking garages into vertipads
    - Two ways to look at AAM
        - Short and long distance (intra-city)
    - Vertiports could be added at all public-use airports (130 in Florida)
- Curt O. and Jacques C. thanked the attendees and described next steps to conclude Phase One, and anticipated Phase Two activities.
- Meeting ended at 11:00 AM.

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ATTACHMENT A

LIST OF ATTENDEES

Name	Organization
Alan Spring	
Alissa Torres	Orange County
Alice Lammert	FDOT
Allison McCuddy	FDOT
Anna Dietrich	CAMI
Anthony Albert	FDOT
Anton Fredriksson	Lilium
Bart Vernace	FAA
Bill W	guest
Bryan Homayouni	CFX
Charlie Wetzel	guest
Curt Ostrodka	VHB
David Roberts	FDOT
David Smith	FDOT
David Mulholland	VHB
David Rottblatt	Eve Air Mobility
Doug Jamison	LYNX
Doug Lampe	Luftcar
Durga M.	Luftcar
Fin Bonset	VHB
Frank Consoli	Seminole County
George Speake	Orlando-Sanford Airport
Jacques Coulon	City of Orlando
Jeffery Ball	Brevard County
Jake Polumbo	FPU
Joseph Jerkins	FDOT
Julie Salvo	Tavistock
Kathy Devault	City of Orlando
Kevin Thompson	GOAA
Luis Ruiz	InNovo Partners
Matthew Broffman	Lilium
Mathew Land	Eve Air Mobility
Mike Hess	City of Orlando
Mike Willingham	Sebring Airport
Mohammed Abdel-Aty	UCF
Nancy Mendonca	NASA
Naveen Eluru	UCF
Paul Schoelzel	FDOT
Rahul Razdan	Florida Poly
Ralph Ireland	Tavistock
Ryan Waterbury	Tavistock
Santh Sathya	Luftcar
Sarah Van Gundy	FDOT
Shellby Rivas	Metric
Sherrell Lall	Metric
Shirley Walker	City of Orlando
Stephen Wilson	FAA
Tanya Wilder	City of Orlando
Tom Draper	GOAA
Trish Smith	Volusia County
Vicky Bellissimo	City of Orlando
William Slot	LYNX
Yolanka Wulff	CAMI

ATTACHMENT B

COMMENTS FROM TEAMS CHAT

Santh Sathya (LuftCar)
Please introduce LuftCar as well. We had our logo in our email exchanged with you. Three attendees are logged in from LuftCar.

Anna Dietrich – CAMI
Community Air Mobility Initiative (CAMI) got missed on the logo list too. We are a nonprofit focused on supporting the integration of the 3rd dimension (AAM) into local communities across the US. https://www.communityairmobility.org/

Mendonca, Nancy (HQ-EO000) – NASA
NASA also hosted 3 recorded NAS 101 webinars. in Sept 2020 1) Airspace operations, 2) terminal operations and 3) enroute operations. The slides and recordings can be downloaded/viewed here https://nari.arc.nasa.gov/aam-portal/airspace

Santh Sathya (LuftCar)
what's class D? LuftCar is a regional transport vehicle flying upto 300 miles… and supposedly in Class D

Mendonca, Nancy (HQ-EO000) – NASA
We're seeing a lot of fluidity in taxonomy around naming. Do you think the Section 330.30 is flexible enough to convey your intent even as the names change? For example sUAS ports. Would you want them to go thru this process?

Fin Bonset – VHB
Santh, Class D typically has a 5 nautical miles radius and extends from the surface to 2,500 feet. Requires approval from ATC

Smith, David P – FDOT
Nancy: Chapter 14-60, Florida Administrative Code provides site approval requirements to fulfill Section 330.30,FS requirements and will be where we (FDOT) will craft specific site approval/licensing requirements for vertiports. 14-60, FAC is available here: 14-60 : AIRPORT LICENSING, REGISTRATION, AND AIRSPACE PROTECTION - Florida Administrative Rules, Law, Code, Register - FAC, FAR, eRulemaking (flrules.org)

Meeting Notes

Mendonca, Nancy (HQ-EO000) – NASA
Another opportunity is for locality/agency to shift how current services are provided to using AAM where the AAM mode provides better performance, is more sustainable/equitable and a lower cost.

Smith, David P – FDOT
I think vertiports could be potentially added as an additional landing area at all public-use airports state wide. There are a number of airports in the state that have a helipad as an additional landing area. There are currently 130 public-use airports in the State.

Matthew Broffman – Lilium
https://lilium.com/newsroom-detail/why-regional-air-mobility
Why we're focusing on Regional Air Mobility - Lilium
Why we don't plan to operate flights under 20km, and why that's a good thing.

Kevin Thompson - GOAA
One item to consider about the I4 corridor. There's a high volume of helicopter tour operators (7 I believe) that operate along I4 during VFR conditions.

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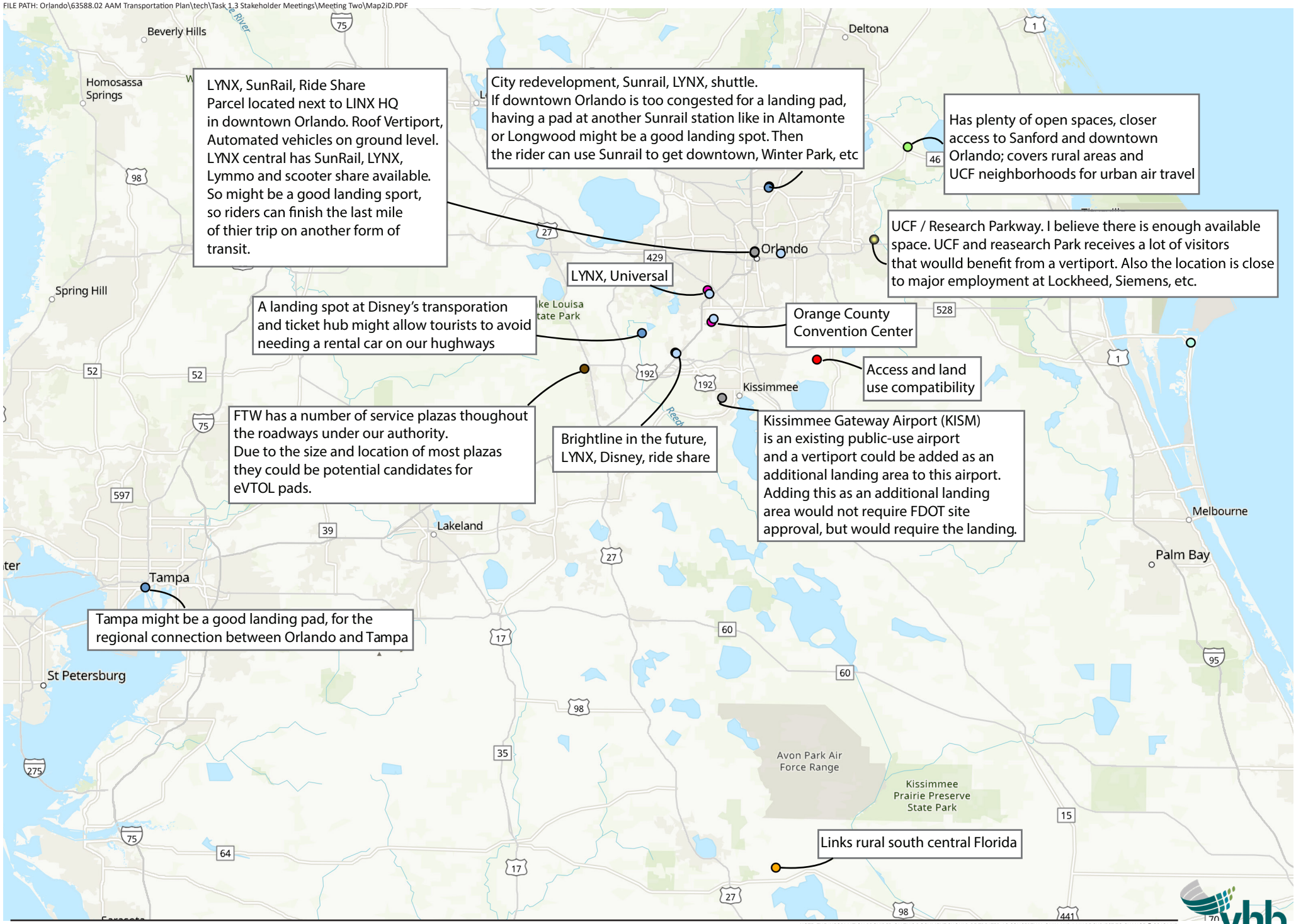
ATTACHMENT C

Regional Visioning Results

FILE PATH: Orlando\63588.02 AAM Transportation Plan\tech\Task 1.3 Stakeholder Meetings\Meeting Two\Map2iD.PDF



ORLANDO ADVANCED AIR MOBILITY (AAM) TRANSPORTATION PLAN

POTENTIAL VERTIPORTS IDENTIFIED BY STAKEHOLDERS

Orlando ▪ Florida

0 6 12 miles

DATE: November, 2021

PROJECT NUMBER: 63588.02

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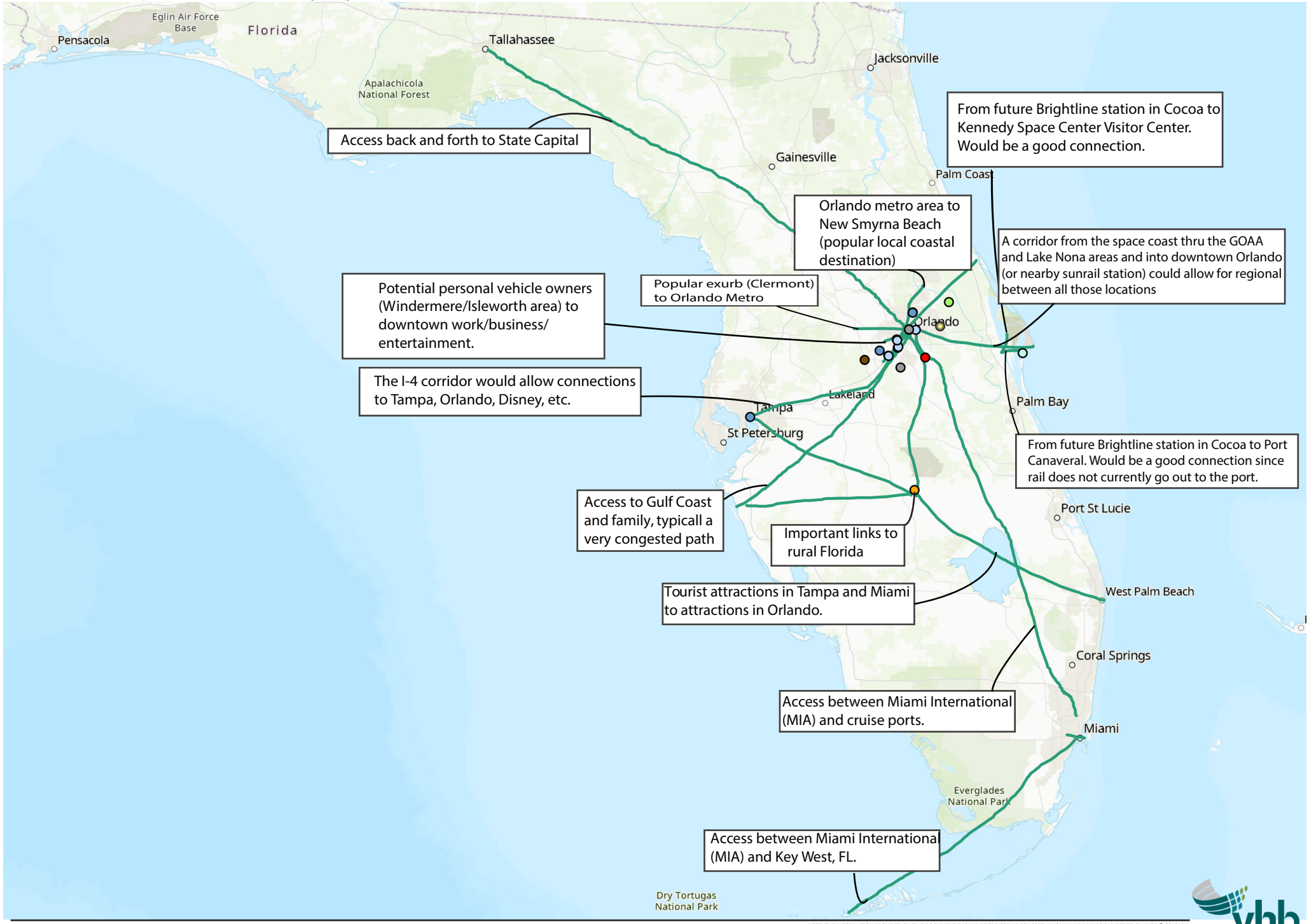
FILE PATH: Orlando\63588.02 AAM Transportation Plan\tech\Task 1.3 Stakeholder Meetings\Meeting Two\Map1iD.PDF



ORLANDO ADVANCED AIR MOBILITY (AAM) TRANSPORTATION PLAN

POTENTIAL AAM CORRIDORS IDENTIFIED BY STAKEHOLDERS

Orlando ▪ Florida

0 32 48 miles

vhb

DATE: November, 2021

PROJECT NUMBER: 63588.02

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