August 16, 2023

Docket Operations Office,
U.S. Department of Transportation,
1200 New Jersey Ave. SE, West Building Room W12-140,
Washington, D.C. 20590

Re: RFI Response: Advanced Air Mobility – Docket No. DOT-OST-2023-0079

To Whom it May Concern:

The enclosed represents a carefully curated response to the above DOT request for information. This consortium leverages the combined effort of over 50 industry experts, scholars, and advocates. Each of the 20 sections has an average of 3 authors to provide a symphony of suggestions from a diversity of perspectives. An effective national strategy must be comprehensive in nature, thorough in analysis, and decisive in execution.

We have compiled a roadmap of relevant considerations with the understanding that this is a rapidly evolving field of aviation. Please consider the Advanced Air Mobility Institute an ongoing and reliable resource to help navigate this largely uncharted territory. Public Trust is the lynchpin. As an international non-profit, we are ideally positioned to draw in the best practices from around the world and convey a sincere message of inclusivity for everyday citizens.

For what it's worth, we often encourage AAM stakeholders to show grace to our respective regulatory bodies – including, of course, the US Department of Transportation and FAA. We acknowledge that government administrators have relatively little to gain from certifying these new aircraft while likely bearing the brunt of blame for future accidents. No form of transportation is perfect and yet we are inching ever closer, together. Your responsibility is to keep the flying public safe and the best way to stay safe is to never try anything new. We commend you for recognizing that there is so much more to gain for society through innovation.

We owe it to ourselves to try—

All the Best,
Dan

Daniel C. Sloat, JD/MBA
Founder & President, Advanced Air Mobility Institute

The Advanced Air Mobility Institute, Inc. is a 501(c)3 non-profit corporation dedicated to educating and advocating for the broadest public benefit through the advanced air mobility ecosystem globally. Ultimately, the AAM Institute is committed to protecting people, their rights, and the systems we rely on. We seek to accelerate access to these new technologies in an ethical and responsible way.

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INTRODUCTION

Recognizing the remarkable strides made by the U.S. Department of Transportation (DOT) in advancing the aviation sector, it is evident that their multifaceted approach involving policy, innovation, and collaboration has played a crucial role in propelling the aviation industry forward and ensuring its continuous growth. The DOT's proactive stance in soliciting industry input on the development of a national strategy on Advanced Air Mobility (AAM) underscores their genuine efforts to shape a safer and more innovative aviation environment.

Within this discourse, we present a collective effort, a compilation of insights from voices spanning the industry spectrum. With a focus on enhancing global competitiveness and industry resiliency, these recommendations emphasize a commitment towards cultivating an aviation landscape that not only flourishes economically, but also wholeheartedly embraces cutting-edge advancements and unwavering safety standards. As aviation evolves, the implementation of these recommendations could serve as a catalyst for transformative progress, establishing new industry benchmarks and propelling the United States forward in its position as an aviation global leader.

What should be addressed for the AAM national strategy?

The Advanced Air Mobility Institute has observed that AAM stakeholder strategies have often been based on decade-away plans and not focused enough on pending AAM operations in the near-term. A comprehensive AAM strategy should address, in detail, how AAM operations will be integrated in the near-term into the airspace, ground-space, and communities, while planning for broader applications and scaling in the longer term. This must include addressing the reality of early AAM operations and use cases, benefitting the few, but a clear roadmap for how the investments made in this technology by the various sectors will benefit larger communities, address environmental concerns, and be a viable mode of transportation. We would like to see the energy used for AAM (charging, infrastructure, and more) as part of our national security giving us ample of home-made energy independent of geopolitical influences. AAM will help drive improvements to other modes of transportation. There is a legitimate concern that this technology is exclusively for wealthy elite, but it is paramount to ensure broad accessibility.

What are the existing barriers to success of AAM implementation?

The aircraft must be certified IAW rulemaking to be able to eventually "file and fly." Currently, every UAS operation and operator must have a waiver or exemption to fly. These exemptions and waivers are not currently transparent and therefore are not scalable or attainable by most wanting to operate in the AAM industry. The agency exhibits a "bring me a rock" posture at times toward operations, operators, and service providers. We need to create a sustainable path to certification for all necessary stakeholders. There is not a current plan that will mandate who owns the responsibility for separation in UTM, AAM airspace, the Federal Aviation Administration (FAA) has not yet determined how they will provide services.

The FAA needs to determine whether they will cede airspace to those that will provide a service in UTM airspace. For a UTM, PSU, or USS provider to provide service, they need to know that the agency is going to implement rulemaking that makes all users in that airspace participants by at least having ADSB out so that if they are not participating in the UTM architecture they will at least be able to be seen by USS and PSU's who will be providing the strategic and tactical separation as part of their service provided. The FAA must determine if communication, navaids, and surveillance will be part of an industry-owned or federally-owned and managed system. This determination will become a matter of who owns liability if an off-nominal situation results in a catastrophic event. When legacy aircraft eventually traverse AAM operational airspace, such a determination will be a key factor in which authority controls.

1. Most Likely Use Cases

Descriptions of the most likely use cases for AAM in the short, medium, and long term along with high-level estimations of when these use cases may come to market. Also, what government actions could enhance or inhibit those market timelines? Are there use cases that are a national priority? Please include descriptions of the operating areas, other transportation options available in the operating area, the supporting infrastructure for the conceptual ecosystem, and the roles and expected involvement that private industry as well as the federal, state, local, tribal, and territorial governments would have in AAM integration.	
Use Cases	**Description**
Overview	Advanced Air Mobility includes both Urban and Regional applications that will use electric powered vertical takeoff and landing (eVTOL) and electric Short Take-Off and Landing (eSTOL) aircraft that will provide short-distance urban transportation applications to improve mobility access, reduce environmental impacts, and reduce travel time, and longer regional connectivity that will connect communities and provide air transportation to communities that currently may not have easy access.
Short-term Use Cases (2-3 years)	Procedures and policy that does not affect, bypass, or involve rulemaking but any findings should support new rulemaking efforts and Safety Management System data collection efforts. Assuming agreements have been made between service providers and the FAA, the ability for multiple users of airspace to communicate with other users via direct or indirect communication through a service provider that is sharing intent. This intent will include information about direction of flight, altitude, speed etc. In order to provide tactical and strategic separation service between aircraft this information must be shared in order to make adjustments to flight. Another aspect of communication must exist via service providers, who will be providing different levels and types of services to a diverse group of users. A. **Emergency Response**: search and rescue operations, community monitoring, fire suppression, disaster relief, and overall increased situational awareness for first responders. B. **Rapid Transportation**: medical transportation aka 'air ambulance' to recover people in remote or hard-to-reach areas, such as mountainous regions or areas affected by natural disasters. Organs for transplantation, or even bringing medical teams to inaccessible or congested areas. AAM can transport personnel and equipment to remote areas or transport critically ill patients to hospitals quickly. C. **Critical Infrastructure**: mapping, environmental monitoring, infrastructure inspections like rail and powerline inspections and other aerial survey applications. AAM may find applications expanding current options in industries such as surveillance and monitoring of remote areas or large-scale facilities, including oil rigs, power plants, and pipelines. D. **Cargo Delivery**: AAM can be used for rapid delivery of goods, especially high-value, time-sensitive items like medical supplies. This use case is already being tested in several places and might be one of the first to see wider adoption. Swift delivery of

	small packages, essential medical supplies, and other time-sensitive goods, particularly in urban areas where conventional ground transportation faces challenges. AAM can be used to transport cargo, including medical supplies, food, and other essential goods, to remote areas or areas with limited ground transportation infrastructure. This can also include last mile delivery from major distribution centers. E. **Tourism**: There are opportunities for eVTOL aircraft to offer aerial tours and sightseeing experiences, providing a unique perspective on landmarks and natural wonders, thereby enhancing the tourism industry. Sporting event connections, for example the 2024 Paris Olympics. In the short term, government actions that could enhance the market timelines include creating clear regulatory frameworks for these use cases, supporting pilot projects, and investing in infrastructure development. Actions that could inhibit the market timelines include overly restrictive regulations, slow certification processes, and lack of funding for infrastructure development.
Medium-term Use Cases (4-8 years)	There should be enough time to have supporting data incorporated into rulemaking that it produces a viable product that can withstand the rigorous safety standards we have today in the National Airspace System. There will be a transition between short term Policy and Procedure changes that include exemptions and waivers to a “file and fly” activity that is “covered” by law, is repeatable and completely transparent and available to all users and service providers. Towards the end of this effort the FAA will have to have made decisions about how to properly allow for the advancement of autonomous vehicle operation and in essence will not stand in the way of industry but will have created a support network that allows for business model expansion and industry innovation in addition to having created a safety protocol/process that ensures the safety of the public both in the air and on the ground for mixed UAS and Legacy aviation users. A. **Urban Air Mobility (UAM)**: Once the safety and reliability of AAM systems are proven, they can be used for passenger transportation within and around urban areas. On-demand and scheduled urban air transportation, allowing transportation of persons short distances in high traffic areas. AAM could bridge the gap between short-range air taxis and traditional airline services, enabling faster and more convenient intercity travel for passengers. B. **Regional Air Mobility (RAM)**: AAM can be used for passenger and cargo transportation between cities, especially in regions where ground transportation is slow or inconvenient. AAM services could expand beyond urban areas to include regional transportation, connecting smaller towns and suburbs, reducing travel time, and increasing accessibility. In the medium term, government actions that could enhance the market timelines include developing air traffic management systems for AAM, continuing to update regulations as the technology evolves and investing in public infrastructure such as vertiports.
Long-term Use Cases (8+ years)	At this stage, we need new rulemaking actions that will address gaps and shortfalls in previous iterations of rule, policy, and procedures by a systematic review of safety data from mid-term efforts and promotion of new activities. A. **Fully Autonomous AAM**: In the long term, AAM vehicles could become fully autonomous, opening up a wide range of new applications such as on-demand air taxi services. B. **Seamless Integration with other Transportation Modes**: AAM could be fully integrated with other transportation modes, providing seamless multi-modal transportation. Expansion to increase efficient delivery of goods, reduce road traffic, and optimize supply chain operations.

Healthcare Use Cases to Implement ASAP	Potential healthcare-related use cases for AAM (sUAS and eVTOL) are based the technology's lower direct and indirect operating cost, potential decreases in fixed costs / Capital Expenses (CapEx) when the technology scales, and the potential to develop an expanded role for air mobility within healthcare systems beyond current uses for emergency air medical transport. Secondarily, emerging mobility technologies may facilitate substantial re-design of healthcare service delivery models, facilitating the transformation and integration of healthcare delivery systems.
	
	These eVTOL aircraft may substantially change the economics of air medical transport via several mechanisms:
	• Lower CapEx relative to Helicopters, especially if/when the technology scales beyond healthcare markets. Anticipated initial vehicle costs in the $1-3M range are far lower than $3-12M currently incurred for acquisition of helicopter platforms. Additional scale (beyond the healthcare vertical) across urban air mobility markets will also substantially decrease vehicle acquisition and operating costs, potentially to levels consistent with luxury cars.
	• Potential for increased utilization of transport assets due to partial autonomy, lower noise profiles, and expanded mission profiles (including cargo applications and non-emergency medical transport).
	• Lower personnel cost via development of hybrid Operator/Healthcare Provider roles given lower training requirements and expertise. Healthcare workers currently engaged in healthcare transport activities could be given additional training for expanded roles including operational expertise for autonomous eVTOL and sUAS systems.
	• Integration of mobility and transport services across the healthcare enterprise, with additional benefits accruing to supply chain functions.
	• **Changing Market**: Consolidation among providers, closure of rural hospitals and healthcare facilities, and the trend towards more distributed healthcare delivery models all may contribute to an increasingly important role for mobility solutions in the design and provision of healthcare services.
	• **Cross-market migration to adjacent use cases**: Integration of eVTOL technology and operations in the healthcare space may provide users and companies in the space an accelerated pathway to adjacent and much larger markets, including:
	  o Direct cargo services linking hub airports/sort facilities directly to integrated vertiports within communities, including possibly existing helipads at healthcare facilities.
	  o Passenger transfer services, linking regional airports with larger hub airports. Direct link passenger transfer services, linking passengers from airports to their final destinations.
	  o sUAS systems connecting healthcare facilities and community care venues (retail pharmacies, doctor's offices, community health clinics, etc.) will also substantially augment existing healthcare infrastructure and services, improving access to healthcare services and decreasing the cost of healthcare logistics systems.

Ongoing Integration Hurdles	• **Public Acceptance**: The general public is familiar with and accepts helicopters in common use for patient transport and eVTOLs will likely be quieter and possibly safer than helicopters. If governments do not address privacy and security concerns associated with AAM operations, public acceptance and regulatory approval may be hindered. Establishing robust data protection measures and addressing public concerns can help build trust in the technology. • **Maintenance**: Electric aircraft need to comply with the same regulations that require the creation and use of maintenance information and instructions for continued airworthiness. Active enforcement of these regulations and purchase contracts preventing restrictions on access to maintenance data and parts are necessary.

	• **Regulatory Considerations**: While new technologies often lead to calls for new regulations, the existing aviation safety rules already cover design, production, operations, and maintenance of civil aircraft. Instead of adding new requirements and restrictions, the focus should be on applying existing rules to the new technologies now being used in aviation. If governments have lengthy or overly cautious regulatory processes, it can significantly delay the deployment and commercialization of AAM technologies. Delays in certification or restrictions on operations can hinder industry growth.
Elements to Prioritize Immediately	a) **Funding**: The transition to electric propulsion could face reluctance, particularly if resources are shifted from traditional aviation to electric-only facilities and if new revenue fails to materialize. Funding strategies will need to be considered carefully to support the transition without undermining existing operations. Insufficient funding or lack of financial incentives for AAM research, infrastructure development, and industry participation can slow down progress and discourage investment. Governments can establish partnerships with private companies, academic institutions, and industry associations to jointly drive the development of AAM. Collaboration can help share expertise, reduce costs, and facilitate knowledge transfer. b) **Infrastructure**: There is a recognized need for investment in aviation infrastructure to accommodate the growth of the AAM sector. This includes new facilities such as special landing sites called 'vertiports,' terminals, as well as federal investment in electric charging stations and air traffic management software. The systems, training, and resources must be identified and fulfilled for the AAM sector to realize its potential. Aviation assets are already in common use in, and many facilities have helipads which could be converted to vertiports and/or multi-ports to accommodate eVTOLs and UAS. In fact, Inconsistent regulations and standards across different regions and countries can create barriers for AAM operations and limit scalability. Governments can work towards international harmonization to facilitate seamless cross-border operations. c) **Workforce**: The introduction of new technologies requires the adjustment of skills. While much of the knowledge and skills currently taught to aviation technicians will be transferable, the use of focused knowledge and skills for electric power may be new to aviation. Efforts to address the technician shortage are crucial. eVTOL integration will likely move through several stages with regard to automation, initially requiring pilots and operators before the introduction of automated systems. Healthcare workers currently engaged in patient transport already have advanced training in healthcare delivery and critical care medicine and may be ideal candidates for training in "hybrid" roles as eVTOL and UAS operators.

2. Safety Enhancements

Understanding that safety must be the key component of any future AAM operations, provide information on how new concepts in aviation, such as third-party service providers, automation, and new forms of navigation-enabling infrastructure, provide for, or even enhance, the level of safety of operations.	
Use Cases	**Description**
Overview	Understanding that safety must be the key component of any future AAM operations, provide information on how new concepts in aviation, such as third-party service providers, automation, and new forms of navigation-enabling infrastructure, provide for, or even enhance, the level of safety of operations. AAM aircraft, such as eVTOL vehicles, are poised to progress from semi-automated aircraft with pilots onboard to highly automated aircraft with pilots onboard to eventual remotely piloted and autonomous aircraft. 1 To facilitate this, automation will provide advanced flight control algorithms and stability augmentation to enhance the aircrafts stability and responsiveness during various flight phases, which will help mitigate the risk of pilot-induced accidents or loss of control

	situations. One of the concepts currently being discussed to enhance safety in these vehicles is simplified vehicle operations (SVO). SVO is a term that the aviation industry has adopted to identify the use of automation to reduce the number of skills a pilot or an operator of an aircraft must acquire to achieve the required level of operational safety. SVO concepts propose changing how the pilot will control the aircraft. One such concept currently being proposed is the unified control concept. This simplified control system integrates control of the vehicle's position and attitude using a unified framework, allowing for simpler and more efficient control. Currently, several eVTOL manufacturers and potential operators that aim to use eVTOL for various use cases are using the unified control concept as part of the aircraft's automation to enhance the safety of the AAM flights. While the unified control concept is currently pursued in eVTOL aircraft, research gaps exist in understanding how using the unified control concept can help increase safety. There is a need to conduct research to understand the impact of SVO control concepts such as unified control, and how these concepts and technologies enhance the safety of operations.
Synthetic Vision System	Within SVO there will also be a significant shift in how the information is presented to the pilots. 3 From the publicly available information, we are seeing a trend of using larger glass, touch displays, single to dual screen set-ups for single-pilot operations, reduced redundant information, integration of electric propulsion information, and use of advanced sensor information displays, for example, Synthetic Vision System (SVS). Currently, limited research has been conducted to examine what information is required to allow pilots to safely operate highly automated, SVO vehicles. There is also very limited research regarding the most effective way to provide novel information to operators, such as power availability and state of charge of the battery and how various display designs impact mission decisions. There is a need to conduct research to understand how various information display methods could be utilized to enhance the level of safety in AAM operations.
Human Factors Research Gaps	The AAM Vertiport will represent the convergence of known and yet-to-be-discovered operational safety factors in a dynamic, complex safety-critical environment. Safety-critical industries such as aviation, oil, and gas, nuclear, and medicine have earned and learned their safety practices, often through significant loss. These industries recognize that 'safety' is a multifaceted, ever-changing concept that needs to be carefully understood, categorized, the data examined, and risk predicted. The broad term 'safety' as it applies to AAM Vertiports often assumes the inter-connectedness of automation and autonomy will lower operational risk, enable scalable operations, and reduce the human error component. However, despite valuable research, these system-wide operational safety concepts are not modeled or tested for AAM Vertiports.
Integrated Vertiport Safety Management System	NASA researchers have proposed a safety framework incorporating safety assurance and risk management called the In-time Aviation Safety Management System. This concept is an architecture for system-wide safety at AAM vertiports; however, it is an architecture yet to be modeled or tested, and therefore the functionality and effectiveness of IASMS architecture can only be assumed; for example, how does an integrated system handle and account for the following; (a) the interconnectedness of the disparate automated data, (b) how and what is to be prioritized and presented to the vertiport manager, and (c) the impact and integration of human performance factors (d) how does the system-wide integrated safety management framework perform in reality? These four broad areas require further understanding, categorizing, and examination to predict safe and scalable UAM Vertiport operations from day one. Furthermore, the criticality of operational safety at AAM Vertiports will have a direct and significant impact on community trust and willingness to fly in Advanced Aircraft and their acceptance of AAM Vertiports. Public trust is critical to the success of the AAM ecosystem from 'Day One.' Therefore, AAM Vertiport operations must have a fully operational Integrated Vertiport Safety Management System (IVSMS) built in compliance with industry best practices and have the same level of rigor as comparable safety-critical industries. However, unlike other safety-critical industries, including traditional aviation, oil, gas, nuclear, and medicine, the

	Vertiports' safety systems require more agility, with a higher data capture and analysis capacity. AAM Vertiport safety systems need to quickly scale from Day One operation throughput to the projected ULM 4 concepts as depicted by NASA. There is no other initiative to adapt the NASA architecture to comply with FAA, and industry standards requirements for an integrated SMS.
Human Performance	Few studies explain how humans will integrate into the AAM Vertiport operational environment. At the time of writing, AAM technology has vastly outpaced the regulations on AAM vertiports; despite considerable research into identified factors, it is the known unknowns that provide postulating and caution of the regulators. The FAA Vertiport Engineering brief published in 2021 proposed the physical characteristics of the AAM Vertiport. However, this document does not provide any performance-based standards or requirements for the operations arriving and departing the AAM Vertiport. The investment into AAM Vertiports is significant, representing approximately $35 to $45 million, not including estimated annual operating costs between $110 million to $130 million per year. Therefore, understanding human requirements is vital to establishing safe operations from day one. Humans must monitor safety-critical functions from different sources, varied in autonomy and sophistication levels. Prioritization and presentation of this real-time safety information will be vital, in many ways more complex than traditional air traffic control and airport operation managers' skill sets.
Safety in the Urban Environment	Establishing the parameters for integrated system-wide safety includes identifying concerns and potential risks relating to air traffic characteristics and density for the safe and efficient transport of cargo and passengers along this route, and using these airports, especially if the frequency of flights increases. Several factors need further research regarding the effect of AAM off-nominal occurrences on road Safety around urban areas (propulsion failures and forced landings into adjacent fields, land, or the highway itself). These roads support heavy traffic, high speeds, and frequent truck movements, with an existing risk of accidents and collisions; safety considerations introducing low altitude enroute air traffic need to be investigated and understood.
Urban Weather	Sometimes called micro-climates, the low-level urban weather phenomena will be a critical element to incorporate into the system-wide safety system of the AAM Vertiport. Weather conditions have been found to have a direct impact on passengers' willingness to fly in AAM and the community of acceptance of AAM in general.
Transport of Dangerous Goods	In addition to the development and introduction of the AAM air network, and road infrastructure, the existing rail network along with the Highway 69 freight corridor means an increase in the transporting of hazardous materials. The AAM aircraft are often powered by lithium Ion, Hydrogen, or other volatile power sources that are challenging for fire departments to control. Research into and the establishment of safety methods, protocols, and procedures for all conceivable occurrences needs to be investigated, understood, and implemented into the system-wide safety management system. This research would establish the processes and protections for leaks, containment, and cleanup. Not only an enroute consideration, but the storage, containment, and handling of dangerous goods (including the AAM power sources and charging stations at vertiports) also needs to be incorporated into the Integrated Vertiport Safety Management System (IVSMS).
Air Corridor Safety Regarding Wildlife	Bird strikes can be hazardous and sometimes fatal for aircraft occupants. The Department of Transportation, FAA report on bird strikes from 1990-2020 found that 71% occurred at or below 500 feet above ground level (AGL). Above 500 feet AGL, the number of strikes declined by 34 percent for each 1,000-foot gain in height for commercial transport aircraft and by 43 percent for smaller general aviation aircraft, which are more comparable to AAM aircraft. Further, bird strikes above 500 feet were more likely to cause damage than at or below 500 feet. Construction of the air routes may impact the animals residing in certain areas. Wildlife crossings and other mitigation strategies may be needed to address this issue.

Emergency Response	Emergency Response Plans (ERP) and drills are integral to an IVSMS. There needs to be further research and physical 'exercises' to understand how the proposed ARMC and AAM Vertiports will interface with local emergency services and established medical facilities. Local fire departments and first responders must be included in the research and development of these safety protocols and processes, with joint exercises required to integrate with the system-wide safety data of the IVSMS. Many of the communities will benefit from AAM aeromedical delivery and transport, reaching remote or sparsely populated areas. Despite these many benefits, there may be accidents or emergencies involving the aircraft itself; therefore, a network of emergency landing sites and strategic response sites needs to be established and integrated into the IVSMS.

3. Expected Customer Experience

Information about AAM regarding scheduling and ticketing a flight, arrival at a vertiport, passenger and baggage screening, flights boarding, and flight and postflight experience. This information should include procedures passengers should expect to encounter prior to boarding; assistance available for passengers (either on board the aircraft or on the ground); how passengers communicate problems in the cabin; expected levels of comfort in terms of vibration, transition phases (in/out of hover), cabin noise, heat ventilation and air conditioning air quality; how stowage of cargo is achieved including essential items such as wheelchairs; and divisions of responsibility between vertiport and operations personnel. Any comments specific to cargo or other types of AAM operations are also welcome.	
Use Cases	**Description**
Noise	Aircraft noise is generally not considered an aviation safety factor; however, community acceptance of AAM noise will contribute to the design of departure and arrival routes into AAM vertiports. As a result, these routes directly affect AAM vertiports' operational performance and safety parameters. Given the importance of community acceptance of AAM vertiports, it is imperative to gather data on potential acceptance and likely noise levels along the AAM corridor and vertiport sites prior to the physical development of the infrastructure. The FAA uses metrics to determine acceptable decibel levels. However, these may not be appropriate for applying limitations on AAM Vertiports as they don't accurately capture the delta between ambient and introduced noise.
Departures & Arrivals	It is possible to have a general perspective of the requirements and recommendations to be established when analyzing the items associated with infrastructure planning as fundamental for its satisfactory operation and delivery of expected value, i.e.: (1) passenger facilities such as toilets and food services, (2) check-in services and vertiport ticketing, (3) passenger lounges, handling, and meet & greet services, (4) assistance for passengers with reduced mobility, (5) departure and arrival support, (6) lost and found facilities, (7) baggage screening, identification, delivery, and transportation, (8) VTOL administration/management services including transfers & disruptions, (9) aircraft interior and exterior cleaning, (10) visa services, trade & corporate services, (11) aircraft guarding, (12) cargo – handling, storage, screening, and physical examination structure, (13) passenger and employees screening and control, (14) aircraft security sweeps and security patrols, (15) anti- sabotage, anti-terrorism, and cybersecurity checks, (16) catering services (vending machines, etc.), (17) security supervision of catering facilities, preparation, and transportation and (18) waste disposal and sanitizing procedures. Some of the main topics related to both main focuses of assessment presented in the previous paragraph will be discussed below. The first topic addressed in detail here is the physical design of the vertiport. Regarding this, criteria must be established that aim to ensure an adequate interface with the passenger in terms of quality, security, safety, among others. In this context, it is considered that a vertiport should be designed as a ground infrastructure that includes a segregated pick-up/drop-off area and the passenger terminal/control room.

ADA Compliance	In the context of inclusion and accessibility, it is highlighted that the AAM has the potential to transform urban mobility for people with disabilities. This is because, among other factors, this new ecosystem brings an opportunity to ensure a positive customer experience for passengers with physical, developmental, and sensory challenges. Therefore, it is highlighted that to realize this potential some key design considerations must be included, such as the provision of (1) accessible main entrances to vertiports and other related AAM infrastructures (e.g., ramps and automatic doors at main entrances to avoid backdoor alternative routes), (2) toilets that can accommodate not only a wheelchair, but also space for that person to move around, particularly if they travel with a companion, and (3) technologies and other accommodations for people with reduced mobility, visual and/or hearing impairments, supporting ease of wayfinding and movement between ground transportation stations and vertiports or between a vertiport land and airside.
Management of Resources	Regarding the tool used for such management, a set of design criteria associated with these infrastructures must be established to guarantee that the vertiport is designed to have a standardized data system that can provide a complete picture of the operating area and the terminal facility as well as the current and future vertiport status to all aircraft operators and infrastructure in the region. The implemented data system must be developed with a user-centric approach and serve as a stakeholder manager providing an interface for aircraft operators and other main infrastructure involved parties (e.g., public agencies, transit operators, etc.) to exchange information including, for example, booking vertiport resources. To enable compliance with established procedures and guarantee passengers the quality of services provided and the reliability of information, the roles, and responsibilities for vertiport's airside operations may be allocated to, or shared between, the staff of the vertiport operator and the aircraft operator. Therefore, the standardized data system must provide a single source of truth regarding, for example, task lists and their statuses. The features must cover (at least) the ability to assign, manage, and monitor these tasks remotely for a network of vertiports from a centralized operations center. Moreover, it must be established that the vertiport operator must provide information interfaces showing all arrival/departure reservations at each vertiport in the network and allow fleet operators to reserve resources at their desired vertiport. It must be enabled that the reservations can be updated until the time of flight, including a manifest of passenger information (e.g., identities, weight, anticipated luggage, and any special accommodations or mobility needs). Finally, the vertiport operator should use this information for security, aircraft loading purposes, and to determine other resource blocking (e.g., need for a wheelchair).
User Experience	The following processes are considered critical when we think about infrastructure: flight scheduling, situational awareness, and information exchange. Therefore, a vertiport must be designed to also have a standardized data system that can manage and monitor the passenger journey in coordination with the fleet operator's or any other third-party passenger management systems. Requirements associated with the minimum procedures passengers should expect to encounter prior to boarding have to be created including services related to (1) passenger check-in, (2) passengers and luggage weighing, (3) safety/security screening and (4) general passenger information. The vertiport operational model must include ground handling services supporting all procedures involving measurement, screening, identification, transfer and, possibly, storage. A complete ground operations set-up shall be created including the services necessary to enable passenger safe and expected experience (e.g., fast operation and comfort), such as, but not limited to (1) baggage and/or cargo handling, (2) safety and security, (3) loading/unloading, (4) passenger movement control, (5) aircraft movement control, (6) marshaling, (7) parking, (8) cabin cooling/heating, (9) ramp to flight-deck communications, (10) catering ramp services and (11) cabin material storage. Requirements must be created to assure that the procedures cover the complete passenger journey through

	the terminal, including security and check-in processes, biometric technologies, passenger dwell time, and aircraft boarding. Therefore, to enable this scenario, a vertiport shall be equipped with the necessary infrastructure for all screening processes for passengers and luggage, check-in stations, as well as firefighting systems and equipment. As already mentioned above, the information exchange is one of the critical processes related to this topic (i.e., expected customer experience).
Open Communications & Reporting	Requirements related to the design of a mandatory Fleet Operations Center that must maintain open communication channels with the aircraft's passengers and monitor passenger well-being and activities throughout the flight must be created (e.g., requirements about standardized communication equipment and procedures). Moreover, the aircraft design should include as requirement the establishment of – (1) an autonomous, (2) a remotely piloted and (3) a manual and live oriented to be executed by the passengers already pre-instructed – disaster recovery processes in the event of a physical or cyber security incident. In this context, a passenger-centered data communications (DataComm) with a simplified user-interface should be developed, however, keeping similar information capabilities (e.g., transmission and electronic display of flight plans, clearances, instructions, advisories, flight crew requests, reports, and other messages) and requirements of current DataComm systems which allows controllers and pilots to transmit a variety of messages with the touch of a button. Thinking about the procedure for reporting incidents, it should be noted that it is known that the Aviation Safety Reporting System (ASRS) already exists as a nonpunitive incident disclosure system that generates significant data that can be disaggregated and analyzed to identify trends. However, it is noteworthy the ASRS must be reviewed to ensure adequate and accurate accommodation of AAM-related reports, and subsequently disaggregate the data with enough accuracy to be a useful policy tool.
Passenger Comfort	When flying, the user has expectations related to levels of comfort in terms of vibration, transition phases (in/out of hover), cabin noise, heat ventilation and air conditioning air quality. In this regard, the maximum accepted levels required in current commercial operations of rotary wing aircraft can be (in general) maintained as initial acceptance criteria during new AAM certification programs and while volume of operations is low. However, requirements related to the scalability of AAM operations and flights under specific conditions must be established. Thus, public surveys about the acceptable level must be conducted with the aim of establishing a new set of requirements and increasing the acceptance/satisfaction rate of users. Specifically on noise considerations, it is highlighted that there are two aspects related to noise impacts to be considered in AAM: (1) cabin internal noise of operated equipment and (2) external noise emissions and community impacts due to operation. Regarding internal noise, to take advantage of existing heliports, provisions must be made to comply with local ordinances on noise levels and procedures for noise abatement, thus, the manufacturers should focus on minimizing the air vehicle source noise (compared to current rotorcraft) to comply with the various noise ordinances that restrict helicopter operations today. Moreover, public surveys about the acceptable level should be conducted with the aim of establishing new requirements and increasing the acceptance/satisfaction rate of users. Regarding external noise, the main constraints are linked to community impact around the vertiport and adopted route, in addition to legal aspects of each city in which the operation will take place. Three factors should be considered: (a) vertiport location, (b) local noise emission limits and (c) route and procedures. When analyzing the set of operations that make up AAM, comments related to cargo operations specifically can still be made. Regarding ground infrastructure, (i.e., vertiports), design criteria must be established including the ability to accommodate autonomous operations and an overall efficient, lean setup enabling high throughput of cargo goods and ground accessibility for further distribution.

Journey Profile	The operational environment and the journey profile, it is known that AAM cargo operations would be autonomous right from the start in rural areas. Therefore, goods need to go the shortest way possible from the flight deck to the ground level, where the transfer to ground-based transport occurs. Moving now to the detailed definition of the topics connected to the second focus of assessment presented in the first paragraph (i.e., passenger journey), it is possible to make an evaluation divided into four phases: (1) scheduling & ticketing a flight, (2) arrival at a vertiport, (3) passenger & baggage screening and (4) flights boarding, and flight and postflight experience. AAM scheduled flight service will make extensive use of automatic ticketing devices. Traditional ticket counters must be used mostly for passengers with baggage or for pre-ticketed passengers who need boarding passes. An automated scheduling solution is necessary to support airside operations. Once a passenger requests a booking, a flight slot must automatically be secured at both departure and destination, ensuring the aircraft is operationally ready and waiting when the passenger arrives. It will also ensure that all the resources needed to support that flight are in place to ensure an on-time departure. The booking process shall be possible through the fleet operator and/or a demand aggregator. The system must enable collection of critical passenger data for future sharing with the vertiport operator to validate passenger identities during the vertiport check-in process and support weight-and-balance calculations. The required information must include at least a valid passenger ID and biometric information such as weight, height, and a photograph of the passenger's face. Furthermore, the booking process needs to contain all the information about luggage rules and responsibilities (i.e., size, dimensions, weight, restricted items).
Operational Transparency	About the minimum information to be provided, it must be defined as a criterion that delays and cancellations should be notified in advance and through a platform or another easy access tool/visual board. In the same concept, next flights per route, quantity of seats available in the next vehicles and time to next flight might be accessible. Flight punctuality is also an important aspect to be considered as a characteristic of this operation so passengers can rely on and trust UAM services. Moreover, a clear definition of transportation conditions and applicable rules for pets is needed, in terms of allowed species, maximum size and cage specifications. A vertiport must provide arrival and departure points for the communities they serve and create a first and last impression of that location. Beyond that, a vertiport must provide an attractive, safe, efficient, comfortable, and familiar transfer of passengers to and from AAM aircraft and various modes of ground transportation. Therefore, basic service functions will be required, as well as thoughtfully designed facilities that will assist the passenger to and from air/ground transportation systems. In the case of big hubs (Vertihubs), complete and detailed information needs to be available and/or easy to access throughout the passenger's flow to allow them to find the boarding zone, be updated about process, documents etc. All procedures, journey information, next steps and time needed for the vehicle must be easily and clearly available. Proper signage, thoughtfully designed access roadways, adequate and convenient parking, safe drop-off and pick-up areas, lighting, walkways, and integrated security systems must all work together to facilitate the safe and orderly flow of passenger activity. In this context, a vertiport design must ensure a fast, efficient, and pleasurable journey through the building, as otherwise defeating the purpose of AAM. Vertiports should provide hold rooms including workspaces and recreational areas as part of the installations. Accordingly, it must provide a higher level of comfort and amenities, to streamline the passengers through security control and on to the gates on the flight deck.
Security Procedures	Because of high facility utilization in what is likely to be a confined space, vertiport operators will benefit from ensuring that any wayfinding signage within the passenger facility is familiar and easily recognizable to avoid passenger confusion and to enable the organized processing of various passenger groups. Thus, a vertiport must provide a seamless interface between ground and air transportation systems. Landside (where passengers enter and exit cars), and airside (where they enplane or deplane) can be separated only by a narrow facility that presumably queues them for departure.

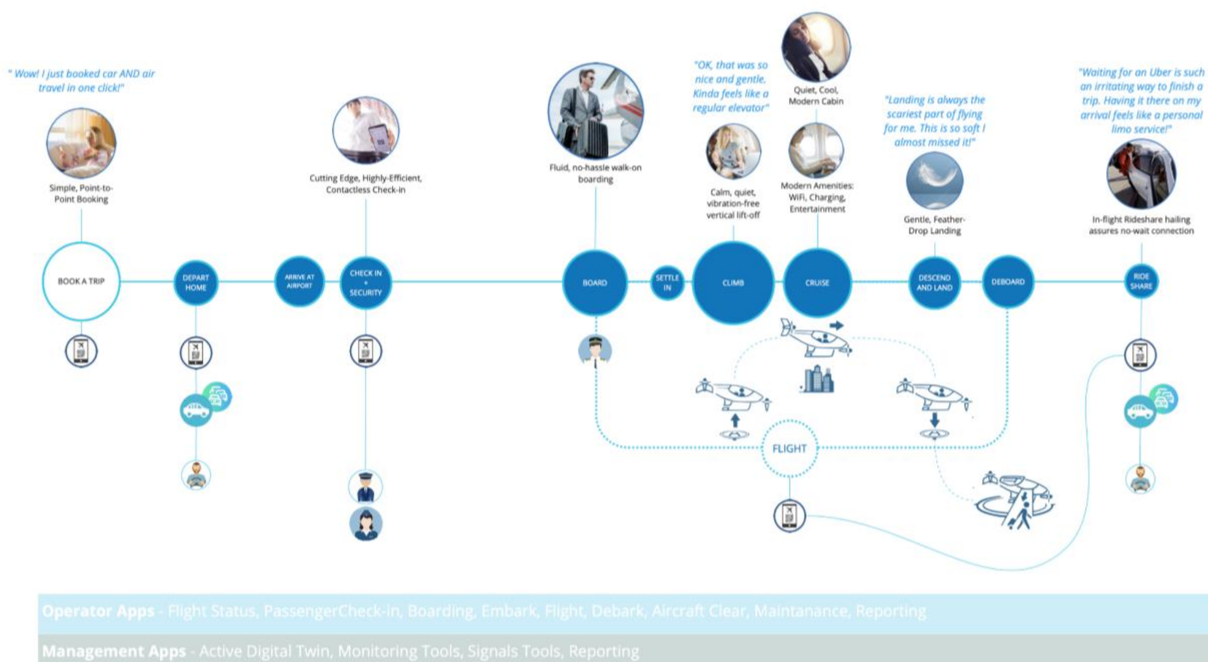
Passenger Validation	Vertiports must remain like traditional airports in that passengers need to proceed through check-in and security procedures at both take-off and landing areas. Additionally, having boarding/disembarking 'Gates' as well as retail and waiting areas. It is recommended that security screening facilities be required at each vertiport. It will be much easier from a scheduling point of view to establish security screening at every vertiport even if only some passengers are deplaning into sterile areas at some destinations. Facilities and operational procedures that effectively segregate crews from passengers will be imperative. Solutions such as CrewID® can be an efficient way to validate the identity, training level, and qualifications of personnel. This type of solution also can act as an access credential and can incorporate radiofrequency, machine-readable optical labels (QR codes) or magnetic-stripe components. With the introduction of new technologies and ongoing process improvements, it will be easier to predict the time spent by passengers at the airport.
Check-in Process	Passengers will also be able to plan their airport experience more effectively and even minimize the duration of their stay. But this change could also harm commercial activities and revenues from hospitality and retail. More intelligent approaches will be necessary for both retail and food and beverage (F&B) concepts. Vertiports may be able to entice passengers with smart to-go or "delivery to gate" concepts for F&B. Retail spaces could be designed as interactive experiential marketing venues, which would need less space for in-store displays, as well as storage and equipment. AAM operators could partner with vertiports on new mobile device solutions, allowing customers to order food, beverages, and other items on the way to the vertiport. They would then have those items available for pickup at the gate prior to boarding. 'CHECK-IN ON AAM BOARDING ZONE' is an essential journey phase where passengers will go through a safety inspection to enter the AAM Boarding Zone. Also, this phase comprises every step necessary to get the person ready to fly, such as checking-in, checked luggage weighing and receiving the safety instructions. Automated mobile applications will allow passengers to complete most of the check-in process before they reach the airport. On arrival, they will deposit their bags into automatic bag drops. Additional solutions, such as off-airport check-ins through partnerships with courier services or other specialist providers, are also conceivable. Integrating service providers who handle luggage will make it easier to plan and govern the capacity of baggage handling systems, which would simultaneously reduce the required floor area for technical equipment. Vertiports can reimagine the experience of passing through security as a simple walk-through process leveraging advanced, automated scanners and risk-assessment tools. Moreover, passengers must be able to book and reserve flights on eVTOL aircraft via a mobile app powered by biometric capabilities. Upon arrival at the vertiport, face pods must be used to identify and verify passengers. Security screening must be required for all passengers (i.e., by at least a metal detector and a face scanner). This screening shall occur before passengers enter gate hold rooms and would ensure that no visitors would be permitted into secure areas.
AAM Subscribers	Passengers may be well known (e.g., as long-term subscribers or frequent users of a service) or completely unknown. If an AAM provider seeks to accommodate both subscribers and "ad hoc" users, different security protocols may be appropriate, each of which could require differentiated passenger facilitation protocols at the vertiport. About security checks, new technologies such as CT scanners will allow more passengers to move through individual security checkpoints. But the specific devices, design and processes at these touchpoints also need to be well-integrated. By coupling standardized processes with highly trained and motivated personnel, airports will be in a good position to handle growing passenger streams. Widely used automated and biometric screening procedures at national borders have already accelerated the border control process and improved the passenger experience. Reconsidering aspects of the air-to-ground transition can make data collection even more efficient. For example,

	immigration formalities, such as filling out visa applications on arrival, can be offered as an in-flight service with the support of a personalized inflight entertainment (IFE) system to collect biometric data and transmit it to authorities at the final destination. Furthermore, like border control stations, automated checks could also be installed at boarding gates, resulting in more compact waiting areas and shorter lines. When planning these areas, vertiport planners could shift their focus to interaction and experience, which could very well contribute to a positive passenger journey.
Processing Efficiency	Faster processing at border control stations will make it necessary to create larger baggage pickup areas and put more pressure on ground handling agents to deliver baggage to the belt even faster. Time gained earlier in the journey through efficient digital solutions could quickly be lost here for passengers due to increased waiting times for baggage. It is known that no more than 30 percent of the total passengers are expected to use baggage services because individuals will only be able to carry hand luggage on board the eVTOLs. However, full baggage services must be required to expedite those that do. Passengers must be able to check in baggage and retrieve baggage at a bag claim area with a similar baggage rack. Additional services or solutions are needed to support luggage transportation. Smart collaborations with baggage delivery services can be one approach that makes long minutes spent at the baggage carousel a thing of the past. An idea to transport oversize/overweight luggage is shipping to the destination, integrated into the operator or airline process. Regular luggage can be shipped likewise (e.g., luggage transport in another vehicle) or by reserving an additional seat to accommodate it. NOTE: Existing security programs such as the Twelve-Five Standard Security Program (TFSSP) and the Private Charter Standard Security Program (PCSSP) are examples of tailoring a level of security screening and control to the perceived risk. The TFSSP requires operators to perform fingerprint-based criminal history records checks on crew members and to restrict access to the flight deck.
Seamless Experience	Under the current regulations, the Twelve-Five Standard Security Program (TFSSP) would apply if the aircraft used exceeds 12,500 pounds at Maximum Takeoff Weight (MTOW). Given the limited range, aircraft weight, and small payloads anticipated in AAM aircraft, the security risk is reduced. There is no mandatory security program required for aircraft below the TFSSP threshold. The PCSSP adds requirements for passenger and baggage screening using x-ray and metal detectors. In the case of those programs, aircraft maximum gross weight and seating capacity is the discriminator. Enhanced security requirements are in place for these aircraft in terms of passenger vetting, screening, and notification of the nature of the operations. Because the AAM value proposition depends on a seamless experience that saves the commuter time, any security regime must be tailored to minimize pre-boarding hassle. A simple automatic door and marked pathway may not be sufficient to ensure passenger compliance when they are on the ramp. It is necessary to discuss the suitability of existing signage, marking, and lighting conventions. Vertiports possibly need a new marking and lighting convention that is of hybrid use for both ground personnel and landing and departing aircraft. Ensuring effective communication with passengers in an elevated noise environment and, furthermore, ensuring passenger compliance with ground and aircrew instructions are challenges not likely to be solved by access control and visual indicators alone. If passengers are to move about the vertiport surface while aircraft are operating, vertiport operators must consider either intuitive visual or augmented audio communications to convey their instructions. During boarding and disembarking, hardstands must be adequately staffed to ensure passengers do not deviate from designated areas and unique visuals including color-coded footprints painted on the ramp, properly grouped passengers moving from the aircraft to the ramp and on to the transport only.

Multi-modal Integration	The team involved in the operation should guarantee all customers will be comfortable with the experience. Clear procedures and briefing, easy flow, and experienced employees to support the customers during departure and landing process. They are responsible for providing a clear, friendly, and reliable boarding briefing. In this sense, the ground services team must be confident, experienced, and accessible, to support passengers with all information requested and through ground processes. A vertiport could potentially "turn" more aircraft in a single hour than many airports handle in a single day corresponding to a higher number of transient people – both crew and passengers – in the facility what demands proper staffing modeling and application to ensure both: crowd control and quality customer service. Therefore, vertiports must have staff performing both safety critical functions on the ramp and customer service duties, opposite of airports with dedicated customer service and concierge staff whose sole responsibility is to ensure a positive customer experience. Moreover, personnel are expected to include passenger service staff, ground crew and vehicle cleaning team. Landside personnel responsibilities include security, luggage management, and other passenger facing functions besides vertiport facility management. Airside's responsibilities include boarding assistance, pre-flight checklists, and general FATO and gate management. The last passenger journey phase will be to follow signs and instructions to disembark, collect luggage or personal belongings and exit the vertiport connecting with the next transportation mode - here the team must also always help them. Finally, for an end-to-end journey, it must be kept in mind that other transportation modes and networks need to be connected. Therefore, eVTOL information (route, time, availability, price, and connections) must be connected with other transport modes and platforms. Moreover, information about connections with other transport modes in apps and vertiports must be provided and a physical connection viable with other transport mode vehicles and networks must be built.
Passenger Journey	Advanced air mobility will offer a unique and innovative travel experience. This document will describe some of the exciting and unique opportunities for a revolutionary travel experience. • **Management Services**: Active Digital Twin of facilities and aircrafts with real-time visualization of current operations and aircraft sensors. • **Crew Operator Services**: Check-in services, rebooking, exception management • **Booking Process**: Booking will be a seamless and well-understood customer experience. A single mobile/web app will allow the customer to book a point- to- point, round- trip journey with partners such as rideshare vendors and air transport in a single transaction. • **Arrival and Check-in**: Upon arriving at the vertiport, passengers will enter a modern terminal specifically designed for autonomous air travel. They will be greeted by friendly staff who will guide them through the check-in process. This may involve verifying identification, flight confirmation, and safety regulations. • **Pre-flight Preparation**: After check-in, customers will proceed to a pre-flight area where they will receive a brief orientation about the autonomous flying vehicle and its features. • **Boarding Process**: Once the autonomous flying vehicle is ready for boarding, customers will be directed to the boarding area. Depending on the design of the vertiport, they may walk directly onto the boarding platform or take an elevator to reach the appropriate level. The boarding process will be organized and efficient, ensuring passengers embark the vehicle safely and quickly. • **In-flight Experience**: As the autonomous flying vehicle takes off, customers will experience a smooth, quiet, vibration-free vertical lift-off. The interior of the vehicle will be comfortable and well-designed, with spacious seating arrangements and large windows to provide panoramic views. Passengers will have access to onboard amenities such as Wi-Fi and entertainment systems.

- **Vertical Liftoff & Climb Phase**: The initial phase of the VTOL flight experience will differ greatly from a standard aviation experience. A VTOL flight will start with a smooth and short- duration vertical climb, allowing the vehicle to reach its relatively low cruising altitude (3,000ft).
- **Cruise Phase**: The Cruise phase of the journey will comprise about 95% of the overall experience. The cabin is extremely quiet and comfortable. A key difference from standard aviation travel might be that there are no meals or restrooms. A typical flight duration might be 10m - 20m. More like an Uber in the sky than a flying city.
- **Communication and Safety**: Throughout the flight, passengers will be kept informed about the journey, including the estimated arrival time and any necessary updates. Safety instructions and emergency procedures will be clearly communicated, and passengers will be reassured of the advanced safety measures implemented in autonomous flying vehicles, such as redundant systems and real-time monitoring.
- **Descent / Landing Phase**: Upon approaching the destination vertiport, customers will experience a remarkably smooth and brief vertical descent. The landing phase will be quiet, and gentle. The white-knuckle ground contact of standard aviation is completely absent, instead the eVTOL landing experience is a gentle, silky touchdown that is a refreshing and unobtrusive moment in the journey.
- **Disembarkation and Ground Facilities**: Upon reaching the destination vertiport, customers will smoothly land and come to a stop. The disembarkation process will be organized, ensuring passengers exit the vehicle in an orderly manner. Ground staff will be available to assist passengers if needed, providing guidance on navigating the vertiport facilities or connecting to ground transportation.
- **Post-flight Services**: Vertiports may offer various post-flight services to enhance the overall customer experience. This could include customer service desks for inquiries or assistance, or arrangements for ground transportation to the passengers' final destination.

Overall, the customer experience at a vertiport embarking on an autonomous flying vehicle will aim to be efficient, comfortable, safe, and secure. The focus will be on providing a seamless transition from making a reservation, arrival to departure, incorporating advanced technology, and ensuring passenger safety and comfort throughout the journey.



4. Research, Development, and Testing Environment

Information about the current status, accessibility, and adequacy of policies and institutions to promote research and development that enable a world-class AAM industry in the United States. Please comment on the adequacy and suitability of existing, congressionally directed test sites. The AAM IWG is also interested in the processes for enabling testing of these technologies and systems, and suggested expansions or improvements of testing locations, platforms, or other suggestions to better enable testing of emerging aviation technologies and highly automated systems. As part of the comprehensive testing options, the AAM IWG is interested in understanding simulation, demonstrations, and validation capabilities that must be available to conduct demonstration and validation activities to accelerate maturity.

Use Cases	Description
Weather Data	To produce sufficiently dense and reliable weather data to feed highly automated AAM systems to maximize safe, high density vehicle throughput at vertiports and in high occupancy corridors, world-class AAM weather infrastructure is required. To fully leverage the ASTM F38 performance-based weather standard to cost effectively meet the data need, investment is required in advanced weather infrastructure at test locations to support the FAA Operational Improvement initiatives to qualify Weather Information Providers and performance-based weather standards. There is also a need to test and validate various P3 weather infrastructure funding models to allow state, municipal, tribal, and private sector entities to determine the best business models for deploying and sustaining advanced weather technology infrastructure and systems. If the Nation can successfully test and demonstrate next generation aviation weather infrastructure and services and identify P3 funding models that can execute the plan, weather data will no longer be the weakest link in the AAM system chain. The research can enable determination of the best business model, or blend of models to drive AAM growth, and economic viability in an equable way, while ensuring the public interest is met.
Public – Private Partnerships	The current Research, Development & Testing (RD&T) environments for AAM in the US are primarily focused on operations in fairly low-risk, low-reward environments in wide open exurban or rural areas that make it easier for AAM operations to deconflict with crewed aviation. These environments usually have a lower density of operations, less complex airspace and flatter, unobstructed terrain that do not necessarily reflect a significant proportion of commercial use cases for the AAM industry. Additionally, a large portion of the RD&T at the current test sites is being conducted by academic institutions and branches of the Federal Government, which inherently institute a lower priority on practical, commercial adoption of technology as opposed to continued research to find optimal solutions. This disconnect from the commercial use cases for AAM in the National RD&T strategy is a key contributing factor to why the United States currently lags other nations in the AAM space. We recommend the FAA and Congress consider a true public-private partnership (PPP) and make a significant investment in the development of a true urban/suburban test bed in a small to mid-sized city that is representative of the use case likely to see the highest rates of adoption of commercial AAM operations in the foreseeable future. The lessons learned from such a test bed could then reliably inform critical industry-enabling pillars such as Federal rulemaking, standards adoption, and infrastructure development. This test bed will serve as a blueprint to scale AAM in similar sized as well as larger cities in the United States and supercharge the growth of the domestic AAM industry. Winston-Salem, NC presents such an opportunity. AeroX, a non-profit based in Winston-Salem was provided an initial $5M grant by the North Carolina General Assembly in 2021 to build the first-of-its-kind urban AAM testbed in the United States. This testbed, project ATLAS (Air Traffic Low Altitude Surveillance) represents a unique opportunity for the Federal Government to evaluate urban AAM operations in the United States and to take advantage of work already underway in Winston-Salem without enduring years of delays in establishing an urban test site from scratch.

Research Methodology	Considerations for research, development, and testing environments in advanced air mobility are crucial to ensure the successful integration of these technologies into our transportation systems. It is essential to establish repeatable and verifiable processes that allow for consistent results and enable the identification and resolution of potential safety issues. This involves creating standardized protocols, test scenarios, and data collection methods that can be replicated across different experiments and organizations, promoting transparency, and fostering trust in the findings. Modeling and simulation tools should complement these experiments and validate the findings. Due to the complex nature of AAM systems, ethical oversight is another critical research and development, as advanced air mobility technologies have the potential to impact various stakeholders, including passengers, communities, and the environment. The development and testing processes should adhere to rigorous ethical guidelines to protect the safety, privacy, and well-being of the individuals involved. Some examples of immediate research agenda items include noise pollution, airspace management, and emissions. These research areas, among many others, may drive specific modeling and simulation scenarios that provide global empirical data. Research and development protocols will also require a deliberate method for assessing AAM technologies. Establishing a widely scalable methodology for exploring advanced air mobility research is paramount for the industry's progress. A standardized framework that can be quickly adopted and implemented by different stakeholders, such as researchers, manufacturers, and regulatory bodies, may accelerate the time between research findings and development. The methodology should encourage collaboration, knowledge sharing, and continuous improvement, enabling the industry to collectively learn from each other's experiences and drive advancements cohesively. A practical suggestion involves a global forum for AAM tests, one in which stakeholders share evidence from tests and maintain a common repository of information. By openly sharing data, test results, and lessons learned, stakeholders can collectively analyze the findings, identify areas for improvement, and avoid duplicating efforts. This approach parallels the evolution of aircraft testing in the United States during the 20th century, where a culture of collaboration and shared knowledge was instrumental in developing and improving aviation technologies.
Testing Budget	Drawing parallels to the earliest stages of aviation worldwide highlights the significance of managing research, development, and testing costs. While ambitious goals and innovation are necessary, balancing cost-effective solutions and substantial progress is also important. Implementing efficient project management strategies, leveraging technological advancements, and fostering collaboration between industry, academia, and government entities can help optimize resource allocation and mitigate excessive costs. In conclusion, the United States must invest in advanced air mobility research, development, and testing to lead the global race in this transformative field. By prioritizing repeatable and verifiable processes, ethical oversight, climate protection, scalable methodologies, evidence sharing, and cost management, the U.S. can position itself as a hub of innovation and establish a sustainable framework for safely integrating advanced air mobility into our transportation ecosystem. This investment will pave the way for safer, greener, and more efficient transportation options, benefiting both the nation and the world.

5. Statutory and Regulatory Scheme

Information about specific statutes, federal regulations, or other legal authorities that could be created or updated to support AAM in the United States and maintain the regulatory agility necessary to safely enable this new form of transportation.

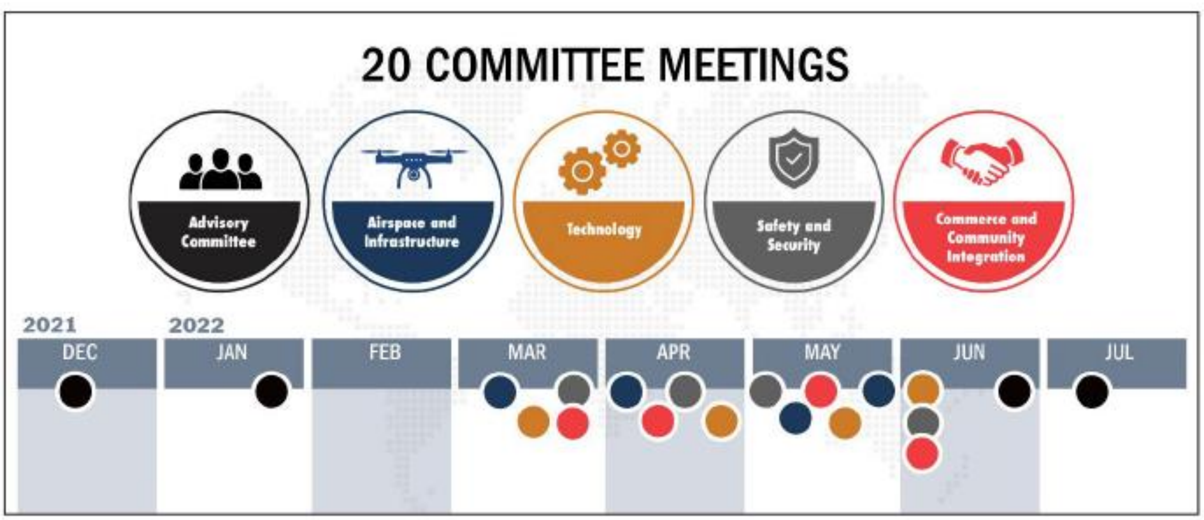
Use Cases	Description
Overview	In creating and amending statutes, regulations, and other authorities to safely enable this new form of transportation, AAM must be recognized, not as a new technology, but as a new transportation ecosystem. The success of this nascent AAM industry will hinge upon its ability to be a supplement to, not a replacement for, current methods of transportation. Therefore, we expect the need for changes in laws and regulations well after the commencement of initial AAM operations to accommodate the growth of the industry, address new use cases, and maximize AAM's benefit to society.
Required Regulations & Policies for Weather	There are two significant constraints on the aviation weather system today that require statutory and regulatory changes to support scaling a safe, reliable, and profitable AAM and enable this new form of transportation. 1) Aviation weather policies and rules developed in the middle of the 20th century and 2) the dependence on government aviation services as virtually the only "approved" sources of weather for aviation flight control decisions. ASTM F38 has been working closely with the Federal Aviation Administration and NASA to draft a new Standard of Performance for Weather Information Reports and Data Interfaces, and Weather Information Providers (WIP). This standard will accelerate the closing of significant low altitude weather measurement gaps with advanced weather measurement technologies. Today, approximately 30% of general aviation and helicopter flights that are cancelled or delayed due to real or perceived weather impacts, could have flown, but did not due to weather uncertainty. Higher density weather measurements will reduce that uncertainty, and the risk of accidents, while improving the reliability and profitability of the AAM industry. To effectively scale cost-effective advanced measurement technologies will require a transition to a performance-based weather data standard. Investments in research, to test methods and means of compliance for meeting the standard is required to inform FAA development of an advisory circular authorizing the use of vetted and qualified 3rd party weather data and services.
Social Benefit	While it is anticipated that early AAM operations will involve premium air taxi service from city centers to airports, federal, state, and local governments must fully embrace the potential of AAM as a mode of transportation that will benefit all members of society, improve quality of life, and create new opportunities in the aviation profession for a larger and more diverse portion of the population. To safely enable this new form of transportation, after certification, we recommend the launch of an integration pilot program for AAM similar to that of the UAS IPP for the integration of AAM into socially beneficial use cases/environments. This would allow for AAM to be tested and analyzed in these different cases/environments, promote public awareness of AAM benefits, and address concerns regarding safety, security, and noise.
Diversity, Equity, & Inclusion Efforts	Further, given existing piloting shortages and the lack of diversity plaguing the aviation industry workforce, AAM must open roles to a larger and more diverse portion of the population to succeed. In fact, it is believed that the nature of AAM technology and operations presents a unique opportunity to expand and diversify the piloting workforce. However, to do so, certain statutes and regulations must be created or changed to safely remove barriers to entry into the profession. Where possible, regulators must embrace new technology to increase access to training opportunities. For instance, 14 CFR 91.109 provides that "[n]o person may operate a civil aircraft (except a manned free balloon) that is being used for flight instruction unless that aircraft has fully functioning dual controls." Given that most eVTOLs are single controller aircraft, such a rule is likely to raise the cost of and limit access to pilot training. Accordingly, we encourage the FAA to thoroughly consider technological advancements in training and simulation that would expand opportunities in the industry without compromising and with perhaps improving safety.

Vocational Training	Moreover, the FAA must ensure that flight schools and technician schools begin to offer their students with a curriculum geared towards AAM and the future of aviation. Thus, to the extent needed, we recommend that the FAA consider changes to curriculum standards, such as those in 14 CFR 147.17, to account for the development of AAM. Last, we recommend that the FAA continue to invest in public outreach to encourage careers in STEM and in aviation. We believe that more programs such as the Women in Aviation Advisory Board established under the FAA Reauthorization Act of 2018 are necessary to address the increasing need for pilots, engineers, and mechanics in the industry.

6. Role of State, Local, Tribal, and Territorial Governments

Information about the role that state, local, tribal, and territorial governments should play in enabling AAM in the United States.	
Use Cases	**Description**
Overview	In creating and amending statutes, regulations, and other authorities to safely enable this new form of transportation, AAM must be recognized, not as a new technology, but as a new transportation ecosystem. The success of this nascent AAM industry will hinge upon its ability to be a supplement to, not a replacement for, current methods of transportation. Therefore, we expect the need for changes in laws and regulations well after the commencement of initial AAM operations to accommodate the growth of the industry, address new use cases, and maximize AAM's benefit to society. In collaboration with federal entities, all levels of government: state, local, tribal, and territorial (SLTT) should work to encourage the development of minimum standards/safety management systems for vertiport operations including passenger and goods movements and ground infrastructure. SLTTs should ensure that state laws do not conflict with federal regulations. The DOT for each state should review existing state aviation standards and guideline, airport facility planning, and compatibility guidance to ensure they apply to advanced air mobility. SLTT governments must make privacy a priority when adopting, encouraging, and regulating AAM technologies in their jurisdictions. Privacy will be the top concern as a barrier to public acceptance because this new technology is something that members of the public may have not been exposed to. SLTT governments will also need to develop training for law enforcement, firefighting, and EMS personnel on how to deal with this changing landscape. Electric aviation is a new concept and creates challenges when dealing with electrical fires. Law enforcement will be relied upon to not only respond to accidents but, as the adoption of the technology expands, will play a key role in vertiport security. Additionally, a large majority of public safety agencies utilize unmanned aircraft in daily operations and the addition to AAM technologies increases the need to airspace situational awareness and cooperation.
State Government	State governments should provide resources and assistance on the use of advanced air mobility technology infrastructure for cities, local and regional governments, transportation planning organizations, other entities, and industry to better identify what the different levels of government can do to integrate industry innovation and community vision and help promote advanced air mobility technology. States like Texas have already taken to the first steps to ensure both the safety and adoption of AAM technologies. The Texas state legislature mandated a committee be formed to assess current state law regarding UAM/AAM and provide suggestions for potential changes at the state level. This committee, made up of SLTT governments, the private sector and citizen advisors spent considerable time to come to a consensus and formalized AAM recommendations that were presented to the Texas state legislature in 2023.
Local / Municipal Government	AAM will affect the general public in many ways and will be regulated and enforced on the state or municipal level. The governing body of a municipality that owns an airport and has a grant agreement with FAA for the planning, design, and acquisition of land for a replacement airport is required to provide adequate soundproofing and noise reduction devices for each public building within the 65 DNL or higher average day-night sound-level

	contour. The municipality must also comply with the Aviation Safety and Noise Abatement Act of 1979 in federal code. Although this statute is limited to airports, there are potential implications in noise abatement for vertiports. Cities like Orlando, FL, and regional governments like San Diego Association of Governments (SANDAG) are already taking steps to understand the role that government should play in coordination with aviation authorities, transportation agencies, and private industry.
Primary Roles for Government	a) **Regulation**: Governments can establish regulations (ordinances/statutes) and standards for advanced air mobility facility requirements, operations, ensuring safety and compliance with federal laws. They can also work with industry stakeholders to develop best practices and guidelines for the operation of advanced air mobility vehicles. b) **Infrastructure**: Governments can invest in the infrastructure needed to support advanced air mobility, such as landing pads (vertipads/vertiports), charging stations (electric/hydrogen), and air traffic management systems. They can also work with private companies to identify suitable locations for these facilities. c) **Public Education**: Governments can educate the public about the benefits and risks of advanced air mobility, addressing concerns about noise pollution, safety, and privacy. They can also work with industry stakeholders to promote public acceptance of these technologies and promote social/economic benefits. d) **Funding**: Governments can provide funding for research and development of advanced air mobility technologies, as well as for the deployment of these technologies in public transportation systems. In summary, state, local, tribal, and territorial governments have a critical role to play in enabling advanced air mobility in the United States. By establishing regulations, investing in infrastructure, educating the public, and providing funding, they can help to ensure the safe and successful deployment of these technologies.



7. Anticipated Power Requirements

Information about the anticipated demand on power grids by AAM, the ability of municipal power grids to accommodate this anticipated demand, and improvements or investments in power infrastructure needed to enable such operations. This also includes information on how AAM could generally assist in achieving long-term energy sustainability and efficiency goals, such as using alternative forms of energy for propulsion (e.g., hydrogen), and the infrastructure requirements that would accompany these alternative power structures.

Use Cases	Description
Overview	A revolution in aviation is underway – spurred by the advent of novel technologies such as distributed electric propulsion and battery electric technologies, Advanced Air Mobility has the potential to be significantly disruptive. However, several major technical challenges exist which threaten to hinder the success of future AAM operations. These barriers have been explored in depth through a collaboration with NASA Langley Research Center, studying the Operational Limits of future AAM. In the context of power requirements, AAM will likely include several operational concepts including aircraft charging, and fuel production for aircraft consumption such as hydrogen generation and Sustainable Aviation Fuel (SAF). For AAM missions that require direct aircraft charging for fully electric or hybrid-electric vehicles, fast charging will be a major requirement. To handle a high volume of passenger and cargo operations at scale, especially in the context of On Demand Mobility (ODM), rapid charging will be required to quickly turn around aircraft, expected to be upwards of 400 kW. This presents a significant technical challenge to existing infrastructure, as current grid capacity is expected to be a major limitation to future operations. Thipphavong identified that existing grid distribution and transmission capacities will cause a significant reduction (20% in the best-case scenario) in Urban Air Mobility operations. This represents required grid investments on a national scale reaching the "trillions of dollars" to upgrade transmission and distribution infrastructure. Black and Veatch outlined possible grid upgrades to support charging infrastructure of eVTOL aircraft, which can range from service line extensions (1MW) to new substation and transformer installations (10MW+). Beyond high acquisition costs, direct operating costs of AAM from energy must be mitigated. Energy cost can be highly variable, especially in extreme conditions such as weather events, such as the Texas winter storm in 2021, where the price of energy increased by upwards of 1000%. Regulating energy price and ensuring that capacity is available for AAM fast charging will require onsite energy assets such as energy storage. When significant energy storage is placed at aviation sites, energy can be strategically purchased to minimize the average cost per unit energy. When coordinated with utilities and grid systems, remuneration is possible through demand response.
Emissions	AAM emissions are entirely dependent on the emissions of the fuels used to generate the electricity for operations. In the case of fully electric aircraft, if vehicles are charged directly from the grid, emissions will vary widely across the United States. Figure 1 highlights the breakdown of grid fuels across six metropolitan areas. Due to the heterogeneity of fuels used across metro areas, the emissions per unit energy vary widely across the United States. This has a profound impact on AAM emissions and can negate any of the sustainability opportunities of battery electric aircraft. Figure 2 shows the effect of the grid emissions on AAM sustainability on a per unit distance basis. In certain metro areas, where the grid emissions indexes are high, UAM contributes more emissions than diesel-powered semi-trucks to delivery packages for Middle Mile Delivery (MMD).
Energy Optimization	Aerovy Mobility is developing research and operational software tools to assess and implement energy solutions for AAM energy infrastructure. We believe that aviation infrastructure of the future will be combined mobility, energy, and data hubs. These possibilities include the implementation of onsite renewable energy generation solutions for co-located aircraft fast charging, hydrogen generation, and SAF production. To avoid significant disruptions to future AAM operations, a national scale distribution and transmission upgrade strategy is required for future aviation infrastructure. At scale, AAM charging, new fuel production, and ground electrification at airports will have a profound impact on energy infrastructure needs, beyond any increase in energy requirements the industry has ever seen. Coordination between the relevant entities for this cohesive national strategy of transportation, energy, and data is crucial to ensuring a safe and reliable AAM system.

Off-grid Power Generation Solution	Charging stations and related parts are the most important piece of the infrastructure puzzle to support eVTOL operations. While EVs (electric vehicles) have entered their second decade of commercial sales and operations they have charging needs unique to them. eVTOLs require a solution that meets their specific energy requirements. The primary differentiator is the required amperage. Due to the larger battery size and energy density of the batteries in an eVTOL they require a much higher amperage to charge. To sustain the proposed business models for regular commercial eVTOL operations high amperage charging stations will be required. Faster turnaround times, possibly as little as 5 to 7 minutes, will be needed to support the use cases proposed. Some preliminary number released by OEMs have stated requirements of 1000-2000 amps. These numbers are unsustainable with the current state of the electrical grid and will require off-grid power generation systems to work in tandem with new charging technology for eVTOLs. In addition to amperage, kilowatt hours (kw) are the second measure of how powerful a charging station is. Kw is the amount of electricity that can be delivered. The majority of EV charging stations charge between 1 and 50 kw. eVTOLs will require charging stations of at least 100 kw up to 1 megawatt (mw) or more. This amount of electricity, coupled with the high amperage will require a dedicated charging technology that will be able to deliver the required power. The Volatus Infrastructure charging station is designed to deliver up to 400 kw at 1000+ amps. The next generation charging station will be able to deliver up to 800 kw at over 2000 amps. This flexibility will be needed due to the large number of vehicles and their different charging needs. The unique charging requirements for eVTOL will require a tremendous amount of power from the electrical grid. The electrical grid is currently insufficient to provide the needed power. This will require a massive investment in off-grid power generation. A combination of solutions will be required to properly support and power the infrastructure.
Power Design Parameters	The burgeoning advanced air mobility industry represents an opportunity to restructure key power generating systems, energy storage, and distribution assets worldwide. To power modern vertiports and air transportation we will need a reimagined approach to build a wide area, fully integrated, sustainable, secure, and resilient infrastructure. For a good starting point, vertiport power requirements should mirror the size of today's airport. The Federal Aviation Administration defines airports by major categories. The four categories are: commercial service airports, cargo service airports, reliever service airports, and general aviation (GA) service airports. Passenger service airports are classified by their activity. For all intents and purposes of this report we'll focus on the general aviation airport as being the ideal model for AAM. According to the FAA "General Aviation Airports are public-use airports that do not have scheduled service or have less than 2,500 annual passenger boardings (49 USC 47102(8)). Approximately 88 percent of airports included in the NPIAS are general aviation". That is a great cross-section for vertiport energy and power design parameters. According to the Sonoma County Airport management team the average GA facility has approximately 10,000 square feet of usable, operational space. The bizenergyadvisor.com suggests that airports on average consume 19.7 kilowatt hours per square foot, per year. Adding electric vehicles would add to that energy demand profile. Bottom line is that the addition of just a few aircraft would shift the electricity demand from facility based to one more aircraft charging centric. Ideally, the future vertiport would be fully electrified net-zero facilities. A general aviation terminal designed around Leadership in Energy and Environmental Design (LEED) guidelines shows significant potential over a traditional GA operation, that is solely grid-tied. For example, Appleton International Airport (ATW) contracted for a LEED GA terminal design and "is projected to consume approximately 54,000 kilowatt hours (kWh) of electricity annually, which is less than one-third the energy consumption of a similarly sized, traditionally designed building. The terminal will produce the majority of its electricity on-site with a 25-kilowatt solar photovoltaic (PV) panel system". This is a notable example of what airport operators are already doing today. Vertiport operations will totally change that thinking.

Energy Storage	Microgrid concepts show promise and will allow for the integration of additional renewable energy sources, the addition of hydrogen fuel cell systems, and without a doubt long duration energy storage should be at the core of these hybrid systems. Specifically, dual carbon long duration, stationery, energy storage units. Energy storage will play a vital role in the future, why not make it happen now? We have mentioned the influx of renewables at airports and as many economies around the world charge toward the 30% integration (of renewable energies into the grid) mark energy storage will be critical to that single success. Dual carbon batteries are also less expensive, lighter in total weight, inherently safer than Li-ion/Li-ion-Ph, and if the graphite is strategically sourced will be key to decarbonization. Not to mention that brownfield developments already have the space and electrical substation assets to house them. So many attributes are converging at your local vertiport. The initial first few vertiports will need to leverage existing regional assets, underutilized communities, and brownfields. Starting from nothing, or clear cutting for greenfield projects just does not cut it – or need to be first and foremost. This will be huge for workforce development, the community at large and it is a great fit for the utility companies as well. For each vertiport we are looking at a grid-tied 5MWh microgrid with 10-15MWh energy storage, with renewable energy technologies integrated where best economically and locally suitable, perovskite solar panels could be key to the building retrofits, with water filtration and collection systems, and could easily be managed with AI. According to the United States Department of Transportation "there are approximately 5,100 public use airports in the nation that are accessed by general aviation aircraft, compared to approximately 500 that offer commercial airline service" (3). So, the anticipated power requirements would be 5,100 microgrids times 5MWh which equates to 2.5+GWh of electricity. Financially speaking, funding for the program would be a cost share between the municipality, the community, the utility, and the aviation community via an advance market commitment.

Table 1: Grid emissions indexes across United States metropolitan areas.

Metro Area (eGRID Region)	Emissions Index ($lbsCO_2$ / MWh)
New York City (NYCW)	816.8
San Francisco (CAMX)	531.70
Dallas (ERCT)	813.60
Denver (RMPA)	1158.90
Cleveland (RFCW)	1046.10
Orlando (FRCC)	832.90

Figure 1: Grid emissions are highly dependent on fuels used for energy production.

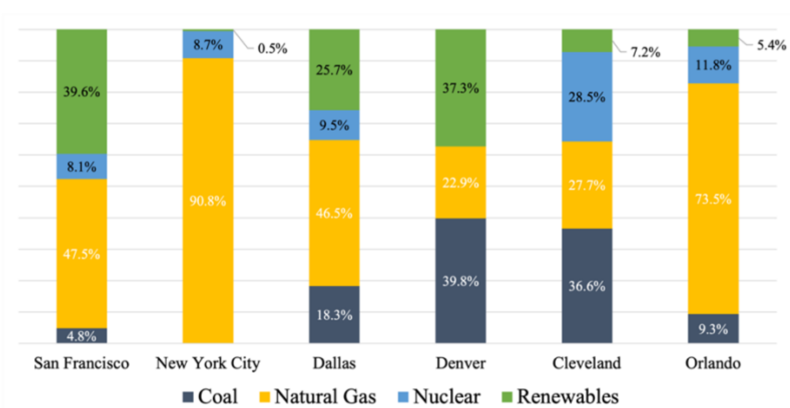
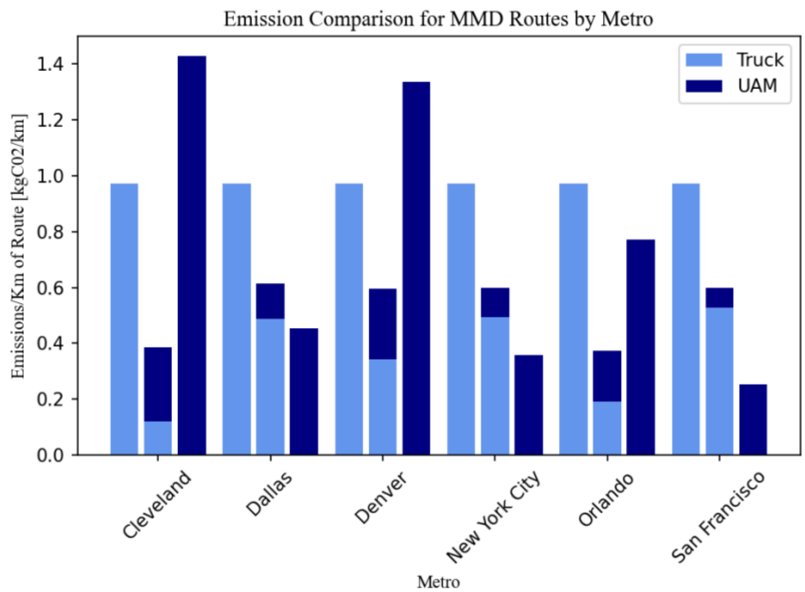


Figure 2: Cargo emissions for Middle Mile Delivery (MMD) operations utilizing electric aircraft, compared to trucks on a per unit distance basis.



8. Supply Chain

Information about existing or planned supply chain requirements for current AAM manufacture, including traceability of components and potential vulnerabilities in the event of possible international supply chain disruptions such as what occurred during the COVID pandemic. To ensure that the AAM industry at large will be supported in the entire life cycle without causing undue security risks and ensuring U.S. competitiveness, the original equipment manufacturers (OEMs) as well as suppliers, are encouraged to provide inputs related to the challenges and gaps they may experience in future AAM supply chains. This includes supply chain challenges related to the entire life cycle, from mining, materials, processing, manufacturing capabilities, and limited/few suppliers. In particular, dependencies on foreign entities that could cause security risks must be clearly understood.	
Use Cases	**Description**
Supply Chain Risk Management	In 2018, the Cybersecurity and Infrastructure Security Agency (CISA) established the Information and Communications Technology (ICT) Supply Chain Risk Management (SCRM) Task Force to improve supply chain resilience. The ICT SCRM Task Force includes Government agencies like the Federal Aviation Administration and Industry Partners to combat counterfeit parts and other supply chain security issues. While this is a good start, the British Journal of Criminology estimated in November 2022 that the number of counterfeit parts in the Aviation Industry supply chain could be as high as 10%. One way to ensure the safety and security of aircraft parts is for the FAA to require a criticality analysis of all ICT components before an aircraft and its subsystems receive a Type Certification (TC), or even a Supplemental Type Certification (STC). First, what is ICT? ICT components are also known as logic-bearing components. They perform and implement critical functions in in different types of systems. On an aircraft, these include avionics, communication and navigation systems, and engine control systems. Those who wish to cause harm or to exploit the technology can add malicious logic into any of these components which can range from information gathering to causing catastrophic damage.

Supply Chain Safeguards	Product teams and stakeholders can work together by conducting periodic criticality analysis of all ICT components which will be monitored and reviewed by the CISA ICT SCRM Task Force. This analysis includes traceability, ensuring proper SCRM measures are in place throughout the complete supply chain, and ensuring security measures account for inside threats across the supply chain. Once the analysis is complete, the product team will submit the final report to the CISA ICT SCRM Task Force for review and approval. The final step is for the FAA to require a completed and approved criticality analysis report for all requests for certification, approvals, and authorizations. This includes both initial certification and recertification due to minor and major alterations for the aircraft and/or subsystems that contain ICT. Incorporating this criticality analysis process will take some time to implement. However, it will improve the chances of safeguarding the supply chain from those who wish to cause harm.
Supply Chain Challenges	• **Battery Technology and Energy Supply**: The successful deployment of eVTOL aircraft heavily relies on advancements in battery technology. Batteries must be lightweight, efficient, and capable of providing sufficient power to support longer flight durations and heavier payloads. Moreover, the establishment of an adequate energy supply network is critical for recharging these aircraft. Developing a robust and sustainable energy infrastructure, along with efficient battery management systems, is essential to support the growth of AAM. • **Manufacturing and Certification**: Scaling up the production of eVTOL aircraft to meet the demands of AAM requires overcoming manufacturing challenges. Establishing efficient manufacturing processes, ensuring quality control, and meeting regulatory requirements are crucial steps. Additionally, the certification process for these new aircraft must be streamlined, ensuring safety standards are met without impeding innovation. Collaboration between manufacturers, regulatory bodies, and industry experts is necessary to navigate these certification challenges. • **Supply Chain Coordination**: The AAM ecosystem involves multiple stakeholders, including eVTOL manufacturers, component suppliers, service providers, and maintenance facilities. Effective coordination across the supply chain is essential to ensure timely delivery of aircraft, spare parts, and maintenance services. Collaboration among these diverse entities requires standardized processes, effective communication channels, and robust logistics management systems to prevent bottlenecks. • **Component Sourcing and Manufacturing**: eVTOL aircraft consist of numerous complex components that need to be sourced, manufactured, and integrated. Coordinating the sourcing of components from different suppliers, ensuring their compatibility and quality, and managing the manufacturing process are potential challenges. Maintaining a reliable and efficient supply chain for components is essential to meet production timelines and quality standards. • **Maintenance, Repair, and Overhaul (MRO) Services**: Establishing a robust MRO infrastructure to support eVTOL aircraft is crucial for their safe and efficient operation. Setting up maintenance facilities, training personnel, sourcing spare parts, and implementing maintenance procedures can be challenging, especially in the early stages of the industry. Coordinating MRO services across different locations and ensuring compliance with regulatory requirements are additional challenges. • **Logistics and Distribution**: Logistics and distribution networks play a vital role in the supply chain for AAM. Coordinating the transportation of eVTOL aircraft from manufacturing facilities to end- users, managing customs procedures, and optimizing transportation routes require efficient logistics management. Handling oversized and specialized cargo, ensuring proper packaging, and managing international shipments add complexity to the supply chain. • **Counterfeit Parts**: The supply chain of eVTOL aircraft involves multiple suppliers and components. There is a risk of counterfeit parts being introduced into the supply chain, which can compromise the safety and performance of the aircraft. Counterfeit parts may not meet quality standards, leading to potential failures or malfunctions during operation.

	• **Cybersecurity Threats**: eVTOL aircraft rely heavily on advanced technologies, connectivity, and software systems. The supply chain involves the integration of various digital components, including avionics systems, flight control systems, and communication networks. Cybersecurity threats, such as hacking, data breaches, or unauthorized access to critical systems, can pose significant risks to the safety and security of eVTOL operations. • **Data Security**: eVTOL aircraft generate and process a significant amount of data, including flight data, passenger information, and maintenance records. The storage, transmission, and processing of this data within the supply chain can be vulnerable to data breaches or unauthorized access. Protecting data integrity, confidentiality, and availability throughout the supply chain is essential to safeguard sensitive information and prevent potential security breaches. • **Supply Chain Disruptions**: Disruptions in the supply chain, such as natural disasters, geopolitical conflicts, or unexpected events, can impact the availability of critical components, spare parts, or maintenance services. These disruptions can lead to delays in production, maintenance issues, or even grounded operations. Ensuring supply chain resilience and establishing contingency plans are necessary to mitigate the risks associated with supply chain disruptions. • **Insider Threats**: Insider threats refer to security risks arising from individuals within the supply chain who have authorized access to sensitive information or critical systems. These individuals, including employees, contractors, or third-party suppliers, may intentionally or unintentionally compromise the security of the eVTOL supply chain. Implementing robust access controls, conducting background checks, and fostering a culture of security awareness are crucial in mitigating insider threats. • **Geopolitical Considerations**: The global nature of the supply chain introduces geopolitical risks and considerations. Factors such as trade disputes, import/export regulations, export controls, and political instability can impact the sourcing of components, international collaborations, and overall supply chain operations. Staying informed about geopolitical dynamics and diversifying the supply chain can help mitigate these risks.

9. Privacy

Information about the technologies, data systems, software, or other products that can be used in conjunction with emerging technologies that potentially impact the privacy of the public.	
Use Cases	**Description**
Overview	Transportation and technology have been merging for decades and the need to protect public and individual data has grown alongside it. When looking at AAM for public consumption and the data that will be accumulated, privacy-preserving data sharing and analytics (PPDSA) methods and technologies can help this emerging industry efficiently analyze this new wave of data while protecting individual privacy. "To enable more efficient and climate-friendly management [of] traffic through smart grids and smart cities, PPDSA technologies can facilitate understanding of consumption and travel patterns while not revealing privacy-sensitive information."
Data Systems	One resource that may prove helpful as the AAM industry moves forward and adjusts for public use is to import AAM data into a trusted third-party data repository. This type of repository has been used by some states to examine interstate transportation and provide data to a single, trusted third-party source. While it does require costs to operate and strong policies and protocols for how data can be used and by whom, it offers state governments and corporations a way to access data securely while providing accountability and protection to personal and business data. The state of Washington uses this type of data repository which allows partnering agencies to create data-driven policy, support research uses, and provide individuals with authenticated access to their own transportation records.

Transportation Data Collaborative	The analytics Washington collects through the transportation data collaborative (TDC) are used to improve congestion, parking, public transit ridership like Uber and Lyft, and other traffic planning and management conditions across the state. Implementing a similar databank through a neutral third party could help ensure AAM policies and protocols that address data access, ownership, and analysis all while protecting the interests of organizations and persons represented by the data.
General Data Protection Regulation	As consumers adjust to the emergence of AAM into daily life, legislation and technologies that promote trustworthiness and transparency are vital. While there is no general federal legislation impacting data protection across all sectors, the UK implemented the General Data Protection Regulation (GDPR) which allows individuals to control their data. It allows users to object to all or specific uses of their data, requests the deletion or copy of their data, and requires that a company notify users of a data breach within 72 hours. GDPR is a comprehensive personal data protection framework designed to safeguard privacy rights. It governs companies operating in EU member states as well as international entities interacting with EU residents. Pressing the federal legislature for a similar type of regulation could help protect consumers and corporations as AAM expands across intrastate and international use.
Privacy Policy	The AAM ecosystem will require seamless interconnectivity amongst various systems and devices, meaning private data could be transmitted to or stored in many places at any moment. Much of the privacy laws for the commercial flight industry could also be applied to AAM, but the new ecosystem will likely pose new challenges to the existing paradigm. Therefore, the AAM National Strategy must introduce an overarching regulation or guideline that ensures privacy protection at every level. A key measure to prevent privacy breaches is vetting all AAM ecosystem parties. As various vehicles, devices, and infrastructure become more synced, losing the chain of custody becomes more likely. Hardware manufacturers and software developers at every juncture of the supply chain must adhere to the NIST guidelines 800-53 and ISO 27000. They should require higher product transparency without compromising their intellectual property since it concerns flight safety. This is why national privacy protection standards must be developed and applied to all AAM-related technology. Another critical challenge of privacy protection in AAM is accountability. Federal laws, including the Privacy Act of 1974 and Children's Online Privacy Protection Act, and state laws, such as the California Privacy Rights Act, are in place for each entity to follow. Still, the AAM requires constant integration, making determining who is ultimately responsible for the overall privacy protection more challenging. Each vendor, service provider, operator, and regulator will only be responsible for adhering to the law within their own scope but not for the AAM ecosystem. Therefore, AAM requires the designation of authority to a particular agency or office to enforce the national AAM privacy protection standards.

10. Workforce Development

Information about the knowledge, skills, and abilities needed in the working population to accelerate AAM in the United States, including federal labor policies that could assist or expand the populations available to support the AAM industry. What can federal agencies do, working together, to build a skilled labor force in the United States to support the growth of this industry? This inquiry also includes information about educational pathways and training programs necessary to produce a workforce competent to operate, manage, fix, improve, and regulate emerging aviation technologies, associated infrastructure, and underlying policies.	
Use Cases	**Description**
Overview	Focus on Building the eVTOL Aircraft Maintenance Workforce: As of June 2023, there is a major shortage of qualified aircraft maintenance technicians. The shortage includes certified Airframe and Powerplant (A&P) technicians that inspect, review, and sign off on all scheduled and unscheduled maintenance tasks. This shortage not only pushes the

	existing workforce to its limits, but it can also impact maintenance down time and cause flight cancellations. Now add eVTOL aircraft into the mix. Reuters reported in July 2022 that the demand for aircraft maintenance technicians will grow to 3.4% annually, but the supply of available and trained technicians will only grow by 1.9%. The shortage will only worsen if no one takes any action. However, here are some options to consider increasing the technician workforce.
Workforce Recommendations	Imagine being 19 years old and already making a living wage. Even better, imagine coming from a lower income area and making a living wage. This is what an early outreach program can do. It can identify teenagers who possess a high aptitude in both electrical and mechanical and then recruit them to become eVTOL aircraft maintenance technicians. This has the potential to impact whole communities in a positive way due to the emergence of eVTOL aircraft. a) FAA adds a new certification for eVTOL mechanics equivalent in stature and responsibility to A&P mechanics. An A&P mechanic goes through an estimated 1,900 hours to earn their A&P certification. The bulk of this training requires maintenance on combustion engines. However, the energy source for an eVTOL aircraft will be batteries. The FAA can create this new eVTOL certification that places an emphasis on electronics technology and decreases the hours required to earn the new certification. This will provide aircraft maintenance technicians an option for their certification pathway. b) Improve outreach to women and minorities. Professional services provider Oliver Wyman states that only 2.6% of A&P mechanics are women, which is an extremely low number. This is not uncommon as only 1.6% of automobile mechanics in the US are women. Regardless, that means there are thousands of capable people who can become certified aircraft maintenance technicians. c) Reach out to high schools, especially in lower income areas, and start the initial eVTOL aircraft maintenance technician training process to give graduating students a head start. The Aviation industry can reinvent itself once eVTOL aircraft are in operation. The FAA can help by developing an equivalent certification tied to eVTOL aircraft. Finally, the FAA and the Aviation industry can team up to reach out women, minorities, and schools in lower income areas to build a strong foundation for eVTOL aircraft maintenance technicians.
Automation Flight Rules	AAM will have significant changes to knowledge, skill, and ability requirements for the pilot workforce due to the differences between aircraft technology and operations within AAM and traditional aviation contexts. For example, the aircraft proposed for AAM are anticipated to utilize higher levels of automation and differing methods of automation function allocation compared to current commercial aircraft. While it is suggested that this may reduce the time needed for pilot training familiarization with the automation and automation transparency will be a central focal point for new pilots. This may require a revision in training to keep pilots up to date with the proportional changes in automation flight rules (AFRs). Regulatory direction and research are needed to determine pilot proficiency in AFR and serve as a basis for required training. The proposed aircraft also incorporate new technological hardware and architecture, such as battery-powered propulsion systems and unified controls, warranting a switch from pilot- managed fuel consumption to pilot-managed battery power/energy, which requires a different set of knowledge and skills. It is essential to understand what training is necessary to prepare pilots for these new operations. Further, understanding how training can be optimized to meet the cognitive and perceptual demands of the novel control system for pilots is a gap to be addressed by new training procedures and related research.

Recruitment Opportunities	Various changes to operations will also occur, such as transition to more repetitive, higher tempo, short-haul flights, and communication protocols with other pilots, mandating a need for research examining the unique psychological and cognitive demands resulting from novel UAM operational routes. Further, AAM operations will shift to single-pilot operations, removing some of the barriers of error mitigation and creating higher cognitive demands for the individual pilot. As such, there is a need to understand the implications of these changes for pilot training and conduct research to understand precisely what knowledge and skills to train and how to train them most effectively. Further, with the ongoing pilot shortage, to meet the demands of the AAM industry, operators will likely need to recruit and train pilots that are outside of the typical pilot demographics in the current aviation industry. The UAM industry is looking at ways to increase the diversity of the pilot workforce by engaging more women and underrepresented groups; there is a need to identify new recruitment and training methods to target the unique characteristics and needs of these new demographics.

11. Global Leadership & International Practices

Information about the steps that the United States needs to take to become a durable global leader in AAM and safe automated technologies, from establishing regulatory standards and practices that will enable the industry to safely develop the engagements necessary that support international AAM services in North America and beyond. In addition, the AAM IWG seeks information about the impact of foreign government approaches to regulate emerging airspace technologies, including recommended practices the U.S. government should consider adopting as well as practices the U.S. government should avoid.	
Uses Cases	**Description**
Ethical Oversight	This section discusses global leadership and international practices. There are several advanced air mobility considerations to make the technology globally scalable and accessible. Leadership and collaboration are crucial for this emerging industry's successful integration and growth. One fundamental aspect is establishing an international authoritative body that sets norms and commonly accepted practices and ensures global knowledge management. This authority would be pivotal in fostering industry collaboration, standardization, and safety. According to a report by Deloitte, a robust governing body can provide regulatory oversight, create certification processes, and encourage information sharing among stakeholders. This is important because of the dynamic nature of the industry and its significant impact on industries and daily life. With such an authority, the advanced air mobility industry can develop a framework that ensures operational efficiency and safety while fostering innovation and growth. First, ethics are paramount to long-term, sustainable practices. Ethical oversight and transparent communication are vital components in advanced air mobility practices. As highlighted by a study published in the Journal of Air Transport Management, the industry must establish ethical guidelines and mechanisms for oversight to address concerns related to privacy, security, and environmental impact. On another note, transparent communication with the public, regulators, and other stakeholders is crucial to building trust and ensuring the responsible development and deployment of advanced air mobility technology. Open and inclusive dialogue can facilitate an understanding of potential risks and benefits, allowing for collaborative decision-making and effective oversight.
Barriers to Entry	Managing barriers to entry is essential to make advanced air mobility accessible to all. Unlike traditional modes of transportation, such as automobiles, entry into the advanced air mobility sector involves significant technological and regulatory challenges. Therefore, creating an environment that promotes innovation, reduces bureaucratic hurdles, and encourages competition is imperative. The International Civil Aviation Organization (ICAO) emphasizes the importance of balancing safety and accessibility to ensure that advanced air mobility benefits society. This model is critical to sustainable advanced air

	mobility operations, as is accessibility. When comparing advanced air mobility to traditional technologies, accessibility emerges as a critical differentiating factor. Unlike previous innovations, such as the internet or smartphones, the development of advanced air mobility requires extensive infrastructure, regulatory frameworks, and public acceptance. Therefore, it is essential to proactively address these challenges to avoid exacerbating existing social inequalities and ensure that the benefits of advanced air mobility are accessible to all. To achieve these goals, there is an urgent need for United States laws to reflect the considerations mentioned above. By enacting legislation that establishes an authoritative body for advanced air mobility, ethical oversight, transparent communication, and managing barriers to entry, the United States can position itself as a leader and noble international partner in this transformative industry. The integration of advanced air mobility will not only benefit the country but also have a significant impact on the global aviation sector. Therefore, policymakers should act swiftly to ensure safety and promote accessibility to align the nation's interests with developing advanced air mobility.
Canadian Perspective & Insights on AAM	As set out by the FAA's May 2023 updated blueprint for AAM operations, as the number of operations increases, air taxis and drones are expected to fly in corridors, with the complexity of the corridors increasing over time from single one-way paths to routes serving multiple flows of aircraft. Therefore, with the development of lower altitude air corridors connecting the nation's communities, the federal government ought to create a framework to decentralize and delegate certain aeronautical powers to local governments, being either at the state or municipal level. This submission, from a Canadian aviation regulatory perspective, to assist in the development of specialized AAM air corridors is on (1) the need for the FAA's support for more localized aeronautical regulations through a delegation of certain powers, (2) a prioritization of local medevac air corridors during that delegation of federal powers; and (3) establishing minimum insurance requirements for vertiport and droneport operators. The creation of more localized aeronautical regulations will be an enabler to the deployment of AAM operations in multiple locations, avoiding duplicative solutions to solve divergent needs, while at the same time fostering trust and acceptance of AAM on a national scale. **<u>Delegation of Federal Aviation Regulatory Powers – Canadian Example</u>** In Canada, airspace currently remains exclusively federally regulated under the *Aeronautics Act*, R.S.C., 1985, c. A-2 ("***Aeronautics Act***"). Federal aviation legislation in Canada commenced in 1919, amended in 1985, and again amended in 1992. During the 1985 amendments, the federal government received a new power to zone around air navigation facilities to prevent the development of lands in a way that would interfere with air navigation signals between the aircraft and facility. The 1919 provision that provided for compensation for loss in value of land because of zoning was repealed. The reason for the repeal is that it would make the law compatible with provincial and municipal laws, and with knowledge that at present time provinces and municipalities did not compensate landowners or developers for such a loss. Section 5.8 of the *Aeronautics Act* was also introduced at this time indicating that > No person is entitled to any compensation or costs for any loss, damage, removal, or alteration resulting from the application of a zoning regulation to any lands, building, structure or object. Then, during the 1992 amendment, the *Aeronautics Act* went through additional changes that included the adoption of section 5.81. Section 5.81 was a modification that contemplated, for the sake of efficiency, a need for the federal government to delegate its

	authority in certain circumstances to a provincial (or State) authority. Specifically, for a more local authority to regulate the use of certain lands adjacent to or in the vicinity of an airport/heliport site for the purpose of ensuring that the land use is compatible with the safe operation the aircraft into and out of that site. This section current reads: > 5.81(1) The Minister [of Transportation] may enter into an agreement with a provincial authority to authorize the provincial authority to regulate, in the same manner and to the same extent as it may regulate the use of lands within its jurisdiction, the use of lands adjacent to or in the vicinity of an airport or airport site that are not the subject of regulations made pursuant to subsection 5.4(2), for the purpose of ensuring that the use is not incompatible with the safe operation of an airport or aircraft. A provincial authority in defined to mean an authority in a province (or State) responsible for the regulation of land use. This delegation of power provision was added in 1992 to the to the *Aeronautics Act* through Bill C-5 because of the increase in air travel, and limitations to certain federal resources, that had developed in Canada since 1985. By incorporating section 5.81 into the legislation, the federal government acknowledged that not all communities or local authorities will want this delegation of federal power. If that was the case, the location may eventually be zoned by the federal government. However, this delegation of power provision was being offered to local governments to facilitate proper zoning controls so that both airports and their surrounding residents could be protected from encroachment by either one of them, particularly with the need to keep up with the increased air travel and resource constraints at the federal department of transportation at the time. This type of regulatory provision that exists in Canada, could benefit the United States, as it empowers more local levels of government (including environmental conservation areas, and Indigenous communities) to have timely engagement with building developers for past and future air corridor planning purposes. It also allows, through the proper exercise of power, for lower levels of government to regulate airspace without concern of exposing the government corporation to a claim for compensation or costs for any loss related to the application of airspace zoning regulations for corridor creation.
Duty to Consult	<u>Constitutional Concerns with Federal Delegation of Powers Addressed</u> Prior to the Canadian legislated amendment allowing for a delegation of certain aviation federal powers, industry stakeholders expressed varying degrees of concern about whether such a legislative change encroached on the federal government’s exclusive realm over aviation. In Canada, the court system has considered the constitutional validity of this transfer of power. Where local municipal laws that have imposed height restrictions around airports and heliports, these local government decisions have been held to be constitutionally valid and *intra vires* the municipality’s land use planning powers. <u>Duty to Consult for Air Corridor Development</u> In addition to the public consultation requirement for air corridor creation, in Canada the federal government has a duty to consult with Indigenous groups, which is a duty affirmed by the Supreme Court of Canada, and it remains an important part of federal regulatory projects. When the FAA delegates certain powers to State and/or municipal governments for air corridor development, that may impact potential or established Indigenous and/or treaty rights, consultation and, where appropriate, accommodation should be provided to the Indigenous peoples of the United States. Failure to consult in AAM corridor creation, in

	certain circumstances, could result in disruption to Indigenous fishing, hunting, and gathering activities, as well as disturbance to cultural and archeological resources. For Indigenous consultation to be meaningful, there is significant Canadian guidance on this topic. Briefly, it must be carried out in a timely, efficient, and responsive manner; transparent and predictable; accessible, reasonable, flexible, and fair; founded on the principles of good faith, respect, and reciprocal responsibility; and respectful of the uniqueness of the Indigenous communities and their right to self-determination.
Delegation of Powers	Practical Implication for Advanced Air Mobility – Delegation of Powers Federal laws must allow for localized governments to regulate in such a way so that divergent community needs can be met, while simultaneously the lands adjacent to or in the vicinity of heliports, airports, vertiports or droneports (hereinafter and collectively "Vertiport") are not developed in a manner such that the lands are incompatible with the approach and departure paths surrounding the Vertiport. Localized regulation authority will still require the local government to co-ordinate with the federal regulator and air operators/OEMs to set the local standards for Vertiport OLS minimums for safe approaches and departures to the site. It also requires the local government to engage with the Air Navigation Service Provider ("ANSP") to develop a communication framework to protect against local navigational/communication interference that can occur through ground-based development. With any delegation of federal aeronautical powers to lower levels of government, it should not be a blanket delegation. Priority should first be given to those operations in healthcare. The purpose of this recommendation as it will assist in ensuring public confidence in the AAM market operations, and because it assists in the continued protection of ongoing air ambulance and medevac flights, which are priority flights. It will also set the initial boundaries for air corridor protections so that their development and future AAM flights do not interfere with current heliport (and future vertiport and droneport) locations that service trauma centers, or drone health operations delivering critical and time-sensitive goods such as organs, blood products, radiopharmaceuticals, and vaccines.
Regulatory Framework	A national regulatory framework, developed in the next 2 years, which supports a federal delegation of aviation authority to local governments for airspace zoning regulation, while reducing exposure to claims for losses, will allow for a flexible implementation of AAM - through air corridor creation and protection - depending on the needs of each local community. A delegation of powers should not be a blanket delegation, and priority must be given first to medevac flight routes, and air ambulance operations, followed by healthcare delivery by air operations. This initial sector-based approach will also necessarily involve the health care insurance industry, and the aviation insurance industry, early in the discussion on Vertiport site locations and the development of air corridors to and from those sites. Minimum insurance requirements for Vertiport operation must also be in place to ensure that additional financial oversight occurs at these locations to ensure the appropriateness and safety of commercial movement of goods and people. The creation, and subsequent protection of, the air corridor OLS necessitates a significant amount of collaboration between the state and municipal planning departments, urban and airport planning consultants, ANSPS, local hospital and trauma centers (for reasons discussed above), architects, legal advisors, and the local real estate market. Even with a federal framework contemplating a delegation of powers, from the Canadian experience (and even with effective collaboration amongst many parties) it can take up to two years to develop dedicated air corridors in urban centers. Effective collaboration and cooperation towards air corridor creation can occur with strong federal government support on this topic.

12. National Security & Aviation Security Implications

Information about the national security implications of accelerating AAM in the United States, specifically how physical security of passengers and cargo should be addressed and who should bear responsibility for security assurances, security and system resilience, and what threats exist in considering the growth of counter-drone capabilities that will operate in similar low-altitude airspace. Information on these and other security issues should include the dual-use nature of any emerging airspace technologies and any opportunities or vulnerabilities created by emerging technologies and associated risk mitigation recommendations.	
Use Cases	**Description**
Overview	AAM's national and aviation security implications could be graver due to increased potential risks. Individual aircraft and passengers will likely choose a wider variety of vehicles, devices, and routes, which makes security management more convoluted than in the commercial airline industry. The risk of one aircraft with a hardware malfunction, software glitch, external hacking, or physical hijack to inflict catastrophe will multiply as AAM becomes more ubiquitous. Given the myriad of possible national security crises caused by an individual's smartphone or armed hijacker, the AAM National Strategy must explicate stringent measures to address all the heightened security threats and vulnerabilities.
Physical Security	The viability of implementing the current TSA measures for AAM could pose new dilemmas. Under current law, whenever someone wants to board any other kind of AAM vehicle must show up earlier than the take-off time to go through metal detectors and other types of screenings. Specific materials and measurements must heavily protect the pilot section of the plane, which could add a significant burden to the aircraft itself. A flight crew or law enforcement member must be on board to neutralize any unruly or malicious passenger that can inflict physical harm on others. Given the smaller dimension of aircraft, shorter length of travel, and the ever-increasing number of vertiports, the amount of manpower and resources to address the physical security aspect of AAM could be substantial. That is why the AAM National Strategy must call for new laws, guidance, and budget allocation for unprecedented national security dilemmas.
Cybersecurity	The privacy section has touched on the constant interconnectivity between vehicles, devices, and infrastructure, making privacy protection evermore challenging. The "CIA" triad of confidentiality, integrity, and availability in cybersecurity becomes inseparable from national security for the following reasons. Confidentiality entails encrypting and protecting any information that could affect lives nationwide. In AAM, the examples would include specific air traffic routes, passengers, aircraft specifications, etc. Integrity entails preventing attempts to interfere with flight data to change the itinerary, route in mid-air, or hack the aircraft to take control. Availability entails ensuring critical information is always on, especially during flight. In addition to the vehicle or devices, the national infrastructure and data services must meet the capacity to provide constant feed without interruption. The AAM National Strategy must frame the national cybersecurity challenge using the "CIA" triad.
International Agreement	There are plenty of domestic threats to AAM already, but AAM also could be easily exploited by hostile foreign actors to inflict catastrophe on national soil - i.e., imagine a 9/11-style terror attack but remotely controlling several eVTOLs simultaneously and making them wreak havoc all over the country. Therefore, it is essential to establish international norms and sign agreements amongst all members with AAM capabilities not to violate any of one another's sovereign AAM operations. It may require creating a multilateral organization dedicated to global standards and laws, which is in the interest of the United States to be an active founding member to shape them. That is one of the key recommendations for the AAM National Strategy.
UAS Drone Detection	Security of the National Airspace System must be the primary goal when incorporating AAM technologies into the airspace. Airspace management is one of the keys to safe operations yet the educations efforts, and more importantly the enforcement efforts by the FAA are lackluster at best. The clueless, careless, and criminal continue to risk the safety

	of the NAS and the introduction of AAM will increase this risk. The use of drone detection by anyone outside certain federal agencies is a grey area that has not been well defined, and no case law exists. Tools necessary to mitigation the risk of the 3 C's are not only prohibited in most cases but are not surgical enough in nature to prevent collateral damage and inherently increase the risk to the NAS.
Unauthorized Access	However, deployment and use of cUAS systems must be assessed to ensure they do not pose a risk to AAM adoption. The potential interference with AAM aircraft navigation and communication equipment by UAS detection and mitigation technology must be evaluated and tested prior to authorized operators deploying and utilizing the equipment. The FAA must ensure that all authorized users of such systems have clear guidance on evaluating the risk of cUAS systems to prevent undue harm to the NAS. This is an area where some progress is being made as evident by the recent creation of the FAA cUAS Detection and Mitigation Aviation Rule Making committee. Cybersecurity concerns should also be at the forefront when discussing the acceleration of AAM. The interconnectivity that must exist for AAM technologies to operate safely in the NAS also creates paths for nefarious actors to exploit gaps in security. These exploits could result in unauthorized access to AAM aircraft navigation, communication, and safety equipment. In a worst-case scenario, a flying taxi or package delivery drone could be electronically highjacked and used as a means to damage critical infrastructure, cause mass chaos, or be diverted into aviation traffic. Collaboration between governing bodies, manufacturers and the private sector must be encouraged to ensure not only interoperability but cybersecurity.

13. Vertiport Development & Operations

Information about the expected role of governments and private industries at all levels as to the development, funding, and operation of vertiports. The term "vertiport" in this capacity is meant to describe a range of specialty landing, boarding, and takeoff areas designed for AAM operations, including single operation vertiports, vertiports integrated into existing airports and heliports today, as well as sprawling, multi-operation, multi-purpose, and multi-transportation option vertiports that act as commercial and transportation hubs. The AAM IWG seeks information on whether system planning similar to the National Plan of Integrated Airport Systems [6] should exist for vertiports, and what level of coordination is required for effective vertiport planning and use.	
Use Cases	**Description**
Overview	To achieve a seamless emissions-free, quieter, and even safer aviation mobility than we currently have today, the necessary roles and interactions between governments and private entities are to focus on bringing more AAM and related stakeholders to the table. This means including other industries outside of our traditional aerospace trade. By bringing together a wide and all-encompassing array of stakeholders, we can assure the successful development of AAM, invite investors to make more educated funding decisions and understand the daily needs of vertiport operations. Specifically, Volatus continues to look forward to more all-inclusive round tables that foster further cooperation between governments and private entities. Volatus feels these table talks and interactions need to include many related mobility industries. AAM infrastructure working groups are an efficient way to draw from the talent pool of professionals ready to contribute and write white papers. Volatus sees the following industries as playing a key role in these interactions, the automotive industry, as well as bus manufacturers, taxi, and other fleet owners, specifically on the operations part of the development. There is a strong need to work even closer with the DOT to better understand land access and use, as well as work closely with energy utilities, including PUCs.

Vertiport Safety through Simplicity	Volatus Infrastructure sees a close future need for the railroad industry to be present and working very closely with fire Marshalls who will sign off any final vertiport infrastructure contracts. This also means bringing in other government agencies, such as the FCC and any other Federal national security agencies need to be at the same table discussing needs and regulations. One of the promises of AAM is to democratize aviation mobility in a clean, safe, and quieter way than how it operates today. After this, we can contemplate bigger projects that will require much longer to build and necessitate greater investments. Volatus has observed a dire need to focus on all aspects of day one of Vertiport operations. For instance, a terminal with one to two FATOs, a charging system, trained staff handling customers walking in, equipment handlers, such as employees handling charging cables and charging aircraft. In other words, what will day one look like? What needs to be in place to operate a vertiport on its first day? All of these functions need to be defined today with the help of governments and private stakeholders. These roles and functions need to be defined this year, 2023 if we would like to see eVTOLs and drones flying within a year to two. While Volatus admires the excitement centered around giant and highly complex vertiports, those will see the day of light in a decade to 15 years with millions of dollars of funds. With this in mind, Volatus strongly feels starting with a smaller but more flexible vertiport infrastructure design that meets the needs of that first day of operations would greatly benefit all, set a template going forward and prove the business case is viable. The focus as of now should be on how vertiports owners can be ready to operate in the next two to three years and plan for future big vertiport projects.
Performance-based Weather Instrumentation	There is a requirement for performance-based weather instrumentation at Vertiports. Built environments create unique challenges for advanced air mobility where buildings and discontinuities in land use create difficult-to-predict wind shear and turbulence hazards. Therefore, ensuring safe AAM operations requires an understanding of wind and turbulence hazards in the vicinity of the FATO both in the design, planning and construction of a vertiport and when operations commence. Each vertiport location will require a combination of climatological assessments, computational fluid dynamics modeling, and real-time weather observations. The impact of winds on vertiport operations will depend on proximity of buildings, and other structures near or on the vertiport. In vertiports located in relatively tight spaces, the vertiport will require a capability to measure winds in 3-diminsions around and on the vertiport. A windsock or automated surface-based weather station is insufficient. If the vertiport is well designed, with relatively unobstructed wind flow, the requirement for 3D winds at the vertiport location is reduced, however having a wind profile of the atmosphere is desirable to measure low level wind shear, and to better measure wind speed above the ground for power planning and e-VTOL transition from vertical ascent/descent to cruise mode. Wind measurements are not only required for safety, but in allowing precise estimate of power consumption that will dictate weight allowance, recharge recovery times, etc., which requires better short-range wind predictions to ensure managing these issues occur several hours before flights. Weather instrumentation should be integrated into the design of the FATO area.
National Plan for Integrated Airports	In terms of funding future AAM infrastructure such as vertiports and vertipads, the major national focus would have to include potential inclusion in the National Plan for Integrated Airports (NPIAS). The NPIAS identifies airports that are important to the national air transportation system and classifies them into four categories: commercial service airports,

	reliever airports, general aviation airports, and military airports. The program also identifies airport development projects that are needed to maintain and improve the national air transportation system. The NPIAS is used by the FAA to allocate federal funding for airport development projects. The program helps to ensure that federal funding is directed to the airports and projects that are most important to the national air transportation system. The NPIAS, or a similar system, can apply to future vertiport development and operation for advanced air mobility in several ways: 1. **Identification**: The NPIAS could identify vertiports that are important to the national air transportation system and classify them into the appropriate categories, such as commercial service airports or general aviation airports, so that Federal funding can be used for vertiport development. 2. **Prioritization**: The NPIAS can prioritize vertiport development projects that are needed to maintain and improve the national air transportation system. This can help to ensure that federal funding is directed to the most important vertiport projects. 3. **Federal Funding**: The NPIAS can allocate federal funding for vertiport development projects, similar to how it allocates funding for airport development projects (assuming they are to be public use and as this would not apply to private vertiport development. This can help to ensure that the necessary infrastructure is in place to support advanced air mobility operations. 4. **Regulation**: The NPIAS can establish regulations and standards for vertiport development and operation, ensuring safety and compliance with federal laws. This can help to ensure that advanced air mobility operations are conducted in a safe and responsible manner. 5. **Supplemental State Funding**: Could state funding be used for vertiport development? Many dependent elements as they would be competing for the same money that airports compete for (same as the NPIAS idea) which would mean states would have to consider a new category for funding purposes. Some block-fund states may also need to look at how they categorize AAM. It should be considered that cities would also have interests in running or operating a public vertiport, not unlike a bus station, where they could facilitate such operations where they could use federal, State, and local funds to maintain and operate.

14. Electromagnetic Spectrum

Information on the electromagnetic spectrum and telecommunications infrastructure needs of piloted and autonomous AAM applications in the near, medium, and long term, including what spectrum-using applications (e.g. communications, navigation, radar, command and control, payload, telemetry, or others) should be considered necessary components of an AAM ecosystem and what the state of development of such applications is in the near, medium, and long term; what spectrum bands are being considered or tested to support such applications; any specific spectral characteristics needed to support various AAM applications (e.g. bandwidth, propagation characteristics, and reliability); network infrastructure deployment scenarios under development for functions such as command and control; network architecture needed for local/regional/nationwide flights; additional systems or capacities needed; forecasting of expected demand in the near, medium, and long-term for frequencies; risks associated with integrating AAM into existing navigation, communication, and other systems; and any statutory, legal or policy changes related to electromagnetic spectrum use that would facilitate AAM.	
Use Cases	**Description**

Overview	The Air Traffic Control (ATC) systems used in the National Air Space (NAS) for traditional, crewed aviation have benefited greatly over the past few decades by having dedicated spectrum assigned for use in Communication, Navigation and Surveillance (CNS) functions that are critical to the safety of the NAS. Any encroachment on the spectrum bands (e.g. LightSquared network adjacent to GPS L1 band) was deemed a critical risk, and the FAA and FCC have taken significant steps to ensure continued protection of these frequencies. However, the decision to use commercial broadcast frequencies (Wi-Fi, Bluetooth, etc.) and forgo protected spectrum for Remote ID (RID) for sUAS has created a significant issue in the ability to architect and implement robust networks of receivers that can overcome large amounts of interference, poor Signal/Noise Ratios (SNR) and inadvertent/malicious jamming of the RID signals. The RID rule, due to go into effect later this year is likely to run into complications with these aforementioned issues. The recommendation remains, as it did from a large proportion of respondents to the RID NPR to use dedicated, protected spectrum for RID and C2 links – whether through commercial 5G network service providers or through the dedication of another low-loss, low-bandwidth, high SNR frequency band with the same protections as those afforded to GPS and other ATC systems.
Vehicle to Vehicle Communications	In the near term, piloted and autonomous Advanced Air Mobility applications should use specific spectrum bands such as C-Band (3.7-4.2 GHz), L-Band (1-2 GHz), and 5.9 GHz-Band (V2V Communications) that offer wide bandwidth, reliability, security, and compatibility with existing systems. The network infrastructure for near-term AAM would include ground-based stations and satellite communication. However, the anticipated increase in spectrum demand poses risks such as interference, congestion, and security vulnerabilities. The medium-term outlook for AAM involves expanding travel. Spectrum bands and spectral characteristics remain similar to the near term, but network infrastructure evolves to integrate existing communication networks with dedicated AAM systems and networks. This may include using some additional spectrum bands or restructuring the current dedication in the NAS. Meeting the demands of increased scale becomes crucial.
Interference Risks	Risks associated with spectrum demand and interference persist during this phase but must be solved before the long term nationwide or global travel is safe and reliable. In the long term, AAM will require nationwide or global transportation networks with autonomous aerial vehicles. Additional spectrum bands like Ku-Band and Ka-Band must be utilized. Nationwide coverage requires an extensive network infrastructure. Anticipated spectrum demand remains significant, accompanied by risks such as interference, congestion, and security vulnerabilities. Some of these risks associated with scaling AAM operations and their solutions include: • **Spectrum Allocation**: Regulatory bodies and governments can allocate dedicated frequency bands or spectrum resources specifically for AAM operations. This would ensure interference-free communication and coordination between AAMs and ground systems. • **Standardization & Interoperability**: Developing common standards and protocols for AAM communication and C2 links would facilitate seamless integration with existing systems. This includes ensuring interoperability between different AAM manufacturers, service providers, and air traffic management systems. • **Privacy & Data Protection**: As AAM operations involve the collection and transmission of data, legal and policy frameworks need to address privacy concerns and ensure appropriate data protection measures. Regulations must define data ownership, consent, and security requirements to protect the privacy of individuals and organizations involved. • **Cybersecurity Regulations**: Strengthening cybersecurity regulations and guidelines specific to AAM operations would help address the evolving threat landscape.

15. System Resilience

Information about how the AAM industry plans to secure critical systems by integrating cybersecurity and identifying critical systems in the design of overall architecture of the sector as it evolves. Furthermore, include what tools are available or must be developed to identify critical AAM systems and ensure that those systems have the necessary measures in place to identify, detect, and mitigate potential software intrusions. The government also seeks information about how overall transportation system resilience will be affected by AAM.	
Use Cases	**Description**
Overview	The infrastructure supporting AAM will have many key differences from tradition aviation. The fundamental need for the AAM industry to function at low altitude, in urban environments, and at scale, has led to a wave of technological innovation, but a secondary impact is that new business models have evolved around this ecosystem for new infrastructure. AAM supporting infrastructure is largely being developed by non-traditional aviation companies and startups. There are limited standards or requirements available for these companies to reference in their development, and many of the design standards that exist are not viable for technology elements utilized by modern systems, particularly in software. The result is a federated system of systems which does not have a consistent, maintained architecture or design. These differences, in totality, create many challenges to overall system resiliency within AAM ecosystems which are not present within traditional aviation. An AAM national strategy should address these challenges.
Digital Challenges	<u>Data Quality Assurance & Operational Assurance</u> These rely on verifying that the data used for decision-making are “good”. To verify data is good, focus must be placed on identifying and communicating what “bad” data looks like. Based on our experience developing complex, safety-critical systems, the following causes of bad data in a highly automated system should be addressed: • Data was produced by a malfunctioning system; • Expected or required data is not available; • Data does not make sense as it relates to the physical world (i.e., physically impossible); • Data came from a compromised or malicious source; • Data was late arriving and may not be timely enough to act on; and • Contingency Management. Traditional aviation relies on humans to manage contingency situations. This human-to-human interaction does not scale to fit the needs of the AAM community. AAM contingencies need to be identified and systems are needed to manage them, eventually without a human on the loop. Additionally, as the industry evolves, a system needs to be in place to identify emergent contingencies that may not have been identified during the early phases of the industry. Standardizing or identifying acceptable means of contingency management along with a list of the contingencies that must be identified and managed is an area that the IWG can help the AAM industry.
Increasing Autonomy	<u>Highly Automated to Autonomous Operations</u> The viability and scalability of complex AAM operations will hinge on increasing levels of automation. This automation will require continuous decision-making about how to accomplish mission objectives while maintaining a sufficient level of safety, both onboard the craft and within the broader context of airspace and operations management. Much of this decision-making will be driven by the infrastructure such as sensor input and data into the system which identify aspects such as environmental, geospatial, and both static and dynamic obstructions. This level of autonomy is often non-deterministic or cost prohibitive to prove determinism. New standards and FAA approved methodologies are needed to enable the high levels of automation or autonomy needed to scale these operations.

Securing the Overall Ecosystem	Cybersecurity Traditional aviation has largely been living in a bubble, relying on an "air gapped" cyber security approach for many elements of the ecosystem. The AAM ecosystems envisioned and being deployed for testing have a myriad of attack surfaces and very little clarity on how to secure the overall ecosystem. This level of clarity needs to be flowed down from the FAA to address both individual systems, components, or services, but also the larger system of systems that is rapidly evolving. Many of these challenges are being addressed conceptually in the form factor of in-time aviation safety management systems (IASMS). NASA and their partners have been working on the IASMS concept and research since 2018. This has resulted in many NASA-developed IASMS services, functions, and capabilities (SFCs) as well as a commercially available IASMS developed by ResilienX. The Flight Safety Foundation recently completed a roadmap for IASMS R&D. This roadmap was developed in consensus with industry and NASA and provides a good list of steps for the Government to focus on. Additional IASMS resources include: • IASMS CONOPS • IASMS for Vertiport Operations • Identifying IASMS SFCs
Quantum Computing	On December 21, 2022, President Biden signed into law H.R.7535 - The Quantum Computing Cybersecurity Preparedness Act, mandating that all federal government agencies adopt advanced cryptography. In coming years, we expect that these standards will make their way into commercial industries as well. Any new systems, such as those deployed in the AAM industry, are strongly advised to upgrade to advanced cryptography. There are existing solutions available from companies like QuSecure which provide the ability to install, deploy and manage advanced cryptographic systems. These include features such as zero trust, cryptographic agility, and backwards compatibility, using standards-based cryptography approved by NIST (National Institute of Standards and Technology). For new systems developed in the AAM industry, it does not make sense to start with outdated cryptography such as the types that we use today. AAM has the opportunity to move forward and begin with advanced cryptography unlike other industries that have to deal with legacy systems. Newer cryptography is resistant to AI (Artificial Intelligence) and quantum computing attacks which is essential. Since much of the AAM industry will rely on wireless communications, advanced cryptography deployment means that they will have the best defense against adversaries who could disrupt communications or take over and control AAM vehicles.

16. Environmental Impacts & Public Involvement

Information regarding the reasonably foreseeable environmental benefits and costs of integrating AAM operations into the U.S. airspace and broader transportation system, including the application of any standard methodologies to identify, investigate, and evaluate (either qualitatively or quantitatively) potential environmental impacts and available mitigation measures. Information regarding opportunities to synchronize, sequence, or coordinate applicable permitting/licensing and public involvement/consultation requirements or processes across Federal, State, local, or Tribal government to minimize duplication and improve efficiency and effectiveness.	
Use Cases	**Description**
Overview	The National Airspace System is a complex and well-organized structure that has been developed and improved throughout the decades. New entrants to the airspace are a normal part of technological progress that the FAA, and airports have managed effectively with each change over the years. The advent of AAM – and to a broader extent electric aircraft, expansion of regional air mobility, and the proposed inter-city and intra-city air taxi service of urban air mobility presents a new challenge from an environmental and public

	involvement perspective. The most common methods to address aircraft noise as it relates to community impacts/effects is to look at modifications to two areas: 1) mitigation at the source: i.e. making aircraft quieter through technological advancements, as well as creating flight paths that avoid overflights of noise sensitive communities – and 2) Land Use Planning through the Part 150 process, and to a broader extent the National Environmental Policy Act (NEPA) process, and its FAA desk reference, 1050.1F that provides explanatory guidance for environmental impact analysis performed to comply with Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of NEPA. The FAA is currently in the process of a review and evaluation of their Civil Aviation Noise Policy. As part of this review, the FAA has published a document entitled The Foundational Elements of the FAA Civil Aviation Noise Policy which should be used as a reference as part of the DOT AAM Interagency Working Group. With many disparate voices within the aviation community including aircraft operators, airport operators, aviation consultants, aircraft manufacturers, and aviation industry organizations – the AAM national strategy should consider these voices in the context of their historical relationship with the federal regulators, and their interaction with state, and local officials.
Social Acceptance	Current barriers to implementation of AAM is a lack of data related to the noise profiles of these new entrant aircraft. While the manufacturers have publicly stated they are designing the aircraft to be 'as quiet as possible,' noise is by definition a subjective term – such that people enjoy a concert but are annoyed by the same decibel levels of a lawnmower, or speaker blaring from their neighbor's car – or an overflight of an aircraft. Because of the subjectivity of annoyance to noise, alternative metrics, and methods of describing community annoyance must be a part of the short, medium, and long term for successful implementation of AAM within communities. Low flying aircraft can be a nuisance to residents regardless of the tone or quality of the sound. To address this, the interagency working group needs to develop a structure for incorporating aircraft operations within the NAS in areas where aircraft are not currently flying – which includes engagement with state and local officials, land use planners, and the local community. Proper planning is the most effective method to mitigate potential negative effects from new entrants to the NAS. Knowing that the FAA's methods for addressing aircraft noise are in the process of being reviewed; and this review involves the implementation of new entrants – the interagency working group must have the FAA at the table to understand the current issues being dealt with related to aircraft noise and community annoyance; and synchronize throughout the short, middle, and long term. This includes the consideration of alternative noise metrics. Aviation provides for fast and efficient inter-state commerce; and as such is in the purview of the federal government to regulate and support its effectiveness. The public must be involved in understanding the benefits of these new aircraft, and on the planning - how they will integrate within local communities and the United States as a whole. A way to do this is to develop tailored communications strategies for elected officials and communities that recognize the distinct roles, responsibilities, and interests of the operators of vertiports, and the operators of AAM aircraft – as they will be operating in new airspace. These strategies should encompass the immediate neighborhood where operations will occur and the wider community. For example, strategies in a neighborhood where a vertiport will be built will be different than those required for a neighborhood with an existing airport. These enhanced community engagement approaches should be expanded to a retail level by reaching out even further into neighborhoods, homeowners associations, and other community groups. It would also be worthwhile to attend community events (e.g., farmers markets, sporting events, and other venues that attract members of the general public) to socialize the operators' presence in the community and to disseminate information to the community. This level of outreach is not currently required by existing regulations; but would meet the needs of all communities; and also address the Biden-Harris administration's commitment to address underinvestment and opportunities in disadvantaged communities.

Potential Environmental Impacts	Greenhouse Gas Emissions: eVTOLs have the advantage of being powered by electric propulsion systems, which can significantly reduce greenhouse gas emissions compared to fossil fuel-powered aircraft. However, the environmental impact depends on the source of electricity used for charging the eVTOLs. If the electricity is generated from renewable sources, the emissions reduction potential is substantial. However, if the electricity is derived from fossil fuel-based power grids, the emissions reduction benefits may be diminished. Noise Pollution: eVTOLs have the potential to reduce noise pollution compared to traditional helicopters or aircraft. However, they still produce noise during takeoff, landing, and flight. As eVTOL operations scale up, there may be concerns about increased urban noise levels, especially in densely populated areas. Noise mitigation measures such as improved design, advanced rotor technologies, and designated flight paths can help minimize the impact of noise pollution. Resource Consumption: The manufacturing and operation of eVTOLs require the use of various resources, including raw materials, energy, and water. The extraction, processing, and disposal of these resources can have environmental implications. Additionally, the demand for batteries, which are a critical component of eVTOLs, raises concerns about the extraction and disposal of materials like lithium. Implementing sustainable resource management practices and promoting recycling and reuse of components can help mitigate these impacts.
Environmental Mitigation Measures	• **Renewable Energy Integration**: Promoting the use of renewable energy sources, such as solar or wind power, for charging eVTOLs can help reduce the overall greenhouse gas emissions associated with their operation. Encouraging the development of renewable energy infrastructure and incentivizing eVTOL operators to use renewable energy sources can support the transition towards a more sustainable and low carbon eVTOL industry. • **Battery Technology Advancements**: Continued research in battery technology can lead to improvements in energy density, efficiency, and charging times. Advancements can extend the range of eVTOLs, reduce charging times, and enhance overall efficiency, thereby reducing their environmental impact. • **Sustainable Manufacturing Practices**: OEMs can adopt sustainable practices by minimizing waste generation, optimizing energy consumption during production, and reducing the use of hazardous materials. Implementing eco-design principles and incorporating life-cycle assessments into the manufacturing process can help identify and address environmental hotspots throughout the product life cycle. • **Noise Reduction Measures**: eVTOL manufacturers can focus on noise reduction technologies, such as advanced rotor designs, acoustic insulation, and improved aerodynamics, to minimize the noise impact during operation. Additionally, implementing operational guidelines, such as designated flight paths and restricted noise-sensitive areas, can help manage and mitigate noise pollution. • **Environmental Impact Assessments**: Conducting comprehensive environmental impact assessments and integrating environmental considerations into the planning and decision-making process for eVTOL operations can help identify and address potential environmental risks and impacts. This includes assessing factors such as air quality, biodiversity, land use, and water resources to inform sustainable operational practices and infrastructure development. • **Policy and Regulation**: Governments and regulatory bodies can play a crucial role in mitigating the environmental impacts of eVTOLs. By establishing environmental standards, emissions targets, and noise regulations specific to eVTOL operations, policymakers can ensure that the industry grows in an environmentally responsible manner. Additionally, offering incentives for sustainable practices can drive the adoption of environmentally friendly solutions.

Ecological Systems	Integrating Advanced Air Mobility operations into the U.S. airspace and transportation system holds significant potential for environmental and social benefits. AAM technology offers sustainable and efficient alternatives to traditional transportation modes. However, to ensure responsible and sustainable implementation, it is crucial to evaluate and address the associated environmental impact factors. Greenhouse gas emissions are a key concern. Assessing the potential reduction in emissions compared to traditional modes allows us to quantify the environmental benefits of AAM technology and its contribution to mitigating climate change. Analyzing the effect of AAM operations on local air quality helps identify measures to mitigate air pollution and ensure compliance with air quality standards. Noise pollution is another factor. Evaluating the noise levels generated by AAM vehicles enables us to develop strategies to minimize noise pollution, especially in residential areas. This protects communities from excessive noise disturbances. AAM operations can impact wildlife habitats and ecological systems. Assessing these impacts is crucial to minimize disruption. Evaluating the visual impact of AAM infrastructure enables us to integrate it harmoniously into the surrounding environment. Energy efficiency plays a crucial role. Analyzing energy consumption allows us to identify opportunities for improvement and promote renewable energy sources. Optimizing energy efficiency reduces the environmental footprint of AAM operations.
Public Involvement	Considering the impact on land use and urban development is vital. Assessing these factors prevents encroachment on protected areas and ensures responsible urban planning. Water quality is important. Evaluating the impact on water bodies helps prevent contamination risks. Implementing appropriate measures mitigates adverse effects. Effective waste management is crucial. Proper disposal and management of waste minimize environmental risks. Robust practices ensure responsible handling of AAM-related waste. Social and cultural impacts must be considered. Understanding changes in communities and impacts on cultural heritage sites helps mitigate negative consequences. To ensure transparency and inclusivity, public involvement is crucial. Community workshops, online platforms, stakeholder consultations, public hearings, and Environmental Impact Assessment (EIA) reviews play key roles. These platforms allow individuals to receive information, provide feedback, and address concerns related to AAM integration, with a focus on environmental impacts. Involving stakeholders ensures a comprehensive and considerate decision-making process. Public hearings provide an opportunity for individuals and organizations to express their views. EIA reviews involve the public in assessing environmental impacts and mitigation measures, fostering transparency and accountability. Comprehensive public involvement, including workshops, online platforms, consultations, hearings, and EIA reviews, is vital in successfully integrating AAM operations. By engaging the public, addressing environmental concerns, and considering the needs of communities and the environment, integration can be sustainable and responsible.

17. Alternative Means of Navigation Beyond GPS

Given that these vehicles are expected to operate in urban, suburban, and remote places, reliable and persistent GPS may not be always available. Additionally, AAM are expected to operate in areas where today's radar arrays do not or cannot provide service. What are the most efficient, reliable, and readily available means to provide communication, navigation, and surveillance for AAM in a way that will not disrupt other modes of transportation? Please provide thorough information on alternative options to ensure continuity of navigation using alternative position, navigation, and timing capabilities.	
Use Cases	**Description**

Overview	In the field of AAM, where autonomous and semi-autonomous vehicles are used for transportation, GPS-denied technologies are very crucial to implement for situational awareness and navigation purposes. The prevalent research that is being performed in this field is computer vision. To make computer vision in AAM a GPS-denied technology, you would need to develop and implement approaches that enable computer vision systems to operate independently of GPS signals. Here are a few strategies that can be employed: The systems are capable of feature-based utilization, using distinctive visual features of a given environment to analyze the location of the vehicle. This allows for navigation without GPS by estimating the position relative to the known features. It can also implement landmark detection and recognition which enables positions of buildings, roads, or other urban features, which enables smooth operation without the need of GPS in place. Vast research on vision-based navigation and guidance system shows promising results that can achieve 3-D waypoint tracking integrated with a vision–based obstacle avoidance.
Simultaneous Localization & Mapping	A very efficient technique called SLAM (Simultaneous Localization and Mapping) solely relies on visual data obtained from onboard cameras. The algorithm is capable of mapping the environment while simultaneously estimating the vehicle's position within the given location of the map. This enables autonomous navigation of the vehicle without the need for GPS. In this area, vast research has been done by implementing SLAM by integrating visual data with inertial measurements to simultaneously estimate the map of a given environment. A common feature in most advanced AAM techniques is sensor fusion. The integration of multiple sensors such as accelerometers, gyroscopes, radar, ultrasonic sensors, cameras, and LiDAR enables robustness and high accuracy levels for a computer vision platform. The collected data can then be employed to train models that can self-learn to navigate and localize using visual information. This extracts useful information about landmarks, and features and orients the vehicle accordingly. However, implementing computer vision could be challenging in terms of various factors. It is crucial for the research and development platform in the AAM industry to focus on factors such as weather conditions, occlusions, scene changes and so on. It is often necessary to combine several approaches of sensor fusion and robust algorithms in computer vision to enable a reliable navigation system in GPS denied environments. The following should be considered by the FAA to incorporate the use of SLAM in AAM technology. Research and development areas should be given the utmost discretion. By providing guidelines and specific standards, and developing criteria for the design, development, testing, and operations, certification processes would ensure reliability and safety. Collaborations with academic institutions and industry stakeholders would be very beneficial to further improve the platform for the latest improvements in this technology. This kind of technology is known to be evolving and therefore updating the guidelines by continuous monitoring should be one of the main considerations. Therefore, a preemptive approach should be able to ensure that the regulatory framework keeps pace with the current advancements.
Inertial Navigation System	Near term modern inertial navigation systems (INS) offer an interference free high resolution high accuracy method for GPS denied environments. INS operates in all weather, lighting, and other environmentally harsh situations. INS is self-contained. INS thus can operate in remote undeveloped areas, rural areas, as well as dense urban areas that present complex electromagnetic interference with no degradation in performance or accuracy. A standard operating procedure, whereby known operating points are used to alleviate accumulated drift, ensure INS accuracy. INS coupled or fused with GPS, Vision Systems, WASS, or other current or emerging GNS systems can provide 99.999% reliability and availability while meeting evolving accuracy navigation requirements for AAM. Even though autonomous navigation is certainly considered the path moving forward in the AAM field, an analog to the automotive advanced driver assistance system (ADAS) should be

	considered with respect to the AAM policy. Although it is primarily associated with the automotive industry, similar principles can be extended to enhance the capabilities of autonomous aerial vehicles. Some examples include collision avoidance systems, traffic awareness, path planning, adaptive cruise control, emergency landing systems, and so on. It is crucial to note that regulatory frameworks should be put in place for vehicles equipped with ADAS technologies.
Next-Gen GPS	GPS is a ubiquitous global utility; knowing one's location is critical for all classes of aviation. Still, today's GPS is relatively inaccurate, unencrypted, susceptible to jamming and spoofing, and suffers from significant amounts of multipath interference. These shortcomings make GPS insufficient for tomorrow's safety-critical and high-precision applications like AAM. To address these issues, a new class of commercial GNSS providers are developing a next-generation commercial GPS system and services to provide the performance and reliability necessary to proliferate AAM. The GPS system, inclusive of WAAS, suffers significantly from slow government development timelines and stringent backwards compatibility requirements. These two aspects drastically reduce the program's ability innovate and evolve at the rate necessary to support AAM. With the advent of low-cost high-performance microsatellite technologies and low-cost space launch capabilities, it is now feasible for venture backed commercial entities, like TrustPoint, to develop, deploy, and operate a constellation of spacecraft to provide next-gen GPS like services. Without backwards compatibility requirements, these new commercial systems can innovate across the technology stack to provide high precision, low cost, fully encrypted positioning services that address significant weaknesses and vulnerabilities of the heritage GPS system. Moving up in frequency to C-band, placing the satellites in low earth orbit (LEO) and adding advanced data elements to the navigation messages, these services can reduce multipath effects for low flying vehicles by up to 96%, improve jam resistance by two orders of magnitude, and provide the first commercially available encrypted services to aviation operators. These capabilities have the promise of facilitating CAT III operations of large future AAM fleets with minimal to no remote pilot intervention needed.
Remote Position Authentication	Today, multi-billion-dollar surveillance radar systems provide objective third-party verification of a vehicle's position, which can be used to authenticate a vehicle's self-reported position. However, these radars will not provide adequate surveillance of low altitudes and small platforms with low radar cross sections. This generates a need for a new system or method for 3rd parties (i.e.: ATC or the FAA) to authenticate the flight path and position of AAM platforms operating beyond radar coverage areas. While it is reasonable to assume an AAM vehicle can broadcast or report its GPS based location over a wireless network to ATC, regulators, or other operators as needed, such reporting relies on the platform or platform operator to truthfully report their position. Such reporting can easily be faked to hide unsafe or unregulated operations, which are traditionally mitigated by surveillance radar. TrustPoint, which controls the signal structure of their service, can support this surveillance function with a new category of patent pending service called "Proof-of-Position." This is done by covertly fingerprinting TrustPoint's signals and if done correctly, these fingerprints can be recorded, but not directly observed by AAM systems. These recordings would then be forwarded in real-time to trusted third parties who will have access to secure keys to authenticate those reports independent of the AAM platform's participation or cooperation. In turn these reports can be used to remotely authenticate a platforms position, filling a critical safety gap in airspace management.

18. Overall Functional Architecture

Given that AAM is an ecosystem consisting of aircraft, airspace, enabling communication, navigation, and surveillance technologies, as well as infrastructure, it is important to ensure consistency of assumptions about functions and requirements from each of these components. Please provide information regarding your assumptions about functional capabilities needed for infrastructure, communication, navigation, and surveillance technologies. This will enable the development of afunctional architecture consisting of comprehensive functional requirements and their performance, information exchanges, and various assumptions about roles and responsibilities.	
Use Cases	**Description**
Overview	Given that AAM is an ecosystem consisting of aircraft, airspace, enabling communication, navigation, and surveillance technologies, as well as infrastructure, it is important to ensure consistency of assumptions about functions and requirements from each of these components. Please provide information regarding your assumptions about functional capabilities needed for infrastructure, communication, navigation, and surveillance technologies. This will enable the development of afunctional architecture consisting of comprehensive functional requirements and their performance, information exchanges, and various assumptions about roles and responsibilities.
Overall Architecture	A federated and service based UTM architecture is recommended for AAM, to ensure scalability and foster innovation. Nonetheless, core safety-critical functions may be centralized to facilitate coordination, communication with legacy ATM systems, and enforcement of strict safety standards. A centralized flight information management system (FIMS) may, for instance, act as an interface between a centralized ATM system and a federated set of UTM service providers (UTMSPs). Clear delineation and careful coordination of centralized and decentralized roles is required to prevent bottlenecks and allow for efficient scalability. Furthermore, a federated approach allows individual UTMSPs to make independent decisions on the implementation of specific services. For example, in neighboring geographic areas, one UTMSP may offer a centralized detect and avoid (DAA) service, while another UTMSP relies on the distributed capabilities of individual aircraft. To facilitate seamless operations and avoid unnecessary complexities, clear guidelines must be established. Two approaches can be considered, and must strike a balance between promoting innovation among UTMSPs while ensuring a sufficient level of consistency and interoperability across the ecosystem: • **Vehicle Compatibility**: Guidelines can be developed to describe how vehicles can transition from one UTMSP to another without requiring different underlying vehicle specifications. This ensures interoperability and flexibility for operators, enabling them to choose different UTMSPs while maintaining a consistent level of functionality. • **Baseline Standardization**: A baseline standard can be developed that all UTMSPs must adhere to when implementing various services within the UTM framework. This would define the minimum requirements for interoperability and operational compatibility. It would provide a level playing field for UTMSPs, ensuring a sufficient level of homogeneity in the system while still allowing room for innovation and competition in service offerings. The degree of autonomy of individual vertiports must also be clearly outlined, including standards and procedures on how a vertiport will collaborate with other neighboring vertiports and interface with one or more UTMSPs.

Communication Infrastructure	Effective and uninterrupted communication is essential for safe and efficient AAM operations. Existing digital communication frameworks do not fully meet AAM requirements, potentially necessitating the development of a dedicated digital communication infrastructure. This should leverage a combination of ground-, air-, and satellite-based components for maximum reliability and coverage. Since the provision and maintenance of a robust communication infrastructure for AAM is a significant undertaking, it may be advantageous to outsource this responsibility to an external service provider. Nonetheless, clear functional requirements and guidelines are imperative to ensure sufficient handover speed, throughput, latency, security, and coverage capabilities. Moreover, protocols and interfaces must be developed for timely dissemination on the status of such an infrastructure, which in turn influences the authorization and routing of AAM flights.
Navigation Infrastructure	Accurate and reliable navigation is crucial for AAM, especially in urban canyon environments where GPS struggles to provide the required positioning accuracy. Clear standards should be developed to define timing and positioning accuracy requirements in different operational scenarios. Moreover, distributed information sharing among in-flight vehicles can enhance robustness, particularly for low-cost sUAS. The underlying architecture must strike a balance between ensuring safety through centralized information gathering by UTMSPs, and allowing for distributed vehicle-to-vehicle information sharing when communication with the UTMSP fails, or when high traffic density overloads the underlying infrastructure.
Surveillance Infrastructure	Collaborative surveillance is important for AAM, but primary radar systems remain necessary to detect non-conforming and potentially malicious vehicles. Surveillance systems must also be capable of detecting small objects and birds that may pose hazards to small UAS and AAM vehicles. Furthermore, standard procedures and interfaces with UTMSPs and counter-UAS systems should be defined to adequately manage detected threats and appropriately re-route AAM traffic. Additionally, a dedicated surveillance infrastructure for weather is needed to meet the micro-weather forecasting requirements of AAM.
Cooperative Control Environment	The AAM concept envisions operations occurring in two control environments, the Air Traffic Control Environment (ATCE) and the Cooperative/Corridor Control Environment (CCE). For operations occurring within the ATCE, it is assumed that current information exchange, infrastructure, and CNS requirements will apply (e.g., two-way communication between pilots and ATC, radar transponders, and ADS-B equipage). For operations conducted within the CCE, it is assumed that information exchange, infrastructure, and CNS requirements proposed by industry and approved by the FAA may provide comparable performance to systems required for the ATCE. Planned analyses and live flight demonstrations, as well as potential future work, examining feasibility of increased voice communication latency may be a key consideration for both ATCE and CCE CNS requirements. It is assumed that an AAM functional architecture should consider scalability for increasing levels of autonomy (e.g., evolution of initially crewed operations to autonomous flights), as well as evolution of operational density and locations. A potential consideration for AAM infrastructure (e.g., vertiports or non-traditional takeoff/landing sites) is reliance on more granular, localized weather data (e.g., visibility and winds within urban and suburban environments). Similarly, as operations increase in complexity and tempo, aircraft equipage requirements may evolve to accommodate operations in adverse conditions. Vertiports should be considered as a subset or paired with the Heliport Circular Advisory and other requirements, EB105 should be sunset and incorporated into Heliport AC. Short term (2-3 years) – Procedures and Policy that does not affect rulemaking; Medium term (4-8 years) – Rulemaking; Long Term (8+ years) – New Rulemaking actions that will address gaps and shortfalls in previous iterations, review of safety data and promotion of new activities.

19. Automation Standards

Information on needed consensus areas, standards, and design guidelines related to automation; critical integration challenges with the national airspace system; and data needed or available to inform standards, safety tools, and artificial intelligence/machine learning enabled systems.	
Use Cases	**Description**
Overview	It is clear that the field of Advanced Air Mobility is rapidly evolving and includes a broad spectrum of technologies. These range from fully autonomous systems to more traditional aircraft with enhanced automation features. One of the primary trends in automation standards in aviation is the advent of fully autonomous drones for various use cases. The integration of these autonomous systems into the national airspace system, however, presents challenges. This is due to the need to ensure the safety and efficiency of all airspace users. To address these challenges, a regulatory framework that can adapt to the rapid pace of technological advancement is needed. Existing aviation safety rules cover design, production, operations, and maintenance of civil aircraft, and it would be advantageous to apply these existing rules to new technologies to avoid inconsistencies, redundancy, and complexity. Artificial Intelligence (AI) and Machine Learning (ML) play a critical role in the development of these systems. The EASA recently updated their roadmap to version 2.0 for the incorporation of ML in aviation, which serves as a guide for the development and implementation of these technologies. Moreover, the data required to inform standards and safety tools is vast and varied. It includes everything from operational data such as flight paths and weather conditions to system-specific data like sensor readings and control inputs. Ensuring that this data is collected, stored, and processed in a way that respects privacy and security concerns is another important area for consensus and standardization. The development and implementation of automation standards should be a collaborative effort involving all stakeholders, including regulators, manufacturers, operators, and the public. By working together, we can ensure that the benefits of AAM are realized while maintaining the highest levels of safety and efficiency in our airspace.
Simplified Vehicle Operations	AAM envisions utilizing highly automated electric or hybrid-electric powered aircraft. Such aircraft target simplified vehicle operations (SVO) featuring advanced flight control systems and displays. SVO implementation in AAM will take three stages: short-term, during which pilots will interface with highly automated vehicles to safely navigate the airspace, mid-term, during which more aircraft automation capabilities will be featured and pilots will be required to intervene during uncertain or off-nominal conditions for which the automation may not be able to respond, and long term, during which unmanned AAM missions may be manifested as a result of aircraft technology maturity, requiring no pilot intervention. These stages of AAM automation create a plethora of safety considerations, barriers to integration, and research questions to address to support AAM's safe integration into the US National Airspace. There will be a transformation in the roles of pilots and the roles of automation as AAM advances within these three stages. For instance, pilot roles will gradually shift from manual maneuvering of the aircraft to high-level cognitive tasks such as monitoring, risk management, and decision-making. Thus, it is imperative to clarify and empirically examine the function allocation of roles of the pilot and the automation respectively to ensure optimal performance and maximize the safety of AAM operations. For instance, research has reported that humans struggle with heavy monitoring tasks due to deficiencies such as mind wandering, vigilance decrement, and inattentional blindness. Thus, empirical research is needed to understand the impacts of various function allocation schemes between the human and the autonomy and the associated impacts to safety.

Human-Agent Teaming	Human-agent teaming (HAT) research can be leveraged to help understand the relationship between pilots and automation as it varies per stage of AAM. Automation reliance and trust in automation findings can be replicated for AAM to determine how to foster a symbiotic relationship between pilots and automation and counter possible HAT issues that could rise, such as workload, overreliance, complacency, or distrust in automation by its users. Research implications can be utilized to inform strategies to support effective AAM pilot-automation interactions. As automation increases and takes on more responsibility for varying tasks originally performed by humans, accountability for critical flight decisions is bound to shift accordingly. For instance, automation could be responsible for detection, avoidance, and diversion decisions in unmanned AAM operations. In unfortunate scenarios where events or accidents could arise, regulatory guidance on who holds accountability for the automated decisions is paramount.
Transition from Automation to Autonomy	Automation capabilities in civil aviation are not new. However, the emergence of autonomous capabilities in civil aviation is less common. The transition from automation, which is deterministic in nature, to autonomy, which is non-deterministic, brings with it a plethora of considerations and potential safety concerns, particularly in the context of AAM. The non-deterministic nature of autonomy introduces inherent uncertainties that can be challenging to capture from a regulatory perspective. Some of the key critical integration challenges for autonomy include: • **Common Communication Interfaces**: In order for autonomous systems to be effectively integrated in an AAM context, systems will require some level of commonality in their communication interfaces to ensure information is being distributed and received effectively. • **Data Transparency**: Civil aviation is built on an infrastructure of data and information sharing between flight information services, pilots, air traffic controllers, etc. The implementation of autonomous systems into the national airspace system will require standards around transparency of data required for the effective operation of autonomous systems. • **Management of Data**: Updated and accurate data inputs are critical to ensuring autonomous systems produce optimal, safe, and correct outputs. A good example of this is updating the flight management system database with information such as geographic reference waypoints. • **Defensive Design**: Autonomous systems need to have a means of self-checking or detecting errors and have features to handle detected errors. • **Designing for unpredictability**: Unpredictability will be inherent for most autonomous systems, particularly those with AI or machine learning capabilities. Eliminating unpredictability entirely is not feasible as dynamic environments are exceptionally difficult to model. Standards need to be designed with this in mind.

20. Other Areas of Interest

Respondents are encouraged to identify areas that are not directly identified or not adequately expressed for which inter-governmental coordination is critical to the success of AAM ecosystem.	
Use Cases	**Description**
Scalability	To accommodate the growing number of electric aircraft, it is crucial to establish infrastructure and scalability to accommodate the key challenge with respect to charging the batteries. Some of the current challenges include the charging speed and time, energy density and range of the battery, power grid capacity and stability, and economic viability. Some of the crucial initiatives that the FAA is currently focused on include research and development funding. This should include partnerships with academic institutions to address various challenges. Policies and regulations specific to charging stations are also one of the main areas to focus on.

Pain Points in Vintage Aviation to Avoid	Research performed in this area already shows the current challenges faced by charging stations. A recent research article focuses on challenges with electric aircraft, current battery technologies, and infrastructure deployment. The review on electric aviation 3 focuses on various opportunities in electric aviation methods. While designing a vertiport several key considerations should be made to aid the pain points of a traditional airport: 1) Optimize charging speed by implementing high-speed charging infrastructure suitable for VTOL aircraft. This includes high-capacity charging stations, transferable power storage, battery cooling systems, and intelligent charging algorithms. Additionally, the use of modular battery designs and planned infrastructure placement can further enhance charging efficiency. 2) Focus on an intuitive layout and clear signage within the charging station area. Direct passengers from the vertiport entrance or waiting area through prominent signage and visual indicators that differentiate between available and occupied charging spots. Adequate spacing, user-friendly interfaces, convenient seating, and amenities should also be incorporated to enhance the passenger experience. 3) Provide real-time information through digital displays or information kiosks. This allows passengers to stay informed about charging progress, estimated wait times, and VTOL availability, enabling them to plan their activities accordingly. 4) Integrate a mobile app that enables passengers to check charging availability, reserve spots, and receive notifications when their VTOL is ready for departure. This streamlines the process and reduces physical waiting, providing passengers with greater flexibility. 5) Ensure the presence of trained staff or customer service representatives in the charging station area. They can help, answer questions, and address any concerns, contributing to a positive experience for passengers. 6) Implement a user-friendly payment system that offers various payment options, transparent billing processes, and the ability for users to track their charging expenses. This ensures convenience and a seamless payment experience. AAM Vertiports require charging stations for different types of eVTOLs produced by different manufacturers, all with their own unique chargers. We recommend a solution to either standardize charging port adapters, voltages, and currents, or design charging port stations that are adaptable to the manufacturers. Adaptable charging stations will have switchable voltages, currents, and a selection of charging adapters.
Human-Machine Integrated Intelligence	The basic core of the future AAM workforce development ecosystem must be data-driven, must be connected into all operating platforms for continuous monitoring of performance across all workforce competencies for safe and efficient operations. The outcomes of said ecosystem will be the core learnings of a system that continuously adapts not only to the overall evolution of the system but also to the individuals trained to perform specific functions. The AAM community initial role will be to generate a basic framework for a system that will first define the human needs, the talents required to implement and operate the AAM of the future. Over time this will have to include the competencies and underlying performance norms, the means of achieving interoperability between the platforms, ground stations, air traffic management, the means of developing or extending competencies and the standard associated with them, and last, but not least, developing a workforce that is objectively qualified to achieve readiness to operate the AAM ecosystem, platforms, and support systems. The success of the future advanced air mobility is very much dependent on a well-integrated intelligence that includes both human and machine.

New Competencies for a New Industry	Perhaps one of the most underestimated infrastructure requirements for any advanced industry is that of a well-prepared workforce. In the case of AAM, these are the aviation professionals of the future. Early solutions being deployed in AAM today are traditional training solutions that do not account for the new reality of many new types of platforms, some more exotic than others, that will have to operate in much more restricted airspace, in much more frequently recurring extreme weather events, and with new generations (Gens X, Z) of personnel who should not have to endure training methodologies from past generations. This is especially true for operators of the aircraft (pilots), but it also applies to air traffic controllers, ground crew (maintenance), and any other profession required to support and manage AAM. Effectively preparing the workforce of the future, specifically for professions in complex operating environments such as AAM, need to be competency-driven, adaptive, and personalized. Aviation industry bodies (ICAO, IATA, others) have identified competencies necessary for pilots operating traditional aircraft. This includes technical or hard competencies such as flight handling to soft competencies such as situational awareness, leadership, and communication. Even though all of these are necessary, are applicable, the performance norms underpinning them are insufficient to fully cover the needs of AAM. And they are specific to the operator (pilot). Performance and behavioral norms will have to be developed and proven for all professions in this new AAM ecosystem. For AAM, new technologies will have to be deployed in an ecosystem that is fully digitized, fully integrated and powered by artificial intelligence including Generative AI. Within a generation, AAM will include a complex ecosystem of autonomous and piloted platforms that will have to coexist in the same airspace. This is what authorities have to prepare for and implement including the workforce that will need to manage, operate, and support these systems.

CONCLUSION

The emerging technologies of advanced air mobility require the same leadership components legacy aviation needed in the last century. The successful enabling of commercial and private aviation in the past 100 years had hallmarks of FAA leadership, consistency and scalability of standards, safety research and continuous learning. These qualities, coupled with a vision to always increase the public's confidence in the safety of aviation, are what is needed now.

The FAA was the world's leader in aviation research and standards development for legacy aviation. While our current environment includes others in the world as technological equals, some of the same challenges exist in order for AAM to be enabled. A strength of the U.S. has been consistent and predictable standards and rules across the 50 states. There is no patchwork of safety or airport design. This consistent and reliable approach has created a national airspace system that was scalable and grew in ways that other parts of the world could not replicate. The population density and economic assets, along with the geographic diversity and scale of the U.S., resulted in the largest, most dense, most efficient, and most safe system in the world. If we choose to allow patchwork standards to emerge now for AAM, we won't create the same scalability.

We are already seeing proposed legislation from communities and states that would affect scalability and consistency. The FAA on at least two occasions has had to emphasize their pre-eminence in the role as the airspace regulator. These are signs that we are behind in establishing and communicating the standards. Further ambiguous leadership will allow more conflict to develop and will inhibit the responsible development of AAM – thereby delaying the economic benefits and standard-of-living benefits AAM can achieve.

It is likely in the absence of forthright FAA leadership that we will see vast inconsistencies in community approaches to AAM that may create multiple challenges to standards such as the National Environmental Protection Act. Local approaches to complex airspace access raise topics such as negative visual impacts or other forms of annoyance which may create issues resulting in perpetual litigation.

The underpinning of aviation success in the U.S. will continue to be uniform design standards for facilities, consistent access rules and consistent safety standards. Establishing minimum safety proximities for vehicles is an example area that could transform the current environment with various research papers and commercial developments assuming a wide spectrum of safety levels. It is critical for the U.S. to establish a consistent safety level and predictable standards for industry and for passengers.

Integrating complex topics such as cybersecurity of electronic signals, data formats of electronic information such as vertiport weather and scheduling information, and vehicle-to-vehicle data formats and frequencies requires leadership with the industry community in the near term. Delaying these actions by the regulator means more ambiguity and confusion which will result in more chaotic proposed approaches, and thus more time when the FAA eventually takes the action to organize a consistent U.S. environment. In today's environment we need to move away from equipment-based thinking (radios/radars/NAVAIDs) and instead think about all information as portable. If the entire system is digitized, then the challenge is distributing information to the right operational entity instead of dealing with equipment limitations.

A primary enabling technology area for AAM is the topic of detect-and-avoid. It is critical to narrow and communicate to industry what the FAA approaches might be in order to accelerate the development of these capabilities. It is not the FAA's role to develop these technologies, but it is the FAA's role to lead the information to help industry consistently achieve safety standards that can eventually be approved. There are new realizations as to the limits of human performance in traditional detect-and-avoid applications and with new Artificial Intelligence learning capabilities with cameras, detect-and-avoid may give the FAA an opportunity to increase safety across all forms of aviation with an appropriate focus on how it will work with AAM. As with previously mentioned technologies, a consistent U.S. approach for this will result in accelerated progress.

An additional characteristic of the current environment that illuminates part of the challenge is the FAA's approach towards new vehicles simply having to operate in the old ATC system with all the same rules. These new vehicles offer new opportunities and the capabilities of the vehicles for both Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) operations should be in the early stages of being addressed now. Without this future-focus, it is possible infrastructure will be built that will create very difficult challenges and limit expansion towards IFR operations. If infrastructure compliance requirements are too short-sighted, the role of the regulator will become much more burdensome.

Consistency is the theme. It has been the fabric upon which the U.S. aviation system has thrived in the past 100 years and put the FAA in a global leadership position. That same consistency is required for AAM in order to establish the right safety standards, predictable access for business, valuable services for passengers, economic development for the country, and a safety-based, continuous learning environment for the industry to continue to serve increasing numbers of people.

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CONTRIBUTIONS

Tracy Lamb: Chief Executive Officer, Quantum AI
Don Berchoff: Chief Executive Officer, TruWeather Solutions
Nick Gunady: Chief Executive Officer, Aerovy Mobility
Adolfo Klassen: Chief Executive Officer, Paladin AI
Chris Marot: Chief Executive Officer, HEKA
Diana Wasiuk: Chief Executive Officer, Harris Miller Miller & Hanson
Rodney White: Chief Executive Officer, The Acceleration Agency
Dixon Gourley: Chief Executive Officer, Energy Dynamics Group
Ryan Pleskach: Chief Executive Officer, ResilienX
Andrew Carter: Chief Technical Officer, ResilienX
Patrick Shannon: Chief Executive Officer, TrustPoint
Grant Fisk: former Chief Executive Officer, Volatus Infrastructure
Nicolas Zart: Chief Strategy Officer, Volatus Infrastructure
Amit Choudhri: former Chief Operations Officer, GEMS
Skip Sanzeri: Chief Operations Officer, QuSecure

Greg Dyer: Aviation Director, Jviation – a Woolpert Company
Christopher Schmidt: Vice President of Finance, P17 Solutions
Donald Williams, Jr.: Researcher & Strategist, Gatson-Williams Research Group
Joey Roberts: Innovation & Technology Manager, CrossFlight Sky Solutions
Chris Byars: Program Integrator, Axient
Vivan Amin: Emerging Technologies Leader, L3Harris Technologies
Jason Day: UAS Program Manager, Texas Department of Public Safety
Philip Weissman: Senior Counsel, Clyde & Co US
Stuart Ginn: President, Coalition for Advanced Health Mobility

Fin Bonset: Director of Aviation Services, VHB
Curtis Ostrodka: Director of Smart Communities, VHB
Richard Primeaux: Senior Producer, The Acceleration Agency
Starr Long: Executive Producer, The Acceleration Agency
Victor Meinert: Consulting Partner, The Acceleration Agency
Timothy Middleton: Principal Consultant, HMMH
Philip Soucacos: Senior Program Manager, HMMH
Salim Andraos: Director of Engineering, HEKA
Ken Vilardebo: Director of Operations, HEKA
Trevor Olds: Business Administrator, HEKA
Nivedha Karigiri Madhusudhan: Capture Manager & Mechanical Engineer, HEKA
Chris Zarzar: Director of Weather Strategy & Innovation, TruWeather Solutions
Meghan Conway: Director of Weather Data & Programs, TruWeather Solutions
Meredith Carroll: Director of ATLAS Lab, Florida Institute of Technology
Bhoomin Chauhan: Graduate Research Asst of ATLAS Lab, Florida Institute of Technology
Maureen Namukasa: Graduate Research Asst of ATLAS Lab, Florida Institute of Technology
Kendall Carmody: Graduate Research Asst of ATLAS Lab, Florida Institute of Technology
Chris Fernando: AAM Industry Liaison, Florida Institute of Technology

AAM Institute Research Council scholars:

- Nabil Hagag, German Aerospace Center (DLR)
- Alyssa Sperrazza, University of Oklahoma College of Law
- Christopher Conrad, Cranfield University Aerospace Engineering Department

Jeenho Hahm: Vice President of Communications, AAM Institute
Jennifer Meszaros: Liaison to Cambodia, AAM Institute
Katherine Ayre: Liaison to Canada, AAM Institute
Veruska Mazza Rodrigues Dias: Liaison to Germany, AAM Institute
Zena Assaad: Liaison to Australia, AAM Institute

BACKGROUND

Advanced Air Mobility (AAM) is an emerging field in which novel aircraft currently in design and testing could provide new levels of accessibility, convenience, and connectivity for people and cargo—and thus transform our nation's transportation system to provide enhanced mobility for the traveling and shipping public. AAM aircraft—typically incorporating electric and hybrid-electric propulsion with vertical or short takeoff and landing capability—could greatly expand the reach and efficiency of current transportation networks by providing, among other things, shuttle services between airports and downtown locations, more dynamic and affordable medical evacuation and emergency response, rapid transportation of goods between cargo terminals and job sites, and on-demand air services between regions without existing rapid, reliable transportation links.

Provided that governments and industry work effectively together to deliver affordable and inclusive services to a broad range of the traveling and shipping public, the prospective benefits of this new and transformative technology could be significant, including expansion of existing aviation services nationwide, reduction in carbon emissions versus current forms of transportation, improved safety and simplicity of maintenance and operations of aircraft, new jobs and career fields in advanced technology, and reduced noise impacts versus traditional aviation. However, as with any new technology, AAM also introduces a series of challenges affecting multiple government and non-government stakeholders, such as ensuring the continued safety and security of the airspace, the security of aviation networks, fully understanding and developing infrastructure requirements, and ensuring input from local communities. The rapid emergence of AAM is already challenging existing regulations and practices of all Federal departments and agencies that are responsible for aviation, communications, defense and security, global affairs, and infrastructure development.

In October 2022 Congress passed, and the President signed, the "Advanced Air Mobility Coordination and Leadership Act" ("the Act"), which requires the Department of Transportation to form an interagency working group (IWG) to develop a national AAM strategy by 2024. The purpose of the strategy is to ensure the Federal government, in partnership with State, local, and Tribal entities, is ready to work with and oversee the AAM industry, including developing new transportation options, amplifying economic activity and jobs, advancing environmental sustainability and new technologies, and supporting emergency preparedness and American competitiveness so that the United States continues to lead the world in aviation into the 21st century.

The DOT established and is leading IWG as outlined in the Act. Safety is the highest priority of the DOT and the Federal Aviation Administration (FAA). Currently, DOT and FAA are working to develop and communicate to the public its regulatory concept of operations to safely enable AAM operations. AAM operations will typically start as piloted flights using traditional air traffic control procedures and existing regulatory structures. However, more ubiquitous and economical AAM operations are expected to require development of new technologies, procedures, and regulations that incorporate highly automated, unpiloted aircraft flying at lower altitudes with smaller areas of separation than in current operating environments. Given the importance of safety and security to the success of a future AAM system, the DOT requests comments on safety challenges and related subjects in response to this RFI. The DOT seeks comments specifically addressing public acceptance of AAM operations and the appropriate means of public engagement necessary to enable AAM operations in the future. The FAA will also continue to share information with industry and stakeholders to produce and iterate upon an AAM Concept of Operations for the national airspace. The AAM IWG will produce a comprehensive national strategy with a focus on interagency, multi-modal, global leadership, and intergovernmental cooperation issues, with the objective of identifying challenges that must be overcome by federal agencies for a successful AAM system to develop in the United States.