Advanced Air Mobility (AAM) Implementation Plan

Near-term (Innovate28) Focus
with an Eye on the Future of AAM
Version 1.0 / July 2023

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1 Advanced Air Mobility

Transportation is constantly evolving, and each step forward yields new opportunities that fundamentally change how people and goods are being transported. A new era of aviation once only portrayed in movies or science fiction is taking off. Advanced Air Mobility (AAM) is an emerging aviation ecosystem that leverages new aircraft and an array of innovative technologies to provide the opportunity for more efficient, more sustainable, and more equitable options for transportation.

1.1 AAM Definition

As defined in the AAM Coordination and Leadership Act (P.L. 117-203, 136 Stat. 2227), October 17, 2022, "AAM is a transportation system that moves people and property by air between two points in the United States (U.S.) using aircraft with advanced technologies, including electric aircraft, or electric vertical takeoff and landing (eVTOL) aircraft, in both controlled and uncontrolled airspace." For purposes of this Implementation Plan, however, the scope of AAM is limited to those engaging in passenger-carrying or cargo operations with a pilot on board.

1.2 AAM Integration into the National Airspace System

The Federal Aviation Administration (FAA) has a long, successful history of bringing new technologies safely into aviation. The agency's role in integrating AAM into the National Airspace System (NAS) is to ensure this new generation of aircraft maintains the highest level of operational safety that defines commercial aviation today. The FAA's top priority and statutory responsibility are to ensure the safety of the traveling public. The agency is

looking at every necessary aspect to support AAM flights: the aircraft itself, the framework for operations, access to the airspace, operator training, infrastructure development, environmental impacts, and community engagement.

As these aircraft are being developed, the FAA will amend, as appropriate, operational rules and pilot training requirements. Longer term, the agency will develop permanent regulations to safely enable powered lift operations and pilot training and certification.

The FAA is implementing a crawl-walk-run methodology that recognizes early opportunities to support Entry into Service (EIS) operations through existing services and infrastructure with minimal changes. The agency is doing this while developing a path to implementation of more advanced concepts and capabilities to support increasing scale and automation of AAM operations, as well as integration with other types of aircraft operating in the NAS.

To address the development of a near-term ecosystem, the FAA created Innovate28 (I28), a joint government and industry initiative that will culminate in integrated AAM operations at one or more key site locations by the 2028 timeframe. The FAA also recognizes and has begun executing the collaborative actions needed to mature AAM concepts, operations, and regulatory frameworks beyond initial operations and into the mid-term and mature state phases (see Section 7). This Implementation Plan shows how the agency expects all these pieces to come together to allow the industry to scale safely.

1.3 Stakeholder Collaboration

Operationalizing AAM in the NAS and establishing timelines from EIS to operations at scale requires collaboration with, and commitments by, many stakeholders to ensure safe, efficient, and equitable operations, including:

Federal Aviation Administration

From a federal level, the FAA has sole and exclusive authority over all aviation safety aspects of AAM integration, including operating rules, aircraft certification, and pilot certification. The agency provides a leadership role in identifying and integrating the responsibilities of all the key actors and stakeholders. The FAA develops and processes all certification, policy and procedures, rulemaking, and regulatory activities to ensure safety of flight, and strives to ensure that industry (including original equipment manufacturers (OEMs), aircraft operators, and vertiport operators) and local, state, and tribal governments can accommodate AAM operations and plan accordingly.

In support of I28, the FAA established internal workstreams, called iTeams. These teams are dedicated to addressing major focus areas for AAM integration, including Certification, Airspace and Air Traffic Management, Infrastructure, Environment, Hazardous Materials Safety, and Community Engagement, to ensure a coordinated approach for I28 operations.

Other Government Agencies

The FAA is leveraging existing programs and research conducted by other government agencies to integrate AAM more rapidly into the NAS, including the National Aeronautics and Space Administration (NASA), U.S. Department of Transportation (DOT), Department of Defense, and others. For example, through the FAA's extensive AAM-focused partnership with NASA's AAM Program and the National Campaign and collaboration with the U.S. Air Force AFWERX Prime programs, the FAA is able to leverage the research, data, and testing experience in the shared mission to safely integrate AAM aircraft.

In addition to collaboration at the federal level, the FAA is engaging with local, state, tribal, and territorial governments that have vested interests in making decisions to ensure safe and successful AAM operations from local and regional planning, power infrastructure, intermodal transportation, and community perspectives. These entities will likely be responsible for the coordination, logistics, zoning, licensing of infrastructure, and the community engagement necessary to support AAM operations.

Inter-Agency Working Groups

The FAA participates in several inter-agency AAM groups, including the DOT AAM Interagency Working Group, which was established by the AAM Coordination and Leadership Act. Much like the FAA iTeams' structure, the DOT AAM Interagency Working Group is coordinating efforts related to safety, operations, infrastructure, physical security and cybersecurity, and federal investment necessary for maturation of the AAM ecosystem in the U.S. They are focused on ensuring cohesive and consistent Executive Branch-wide policy through a collaborative and proactive approach that supports the FAA's integration of AAM into the NAS.

The FAA also participates in the newly-formed International Civil Aviation Organization (ICAO) AAM Study Group. The 41st ICAO Assembly recognized that the rapidly evolving AAM ecosystem requires a globally harmonized operational and regulatory framework and guidance. ICAO provides the forum for 26 international stakeholders to develop a holistic vision and framework to achieve global harmonization and interoperability of AAM implementation, allowing all countries to benefit from the AAM operations. The FAA and other government agencies participate in all relevant ICAO technical panels that will ultimately work on international standards and recommended practices for AAM as the specific work is forwarded for their action from the AAM Study Group.

AAM Operators and Manufacturers

Companies developing or operating AAM aircraft are key stakeholders in the integration process. These companies will need to work with government agencies to bring forward the use cases and locations of interest, obtain necessary certifications and approvals, and ensure that their aircraft and operations meet safety and regulatory requirements. They will also need to consider the environmental impacts of their aircraft and operations, engage with relevant communities, and minimize environmental and other impacts on communities.

Infrastructure Providers

Any time new transportation is introduced, communities must plan for the integration of those operations either within existing infrastructure or through the development of new facilities. Companies that provide charging stations, vertiports, and other infrastructure necessary for AAM operations will also play a role in integration. Providers of private infrastructure that do not require FAA approval will, in particular, need to engage with relevant communities, minimize environmental and other impacts on communities, and foster community support.

Communities and the Public

As AAM aircraft begin to operate in urban areas, communities and the general public will be affected by these new technologies, capabilities, and services. Community involvement is the process of engaging in dialogue and collaboration with communities affected by FAA actions. This process supplements the public involvement activities required under other laws or requirements. Public engagement and education through involvement of all stakeholders will be necessary to ensure that communities understand the benefits and impacts of AAM operations, and to address any concerns they may have. The AAM industry offers the prospects of convenient alternatives to traditional transportation, as well as increased access to air transportation. However, for this emerging industry to reach its fullest potential, it must gain the support of the general public. The FAA encourages communities to get involved now in these early phases, and to stay engaged.

2 Introduction to Innovate28

On May 3, 2023, the FAA released Version 2.0 of the Urban Air Mobility (UAM) Concept of Operations (ConOps) that describes the technical roadmap for enabling UAM, which is an urban-focused subset of AAM, from the near-term to far-term. The focus of this Implementation Plan, Version 1.0, is to document the work required to enable initial AAM operations in a variety of operational settings or “key sites” in the near-term.

Initial Integration of AAM Operations at One or More Key Sites

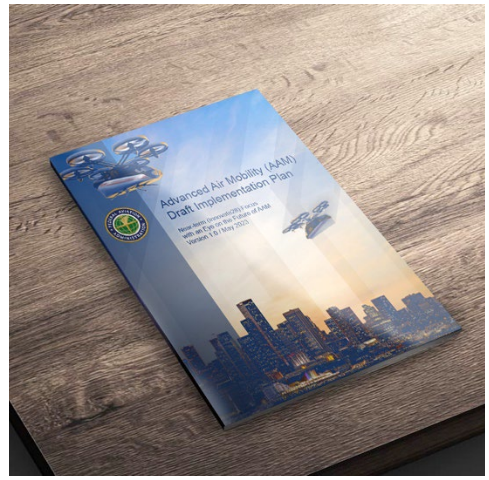
Innovate28 (I28) is an FAA initiative that will culminate in integrated AAM operations with OEMs and/or operators flying between multiple origins and destinations at one or more locations in the U.S. by 2028. I28 marks one milestone on the AAM evolutionary continuum and the path to full integration and operations at scale across the NAS. I28 will leverage public-private partnerships to identify key locations and use cases of interest to AAM industry stakeholders while promoting an all-hands-on deck approach to ensure the necessary steps are taken to enable these operations. Leveraging lessons learned from OEMs and/or operators conducting individual EIS building block operations, I28 operations are expected to be larger in scale than initial EIS operations. I28 is intended to result in “leave behind” processes, infrastructure, procedures, and local knowledge at the key site(s). Additionally, the collective experience gained through the I28 initiative is expected to support expanded operations in other areas of the country.

Repeatable Implementation Methodology

The I28 implementation approach includes documenting steps and protocols and collecting data over the course of the effort to develop a repeatable methodology, including processes, procedures, and mechanisms, for expanding AAM operations to other locations across the NAS. This methodology will be used as a guide for future sites to collaborate with the FAA and other stakeholders to streamline implementation of AAM solutions. The FAA will also leverage the I28 efforts, as well as the EIS building blocks, in its ongoing work to evolve and advance AAM into the future.

3 Implementation Plan Overview

This AAM Implementation Plan is a living document that will guide implementation efforts and mature as the FAA works with stakeholders to refine and execute AAM implementation strategies. It will be updated periodically to reflect the continued plans and progress with AAM integration, roadmaps, and schedules for I28 and beyond as work continues to advance towards the mature state vision of AAM operations across the NAS.



Version 1.0 provides details for the near-term I28 initiative, which will enable a repeatable AAM ecosystem at key locations based on information known to date. The evolution of AAM beyond I28 is also previewed. Version 1.0 specifically addresses the following:

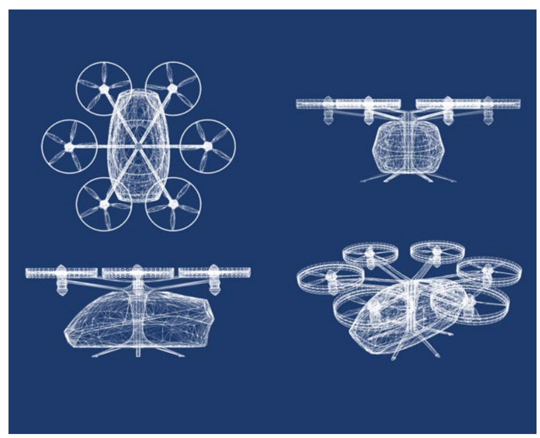
- **I28 Key Site Operations**
  - Description of the operating environment in 2028 based on assumptions and expectations of AAM aircraft and operations, including a scenario thread for a generic key site location
  - Overarching framework that FAA stakeholders can use to identify and work through key challenge areas, executing to a common vision
- **I28 Workstreams**
  - Holistic approach to the required efforts, both internal and external to the FAA, needed to meet I28 goals (presented in Section 2)
  - Descriptions of work completed to date and gaps to be addressed in Certification, Airspace and Air Traffic Management, Infrastructure, Environment, Hazardous Materials Safety, and Community Engagement
- **I28 Integrated Master Schedule**
  - Detailed schedule across workstream focus areas that supports I28 operations and leave behind processes
  - Tool for tracking the milestones of internal and external stakeholders (e.g., tribal/state/local government, and industry) who manage their own activities relevant to implementation at specific site(s)
- **AAM Evolution Framework**
  - High-level view of the evolution of AAM operations and an associated framework for the continued development and commitments that are needed to advance AAM integration in the NAS

4 Innovate28 Key Site Operations

The I28 initiative envisions a near-term AAM operational ecosystem that has advanced from EIS at various locations to substantive presence at locations of interest. Since AAM aircraft are currently undergoing or are being planned to undergo the certification process, and specific operational needs are still being defined, it is necessary to make assumptions as to how the AAM industry will operate and what the supporting capabilities will be in 2028. The I28 key site operations presented here are based on industry and FAA projections on the state of technology development, air and ground supporting infrastructure and services, and other capabilities. These assumptions will continue to be updated in future versions of this document as the industry advances and regulations are developed.

The following addresses the assumptions and expectations about AAM aircraft with respect to certification and operating characteristics. I28 AAM operations are then described in the context of the operating environment, including flight operations, airspace usage and route structure, air traffic control (ATC) services, and infrastructure. A scenario thread is also presented for an I28 AAM operation.

4.1 AAM Aircraft



For I28, AAM aircraft will be authorized for piloted operations and will transport passengers and/or cargo within the limits of the aircraft and certification regulations. The aircraft are expected to range in size from single passenger to larger occupancy shuttles, and employ new means of propulsion (e.g., electric motors, hydrogen fuel, hybrid designs). Many are capable of vertical takeoff and landing (VTOL) or short takeoff and landing (STOL) operations and quickly transition to fixed-wing operation after takeoff. It is assumed wake characteristics will be known, including the impacts of wake from other aircraft on AAM aircraft and an AAM aircraft's own wake generation.

AAM aircraft are expected to be type certificated as special class under 14 Code of Federal Regulations (CFR) § 21.17(b). Because these aircraft have novel airframes and powerplants, the FAA is using many of the performance-based regulations in 14 CFR part 23, *Airworthiness Standards: Normal Category Airplanes*, for the certification basis. AAM commercial operators are expected to be certified to operate under 14 CFR part 135, *Operating Requirements: Commuter and on Demand Operations and Rules Governing Persons on Board Such Aircraft*. Pilots of powered lift aircraft are expected to be rated (type rated as required) for each powered lift aircraft they fly, and they will be required to meet updated qualification requirements for operating under part 135.

AAM aircraft are expected to operate under part 135, including seeking FAA approval for the carriage of dangerous goods and hazardous materials, consistent with the aircraft's type certificated operating weight to include passenger carriage or cargo capability and their frequency of operations. These operations must be part of the operator's FAA approved Dangerous Goods program and further authorized within the operator's Operations Specifications.

4.2 AAM Operations

The descriptions of I28 AAM operations in this section are agnostic to location. As key sites are identified, site-specific airspace and air traffic management (ATM) solutions will be developed for operations within defined geographical areas based on AAM operator use cases.

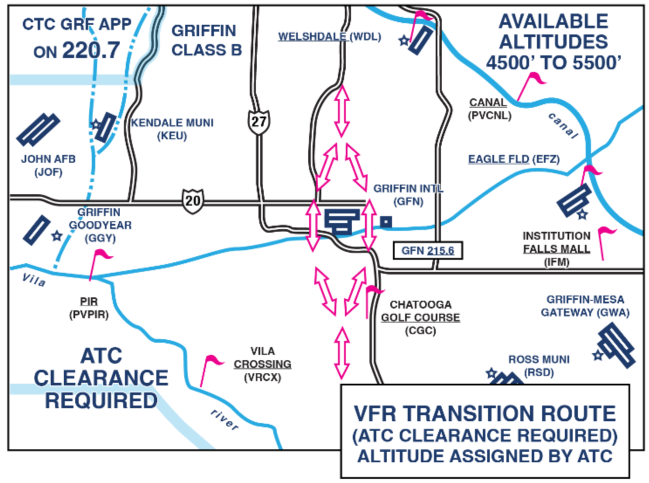
Airspace Usage and Route Structure

AAM operators are expected to comply with existing communication, navigation, and surveillance (CNS) requirements for the airspace in which they will operate. For I28, the expectation is that the aircraft will operate from the surface to 4000' above ground level in urban and metropolitan areas, and in relatively close proximity to or directly on airports. This means that AAM aircraft will operate predominately in or around Class B and C airspace.

To operate within Class B airspace, pilots must receive ATC clearance, and aircraft are required to be equipped with an operating two-way radio, Automatic Dependent Surveillance – Broadcast (ADS-B) Out, suitable navigation capability, and an operable transponder with altitude reporting capability. Initial AAM aircraft operations are generally expected to operate in compliance with Visual Flight Rules (VFR) weather minima in visual meteorological conditions (VMC).

VFR aircraft operating within Class B airspace receive separation services from ATC. VFR aircraft may obtain an ATC clearance to transit Class B airspace, if needed, however, the FAA encourages VFR pilots to operate above or below, or transit Class B airspace using established VFR corridors. To operate within Class C airspace, pilots must initiate two-way radio communications prior to entry and maintain communications while in the airspace. They must also be equipped with a two-way radio and an operable transponder with altitude reporting capability.

The addition of AAM operations will add to the already busy traffic levels of Class B and C airspace. In cases where existing VFR procedures do not meet the needs of air traffic facilities or AAM operators, special agreements or coordination may need to occur to accommodate the increase in traffic levels. Ideally, agreements made at the local level will reduce ATC workload.



Charted routes will be the primary routing structure used by AAM aircraft. This approach enables the FAA to develop routes that accommodate AAM operator needs while leveraging the existing design and charting processes. The development of airspace route structures for I28 operations will consider design standards based on 14 CFR parts 135 and 91, *General Operating and Flight Rules*, local procedures, terrain, and traffic flows. Pilot adherence to charted I28 routes and the recommended altitudes or flight ceilings associated with them are voluntary. However, ATC may assign charted routes and altitudes where pilot compliance is required, provided such procedures are called for in specific FAA-operator Letters of Agreement (LOAs), or are necessitated by traffic density and/or safety considerations. ATC may also restrict operations within designated operating zones when certain criteria are met, and as requested by the appropriate authorities. Noise and other environmental considerations are accounted for in the airspace design. Changes to airspace design and/or new routes will likely require the FAA to conduct environmental review and community outreach.

I28 AAM routes will be designed for use in VFR conditions only, and where possible, use existing or modified low altitude VFR routes and constructs. While these routing constructs do not inherently provide separation or segregation of participating AAM traffic, they are developed to assist pilots in avoiding major controlled traffic flows. The routes[1] may include:

- **VFR flyways** - General flight paths not defined as a specific course, for use by pilots in planning flights into, out of, through or near complex terminal airspace to avoid Class B airspace. An ATC clearance is not required to fly these routes.

- **VFR corridors** - Airspace through Class B airspace, with defined vertical and lateral boundaries, in which aircraft may operate without an ATC clearance or communication with ATC.

[1] *https://www.faa.gov/air_traffic/publications/atpubs/aim_html/chap3_section_5.html*

- **VFR transition routes -** Specific flight courses depicted on a terminal area chart for transiting a specific Class B airspace. These routes include specific ATC-assigned altitudes, and pilots must obtain an ATC clearance prior to entering Class B airspace on the route.

- **Special flight rule areas** - Airspace of defined dimensions, above land areas or territorial waters, within which the flight of aircraft is subject to the rules set forth in 14 CFR Part 93, unless otherwise authorized by ATC.

I28 AAM routes may include non-published routes. They may also require development of new routes. More information is needed to make this determination; it may be a combination of existing and new route structures until a specific AAM route process can be developed. It is important to note, however, that no unique AAM airspace structures (e.g., dedicated AAM airspace corridors) or procedures are expected to be implemented by this 2028 timeframe.

Efforts will be made when developing and designating AAM routes to ensure, to the extent possible, that the flow of AAM traffic does not negatively impact or interfere with other air traffic flows or other airspace available to ATC today. In some cases, this may be unavoidable, and operational efficiency will need to be considered. As previously noted, these routing constructs do not inherently provide separation or segregation of AAM traffic, therefore see-and-avoid will continue to be the primary means of aircraft separation.

Air Traffic Control Services

For I28, ATC services will be provided to AAM operators as needed or required and are defined in FAA regulations, directives, and agreements (e.g., FAA Order Joint Order (JO) 7110.65, *Air Traffic Control*, LOAs, Memorandums of Understanding (MOU), Notices to Air Missions (NOTAM), and Advisory Circulars (AC)). AAM operations may require an LOA covering local procedures or routes, establishment of reserved discrete beacon codes, and use of abbreviated call signs.

The following lists the expectations of ATC and OEMs/operators with respect to operations at designated key site locations.

- AAM operators comply with the appropriate CFR pertaining to ATC or apply for a waiver/exemption.

- AAM operations are expected to be conducted with flight schedules that are predetermined. Schedules are provided in advance of operations and coordinated with local ATC and all other identified stakeholders.

- The pilot has two-way radio communication with ATC when required.

- VFR aircraft operating within Class B airspace receive mandatory traffic advisories and safety alerts, as well as separation services where required.

- VFR aircraft operating in Class C airspace receive sequencing services and ATC separates IFR aircraft from the VFR aircraft. VFR aircraft receive traffic advisories and safety alerts. VFR pilots retain responsibility for their separation.

- In other airspace, ATC provides oversight with traffic advisories and safety alerts, but the pilot is responsible for separation.

- AAM aircraft operators are not guaranteed ATC flight following services outside of Class B, C, or D airspace where mandatory air traffic services are not required.

- Air traffic automation is as it currently exists.
    - There are no expected major changes to ATC automation systems within the 2025 to 2028 timeframe to support I28 operations.

- Third-party service providers may support non-safety critical aspects of operations (e.g., operator scheduling of flights), but not substitute for ATC services where required by rule.

- Existing communication methods are used for pilot-controller communications for AAM VFR operations.

Infrastructure

Initial AAM operations in the 2025-2028 timeframe are expected to primarily use existing airports and heliports (with modification where required to meet FAA's interim guidance for vertiport design). Greenfield or infill (repurposed) development for new vertiports is also expected to connect operations to destinations near a city center or other preferred locations. It is unlikely, but possible, that specially built vertiports will be available in this timeframe. Modifications may be required for existing ground and air infrastructure due to the nature of these new aircraft. For example, if heliports are used as vertiports, they require the following infrastructure to successfully operate in the 2025-2028 time:

- *Adequate AAM aircraft parking zones for loading/unloading.* An efficient vertiport has parking zones that are separate from the "pad" that is used for takeoff and landing. Separate parking zones allow for safe entrance and egress of passengers. They also allow for parking of vehicles waiting for demand to materialize.

- *Infrastructure sizing, dimensional geometry and load bearing requirements modified to comply with FAA* Engineering Brief (EB) #105, Vertiport Design (September 21, 2022). The dimensional and sizing requirements for vertiport landing and safety areas may warrant differences from heliports based on the design and performance characteristics of AAM aircraft.

- *Charging stations.* Safe rapid charging stations for electric batteries are present at vertiports as well as adequate cooling stations and hazardous materials (HazMat) lockers/storage for batteries and fire suppression for battery fires. Sufficient amperage is available to reduce recharging time to the minimum.

- *Weather station.* The vertiport has a weather station, possibly an Automated Surface Observing System (ASOS) or Automated Weather Observing System (AWOS), if it is remote from an airport. AAM pilots need to know wind speed and direction, as well as visibility, when planning an arrival or departure. Vertiports co-located with an airport can use the airport's weather system.

- *Fire management services.* The vertiport has access to fire management services with personnel trained in handling electric/hydrogen fueled fires.

New vertiport facilities follow the guidance in FAA EB #105, Vertiport Design. FAA vertiport guidance is updated over time to address the variety of aircraft and operations seeking EIS.

- Airport sponsors or proponents submit a Form 7460-1, *Notice of Proposed Construction or Alteration*, in accordance with 14 CFR § 77.9 for any proposed on-airport (or on-heliport) vertiport support infrastructure (e.g., charging stations, fueling stations, AAM terminal). Airport sponsors with federally obligated facilities, which are airport sponsors who have accepted federal financial assistance, must also conduct proper planning activities including an update to their FAA-approved Airport Layout Plan.

- Sponsors of non-federally obligated facilities or proponents of a new vertiport facility not on or co-located with an existing federally obligated airport or heliport submit a Form 7480-1, *Notice of Landing Area Proposal*, at least 90 days in advance of the day that construction work is to begin on the landing area. This notification to the FAA is required in accordance with 14 CFR part 157, *Notice of Construction, Alteration, Activation, and Deactivation of Airports*.

New vertiport facilities that require approval and/or funding from FAA will undergo FAA environmental review. Facilities that do not require FAA approval or funding may be expected to engage in community engagement consistent with any applicable local rules.

All non-FAA stakeholders will have agreed to established criteria for ground infrastructure, including: vertiport location, charging, cooling, maintenance, security, ground safety, and parking in accordance with federal regulations where applicable. Take-off and landing from the Touchdown and Liftoff Area (TLOF) is recommended for approach and departure operations from a standalone vertiport or vertistop (vertiport with limited services). It is unlikely that AAM operators will use "hover taxi" to taxi or re-position on the airfield due to anticipated battery limitations.

Security

Security is a key component to the safe and secure integration of AAM. However, AAM presents unique challenges for aviation security. Therefore, a Working Group under the broader DOT-lead Interagency Working Group previously discussed was established to focus strictly on security issues to inform the whole of government strategy for addressing the integration and evolution of AAM as required in the AAM Coordination and Leadership Act.

4.3 I28 Scenario

The following provides a glimpse of what I28 might look like once an AAM aircraft has successfully completed the certification processes (including wake turbulence classification)[2] and is ready to fly. This scenario sequence reflects the use of designated operating areas, to include landing and departure areas, other existing infrastructure, services, and existing policies and procedures to the degree possible. LOA negotiations between air traffic, OEMs and operators, airport operators, port authorities, emergency management services, and federal, tribal, state, and local law enforcement organizations establish the processes and procedures for safe and efficient operations.

This simplified thread steps through an I28 AAM operation departing a vertiport in uncontrolled airspace and landing at a tower-controlled airport in controlled airspace:

1. The pilot follows established procedures for checking weather and NOTAMs for departure, en route, and destination, and files a flight plan if required. While passengers prepare to board the AAM aircraft, the pilot conducts aircraft walkarounds, preparations, safety protocols, and departure checklists.

2. Departing in uncontrolled airspace, the pilot is responsible for adhering to appropriate rules governing flight in uncontrolled airspace. The pilot announces their departure intentions over a common radio frequency and maneuvers the aircraft to the takeoff location. After visually ensuring their departure area and path is clear, the pilot departs.

3. The pilot is aware of the requirements for flight in controlled airspace. The aircraft enters controlled airspace by means of two-way radio communication and the appropriate clearance from ATC. Published procedures or agreements (national, local, or signatory) reduce the need for ATC communications.

4. ATC issues instructions or clearances to provide separation and/or sequence the aircraft with other traffic. The pilot on board complies with instructions given by ATC or follows previously coordinated and approved instructions from the approving ATC facility (via published procedures or agreements).

5. ATC transfers control and communication from controller to controller as the aircraft transits different ATC sectors. After the pilot obtains information on destination runway(s) in use, weather, and other pertinent airport information, they start their approach to the landing site or follow a previously approved approach path. The ATC tower issues a clearance to land. The pilot may ask and be permitted to land at airport areas other than runways and taxiways.

[2] *Without wake turbulence classification, ATC is required, per FAA JO 7110.65, to provide the existing maximum wake turbulence separation in Class B airspace (10 nautical miles in front and behind the aircraft), including VFR aircraft.*

6. The pilot on board completes landing checklists, their approach, and safe landing at a new, existing, or predetermined approved landing site. The aircraft is maneuvered to the approved parking area for deplaning.

7. Passengers and crew follow established procedures for deplaning the aircraft. Following prescribed security procedures, the passengers exit the area or are directed to any further security screening required to enter the secure terminal area for connecting flights.

This is a high-level view of I28 operations and the near-term integration phase. The assumptions, expectations, and nature of operations will evolve over time to reflect the technology and infrastructure advancements that will provide increased scalability and types of operations.

5 Innovate28 Workstreams

The FAA is taking a holistic approach to the efforts required for AAM implementation. The I28 leadership team in the NextGen organization (ANG) established iTeams comprised of representatives across FAA lines of business (LOBs) to bring together expertise in different areas associated with AAM implementation and foster collaboration in the planning and execution of required activities. The iTeams represent the major workstreams associated with AAM implementation, including Certification, Airspace and Air Traffic Management, Infrastructure, Environment, Hazardous Materials Safety, and Community Engagement.

This section addresses each workstream and describes the activities completed or underway, as well as gaps to be addressed, to support near-term I28 implementation goals. Integrating this information supports the development of a coordinated roadmap to I28 AAM operations. While the initial focus is on enabling near-term AAM operations, the work efforts and milestones within these workstreams will continue beyond I28 to support the continuous evolution of AAM.

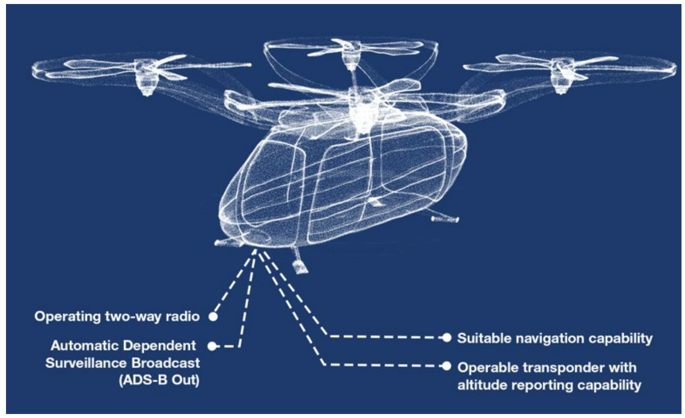
5.1 Certification

The FAA has a proven track record of safely certificating and integrating new and novel design features, aircraft, and safety-enhancing technologies into the NAS. New AAM aircraft are expected to offer capabilities ranging from single-pilot, recreational eVTOL aircraft, to piloted, powered lift, multi passenger short range aircraft. The type certification of AAM aircraft is possible because the FAA can leverage the current regulatory framework, which allows development of project-specific requirements tailored to fit the unique aspects of novel designs. The flexibility to tailor requirements can come in the form of special conditions or unique airworthiness criteria under a special class, depending on the AAM design (airplane, rotorcraft, or powered lift).

5.2 Operational Suitability

As AAM aircraft near issuance of their Type Certificate, the OEM will engage with multiple boards within the FAA's Flight Standards Service (AFX) to conduct operational suitability reviews. It is during this process that the Flight Standardization Board will determine the aircraft type rating, the Maintenance Review Board will determine the scheduled maintenance taskings for development of an operator maintenance program, and the Flight Operations Evaluation Board will determine the requirements of the aircraft's master minimum equipment listing. The applicant may also apply for any needed regulatory exemptions during this process.

5.2.1 Operations Certification



To satisfy regulatory responsibilities and promote convergence, AAM industry engagement concerning operations certification will resemble a mix of traditional aviation with one-on-one engagement combined with utilization of existing and/or new forums that invite FAA-industry (e.g., standards development organizations) collaboration. In other words, the FAA will use normal processes with a mix of one-on-one outreach with individual applicants, and larger groups via forums to achieve a successful collaboration. This is a key procedural step in setting common expectations across the industry.

The FAA is engaged in rulemaking to enable AAM operations. The efforts are currently oriented around piloted operations, and in the interim the agency expects to use waivers, deviations, and exemptions as appropriate for initial operations. For AAM operations to be successful in 2028, it is important to connect, as seamlessly as possible, the interim methods with proposed rulemaking (and an overall framework, including external and internal guidance) as operational experience accrues.

Rulemaking Activities

Integration of Powered Lift: Pilot Certification and Operations: Publication of a Notice of Proposed Rulemaking (NPRM) is expected in June 2023. This action proposes an SFAR for alternate eligibility requirements to safely certificate initial groups of powered lift pilots, as well as determine which operating rules to apply to powered lift aircraft on a temporary basis to enable the FAA to gather additional information and determine the most appropriate permanent rulemaking path for these aircraft.

Recognition of Pilot in Command Experience in the Military and Air Carrier Operations: The final rule was published on September 21, 2022. This action extended the 500-hour credit military pilots of fixed-wing airplanes can use towards the 1,000 hours of air carrier experience to pilots of powered lift aircraft operations. This allows credit for select military time in a powered lift aircraft flown in horizontal flight towards the 250 hours of airplane time as pilot in command (PIC), or second in command performing the duties of PIC, required for an airline transport pilot certificate.

Update to Air Carrier Definitions: This NPRM was published on December 7, 2022, with comments submitted by February 6, 2023. This action proposes to amend the regulatory definitions of certain air carrier and commercial operations. The proposed rule adds powered lift to these definitions to ensure the appropriate sets of rules apply to air carriers' and certain commercial operators' operations of aircraft that FAA regulations define as powered lift. The FAA also proposes to update certain basic requirements that apply to air carrier oversight, such as the contents of operations specifications and the qualifications applicable to certain management personnel. In addition, this action proposes to apply the rules for commercial air tours to powered lift. This proposed rule is an important step in the FAA's integration of this new entrant aircraft in the NAS.

Airman Certification Standards and Practical Test Standards for Airmen; Incorporation by Reference: This NPRM was published on December 12, 2022, with comments submitted by February 10, 2023. This action proposes to revise certain regulations governing airman certification. Specifically, the FAA Airman Certification Standards and Practical Test Standards are currently utilized as the testing standard for practical tests and proficiency checks for persons seeking or holding an airman certificate or rating. The FAA proposes to incorporate these Airman Certification Standards and Practical Test Standards by reference into the certification requirements for pilots, flight instructors, flight engineers, aircraft dispatchers, and parachute riggers.

The following list includes examples of guidance that may need to be developed or updated in support of AAM integration rulemaking activities to describe standards and means of compliance, as well as promote good safety practices. This list is not all-inclusive.

- Advisory Circulars
- Development of standards and practices for Flight Standardization Boards and Maintenance Review Boards
- Processes and Procedures for issuance of 14 CFR part 135 Air Operator Certificates
- Amendment of internal FAA Orders and related change management
- FAA Order 8900.1 Flight Standards Information Management System
- FAA Order 8260-series
- Development of training for workforce to support AAM oversight and certification
- Development of and guidance related to the issuance of Operations Specifications (OpSpecs), Management Specifications (MSpecs), Training Specifications (TSpecs), and Letters of Authorization as appropriate, for AAM Operations
- Guidance and procedures for the issuance of licensing and certification of industry personnel
- Aeronautical Information Manual (AIM) and Aeronautical Information Publication (AIP)
- Pilots Handbook of Aeronautical Knowledge
- Flight Standards infrastructure guidance

Flight Standards is working to further adapt its organizational structure for both conventional and emerging operations. Aircraft capabilities and procedures (defined by manufacturers) are inextricably linked with operational approvals and personnel training, along with procedures for flight operations and continued airworthiness. As such, Flight Standards will continue to work closely with the FAA's Aircraft Certification Service (AIR) as part of an integrated oversight strategy by dovetailing its efforts with the certification of AAM aircraft and the issuance of Type Certificates (and continuous operational safety after entry into service).

Flight Standards is evolving its tools used for coordination of manufacturer/operator applications to increase efficiencies and enhance communications. For simple certifications, some steps can be condensed or eliminated. Some applicants may lack a basic understanding of what is required for certification. Other applicants may propose a complex operation but are well prepared and knowledgeable. Because of the variety in proposed operations and differences in applicant knowledge, processes will be thorough and flexible enough to apply to all possibilities. Industry applicants have the responsibility for compliance. Flight Standards will ensure applicants are aware of applicable regulations, standards, and requirements.

Flight Standards is making improvements to the prioritization and processing of certification of new operators and repair stations. This includes exploring various ways to reduce wait times, while ensuring resources available to support valid business ventures. Similarly, as with conventional aviation and drone operations, surveillance and oversight will be scaled taking a risk-based approach, ensuring application of the right level of FAA (and industry) resources. For cases where direct oversight is not applied as frequently, the FAA will work with industry on broad safety promotion and compliance activities.

5.2.2 Aircraft Certification

Aircraft certification is a process through which the FAA approves the design, production, and airworthiness of aircraft in the U.S. The certification process ensures that an aircraft meets minimum safety and environmental standards set by the FAA before it can be operated commercially or privately in the U.S. airspace.

The certification process involves several stages, including design approval, production approval, and airworthiness approval. Design approval involves reviewing and approving an aircraft's proposed design, including its systems, structures, and performance capabilities. Production approval ensures that an aircraft is built according to the approved design and meets the FAA's quality standards. Finally, airworthiness certification ensures that the aircraft is in a condition for safe operation and conforms to its approved design.

Currently, AIR is engaged with over two dozen manufacturers targeting the development of novel aircraft and propulsion technologies that underlie the design and operation of AAM aircraft. While some of these companies are relatively early in their technology development, vehicle design, and operations concepts, and in their readiness to engage in a new type certification program, nearly half of the companies have reached a level of maturity and development to have manufactured flying testbed prototypes. Their progress reflects positively on readiness to advance in the type certification process.

AIR is also currently working to define clear certification requirements and pathways to showing compliance for several novel aircraft technologies that are anticipated to be key to the future of AAM design and operations. These technologies include electric propulsion, large lithium-ion battery arrays, hydrogen fuel cell systems for electrical energy supply, distributed propulsion systems with highly integrated flight and propulsion controls, increased automation, and VTOL capabilities for winged aircraft.

The FAA determined that its existing aircraft certification processes are sufficient to type certificate powered lift as a special class under 14 CFR § 21.17(b). The special class process allows the FAA to address the novel features of unique and nonconventional aircraft without the need for additional processes such as special conditions or exemptions that would be required if the FAA used existing airworthiness standards. Under the special class process, the FAA designates or creates applicable airworthiness requirements as the certification basis for each aircraft design, including its engines and propellers. This designation and creation of applicable airworthiness requirements includes appropriate requirements from the existing airworthiness standards applicable to normal category and transport category airplanes, normal category and transport category rotorcraft, aircraft engines and propellers (parts 23, 25, 27, 29, 33, and 35), and it may also include unique airworthiness criteria developed specifically for the individual product.

In order to move forward to a more streamlined certification process, the FAA has proposed an update and expansion of the requirements for Safety Management Systems (SMS) and requires 14 CFR parts 5, *Safety Management Systems*, 21, *Certification Procedures for Products and Articles*, 119, *Certification: Air Carriers and Commercial Operators*, 91, and 135 certificate holders to develop and implement an SMS. The FAA also proposed this rule in part to address a Congressional mandate as well as recommendations from the National Transportation Safety Board (NTSB) and two Aviation Rulemaking Committees (ARCs). The Notice of Proposed Rulemaking on Safety Management Systems was published in the Federal Register on January 11, 2023, and the comment period closed on April 11, 2023.

Acceptable Means of Compliance

A key tenet of the FAA's approach to AAM certification is that an applicant's means of demonstrating compliance with the airworthiness requirements for its proposed design (i.e., the applicant's Means of Compliance (MOC)) must be accepted by the FAA. Although the FAA is leveraging the performance-based requirements from 14 CFR part 23 as modified by amendment 23-64, the consensus standards that the FAA has accepted as MOCs for normal category airplanes may not be appropriate for a particular proposed AAM due to its configuration, complexity, or novel technology. Work is still in progress to provide applicants with standardized MOCs that consider configuration differences, complexity, and novel design.

Noise Considerations

Aviation noise remains one of the primary environmental challenges to the continued growth of aviation. Pursuant to 49 U.S. Code (U.S.C.) 44715, the FAA has the responsibility to "protect the public health and welfare from aircraft noise." This responsibility includes broad authority to adopt regulations and noise standards as necessary. The FAA regulates the maximum noise level that an individual civil aircraft can emit through requiring aircraft to comply with certain noise limits. These limits and associated testing standards are found in *14 CFR part 36, Noise Standards: Aircraft Type and Airworthiness Certification.* Any applicant seeking a type certificate for their aircraft in the U.S. must comply with noise standard requirements as a part of the type certification process.[3] In addition, the FAA must complete a Noise Control Act finding, which ensures that the latest safe and airworthy noise reduction technology is incorporated into aircraft design and enables the reductions in noise experienced by communities.

When establishing the noise certification basis for AAM, the FAA will examine each application and determine whether existing part 36 requirements are appropriate as a noise certification basis, as is done for all applicants whose aircraft are subject to noise certification. If the current standards cannot be appropriately applied, the FAA may promulgate a rule of particular applicability for that applicant's aircraft model to establish a noise certification basis. Such a rule will require environmental review pursuant to the National Environmental Policy Act (NEPA). To date, for the one aircraft presented for noise certification, the FAA has determined that the existing testing procedures and requirements in part 36 are applicable. The FAA is currently evaluating other applications and will determine the noise certification basis for them.

5.3 Airspace and Air Traffic Management

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

[3] *If the AAM aircraft is non-electric and has a thrust of >6000lbs, engine emissions regulations could also possibly be applicable.*

The FAA's Air Traffic Organization (ATO) leads the planning, development, and implementation of airspace and ATM solutions, including development of airspace and route structures, policies, procedures, and ATC training. For I28, the ATO developed a general approach for airspace route design and usage, and traffic management that supports AAM VFR operations in the near-term (see Section 4), including the use of existing VFR route constructs.

I28 ATM processes will support a future national strategy, and supplemental directives will ensure consistency in how AAM route networks are designed. Existing mechanisms used by air traffic beyond traditional airspace classifications include the establishment of a special air traffic rule which applies within a Special Flight Rules Area (SFRA). Evaluation of these and alternative methods early in the planning process will allow the required collaboration to ensure timely resolution and publication of AAM route and network design.

Depending on the volume and specific operational needs of I28 operations, local air traffic facilities may need to update their procedures, utilize existing non-rulemaking airspace strategies, and complete an analysis to determine the need for airspace changes. The air traffic planning and analysis policy uses an interdisciplinary approach to effectively manage NAS changes. This would include the development of necessary training in a training delivery plan.

Sufficient time will be allotted throughout I28 development activities to ensure the necessary rulemaking or non-rulemaking activities, route publications and distribution, and training materials can be developed; and controller training can be completed to support the safe management of NAS operations.

In parallel, the ATO will continue to address AAM through its ATO AAM Near-Term Operational Integration Workgroup (NTIWG), which was established in November 2021 to identify air traffic considerations and impacts for near-term operations. After concluding their review in June 2022, the NTIWG had identified 55 recommendations to help address the integration of AAM operations in the near-term. Many of the recommendations require changes to FAA policy and guidance directives including, but not be limited to:

- JO 7110.65 Air Traffic Control
- JO 7210.3 Facility Operation and Administration
- JO 7400.2 Procedures for Handling Airspace Matters

The ATO also recommends a detailed policy review be conducted to determine if other associated orders and ACs need to be updated or developed. Topics that should be considered include:

- Wake Turbulence Categorization and impacts to operations
- Aircraft Certification and how that translates to ATC Service Provisions and Separation
- Minimum Safe Altitude as it applies to AAM
- Workforce and facility staffing considerations

5.4 Infrastructure

AAM operations require specialized infrastructure to support the safe and efficient operation of eVTOL aircraft. This section addresses how existing infrastructure can be leveraged to support near-term operations. It also documents what has been completed to-date to enable the planning, design, and construction of new vertiports or modification of existing facilities. The FAA remains committed to fostering collaboration with industry and local stakeholders to enable vertiport construction. Additional aspects of infrastructure will need to be addressed as I28 efforts progress, including electrification to support charging of AAM aircraft and power for AAM operations. The DOT Interagency Working Group will address these and other topics not directly in the FAA's purview.

5.4.1 Existing Infrastructure

To enable near-term operations, operators and manufacturers desire to use existing infrastructure, including commercial service airports, underutilized GA airports, and heliports. It is likely though that existing heliports and airports will require modification or enhancements to accommodate early entry aircraft and their unique operations.

Facility owners and operators should plan for dedicated takeoff and landing areas and support facilities that address the needs of eVTOL operators, including limited taxi capabilities and charging. Airport and heliport owners should engage existing and future tenants who intend to operate eVTOL aircraft to ensure planning and siting of infrastructure and equipment adequately accommodates their intended operations.

Construction of on-airport vertiport facilities may require FAA notification under 14 CFR part 77, *Safety, Efficient Use, and Preservation of Navigable Airspace* and updates to an airport's FAA approved Airport Layout Plan (for federally obligated airports). Modifications to existing federally obligated infrastructure will also undergo FAA environmental review and community engagement. Facilities that do not require FAA approval or funding may be responsible for community engagement consistent with local rules.

5.4.2 New Infrastructure

Communities, developers, and operators may also choose to establish new vertiports, not co-located with an existing airport or heliport. State licensing and local zoning ordinances may require updates to accommodate these new types of landing facilities. Where no federal funding is used, FAA oversight and engagement with these new vertiports and their surrounding communities may be limited. Communities are encouraged to plan for vertiports capable of accommodating multiple operators that will benefit passengers. They should also plan for equitable, multimodal placement of vertiports to connect transportation systems without creating new sources of traffic congestion and parking concerns whenever possible. Construction of new infrastructure would trigger FAA notification under 14 CFR part 157.

5.4.3 Vertiport-Related Research

In 2019, the Office of Airports (ARP) and the Airport Technology Research and Development Branch (ATR) began a multi-year research project to support the development of vertiport standards. ATR is investigating and evaluating VTOL and STOL aircraft design and performance to develop design standards and guidance.

For Phase 1, ATR completed a literature review (2021) that identified gaps in available performance data; a result of AAM company concerns about the release of proprietary information. With the help of FAA's Emerging Technology Coordination Branch (formerly known as Center for Emerging Concepts and Innovation) and other AIR offices, using existing mechanisms for communication with applicants and data protection, ATR obtained preliminary AAM aircraft data. The literature review findings, analysis of the aircraft data, and further interchange with manufacturers and operators, supported the development of interim guidance. On September 26, 2022, ARP released EB #105, Vertiport Design. The EB serves as interim guidance to airport sponsors, vertiport operators, and infrastructure developers for the design of vertiports for VTOL operations, until a performance-based AC is released in 2025. The EB is prescriptive and purposely limited to address eVTOL operations using design and performance data available from VTOL aircraft manufacturers currently working toward certification.

Phase 2 of the research was completed in summer 2022 and involved six hypothetical vertiport locations covering a range of diverse scenarios, including on-airport, off-airport (in close proximity to complex airport environment), urban, and rural vertiport environments. Modeling analyzed TLOF occupancy times for arrival and departure operations. The scenarios used site-specific information, allowing development of conceptual layouts for each scenario in an airport layout plan-style drawing.

Phase 3 of the research (started in January 2023) included simulation exercises and operation testing with various AAM companies. The simulation exercises will support preparations for on-site operational testing which will further evaluate landing precision, approach/departure profiles, rotorwash/downwash impacts, and aircraft taxiing.

The FAA also has an interagency agreement with the Department of Energy's National Renewable Energy Lab (NREL) to determine how aircraft electrification affects a vertiport, heliport, or airport's electrical grid. The research will look at vertiport charging requirements, hazards associated with charging stations, and cybersecurity.

Collaboration among FAA organizations and research branches has been key to ensuring FAA research is relevant and addresses the variety of operations anticipated for I28 and beyond. ARP receives notification of new and innovative aircraft and technology through the AIR Intake Board and other collaborative processes, and then facilitates introductions, as needed, between AIR, the manufacturer, and ATR. The FAA iTeams will continue to coordinate and collaborate on research areas of overlap.

To enable near-term operations, the following areas require further research:

- Vertiport fire extinguishment equipment and electric aircraft firefighting tactics
- VTOL aircraft parking needs
- Vertiport signage, markings, and lighting

5.4.4 Vertiport Standards and Oversight

The FAA is using existing policy, regulations, and infrastructure as a baseline for vertiport guidance and regulations development; however, it will be the responsibility of the operators, manufacturers, state and local governments, and other stakeholders to plan, develop, and enable vertiport infrastructure for I28 operations.

The FAA cancelled its AC on Vertiport Design in 2010 due to a lack of commercially available aircraft. Standards are needed to address the wide variety of aircraft and operations intended under AAM. While the FAA published prescriptive interim guidance for the design of vertiports in EB #105 in September 2022, ARP plans to release a performance-based AC in 2025. Data obtained through operational testing of prototype and production VTOL and STOL aircraft will greatly influence design standards and guidance in the AC. Since AAM is constantly evolving, ARP anticipates updating the vertiport AC more frequently than other airport-related ACs.

The FAA also established a cross-LOB/staff office 'Vertiport Process Improvement Team' to identify a path forward with developing criteria and standards for processing and analyzing proposed vertiports. This team identified actions necessary to address gaps in existing policies, procedures, and standards, including but not limited to the following:

- Initiate a rulemaking project for 14 CFR parts 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*, and 157 to clarify applicability to vertiports and supporting infrastructure and define vertiport imaginary surfaces

- Review and update JO 7400.2 Airport Airspace Chapter to address vertiport infrastructure and imaginary surfaces

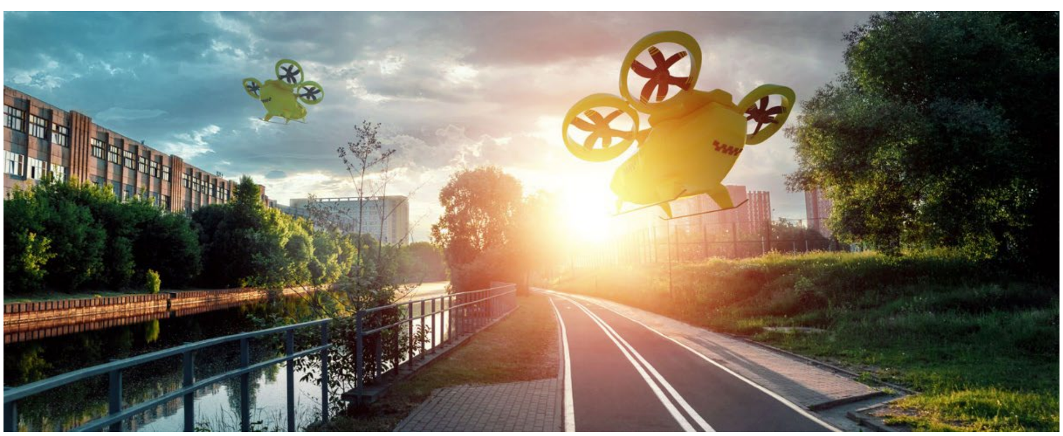
- Review and update FAA Forms 7460-1 and 7480-1 to identify and address vertiport/supporting infrastructure information and data needed for FAA processing/review

- Define FAA's role in vertiport inspections

Existing statutory authority may limit the agency's ability to regulate (i.e., 14 CFR part 139, *Certification of Airports*) and fund vertiports, particularly for private-use facilities. Without certification or federal funding, facilities may not comply with FAA design standards (a current condition that exists in many heliports) or have similar safety equipment and firefighting equipment onsite like today's commercial service airports.

5.5 Environment

The FAA is responsible for evaluating the significance of environmental impacts for aviation operations in the U.S. and disclosing those impacts to the public. As such, to enable near-term AAM operations, the FAA will consider the impact of AAM aircraft on a variety of aspects of the human environment, including (but not limited to) noise, air quality, visual disturbances, and disruption to wildlife. The FAA has policies and practices in place to conduct environmental review for legacy aviation. However, the FAA is still evaluating how best to streamline the environmental review process for new entrants, such as AAM.



The majority of questions related to compliance with environmental requirements in support of I28 remain open due to the need for additional information on what FAA approvals will be required for different aspects of the operation and any infrastructure, and what FAA offices will be responsible for such approvals. In addition, further information from manufacturers and operational data for aircraft is needed for the analysis of noise and emissions impacts. In particular, in order to determine whether compliance with NEPA is required, the FAA will need to identify whether there is/are a major federal action(s) triggering NEPA. Certification of aircraft, such as AAM, is a major federal action that will trigger compliance with NEPA, however there may be other FAA actions (e.g., approving or establishing where the AAM aircraft fly) that could trigger NEPA. For example, developing routes for AAM aircraft or introducing AAM into the NAS that will impact other flight operations may trigger NEPA. If NEPA applies, the LOB responsible for the approval will need to determine and conduct the appropriate level of environmental review (including potentially public involvement), as well as consider the need for supplementary community engagement.[4]

The FAA's Office of Environment and Energy (AEE) and the Office of the Chief Counsel (AGC) will provide support and advice to FAA LOBs in identifying applicable actions and determining the appropriate level of environmental review and associated public involvement and community engagement. If environmental reviews are required, the applicable LOB(s) will be responsible for planning, coordinating, and (where applicable) funding the environmental review and provide any associated public involvement and community engagement needed.

5.6 Hazardous Materials Safety

As AAM operations are initially expected to be conducted under 14 CFR part 135, AAM operators will be required to have hazardous materials training programs approved by the FAA; hazardous materials manuals accepted by the FAA; and Operations Specifications permitting or prohibiting accepting, handling, and transporting HazMat. These requirements apply whether or not a part 135 certificate holder chooses to transport hazardous materials. Part 135 HazMat training and manual requirements are function-based and scale to the scope and complexity of a certificate holder's operation.

DOT Hazardous Materials Regulations (HMR; 49 CFR parts 171-185) apply to any operator transporting hazardous materials in commerce. The HMR are promulgated by the Pipeline and Hazardous Materials Safety Administration (PHMSA). Regulations applicable to aviation are promulgated in coordination with the FAA.

As part of an operator's SMS, safety risk assessments accounting for hazardous materials being transported, relative to a specific certificate holder's system, can help to inform supplemental risk management strategies in AAM operations.

[4] The term "public involvement" exclusively refers to activities required under NEPA and other environmental laws and requirements (e.g., scoping meetings, circulation of environmental documents for public review and comment). "Community engagement" refers to agency-specific guidance that FAA employees are encouraged to use.

5.7 Community Engagement

Changes in airport operations, airspace procedures, aviation infrastructure, and technology can have effects on communities. When developing a new project or procedure that may impact the public, the FAA proactively engages with airports, communities, and elected officials to better understand community concerns about aviation noise and in some cases adjust or mitigate these concerns. With AAM, the FAA will proactively engage with airports and elected officials to ensure they understand AAM and expected operations. Currently the scope of what may need to change to accommodate the safe integration and operation of AAM operators into the airspace is evolving. The FAA's level of engagement will follow the level of change; however, given the expected scope of AAM changes, the FAA does not expect the same type of engagement that the agency conducts for major airspace changes.

Engagement at the regional level is the most effective path as AAM stakeholders and the FAA consider key site locations for I28. The FAA's Community Involvement Manual provides flexible guidance and best practices applicable to all FAA actions and will be leveraged for AAM operations and I28. Additional guidance also exists specifically related to airspace procedures. While the FAA does not expect to develop new or unique agency policy, it will be important to ensure all aspects of the I28 project utilize these best practices.

Elements of community engagement are already part of normal business practices for some FAA LOBs or Staff Offices. For example, compliance with NEPA and other environmental requirements often includes required public involvement elements, such as the distribution of an environmental document for public review and comment, that might be one element of a robust community engagement strategy. It is important to note that community engagement supplements but cannot substitute for these required public involvement activities. While public involvement is led by the FAA under some environmental laws or other requirements, community engagement may also be led by the proponent of the project (which may be FAA in the case of many airspace changes but can also be airport sponsors or operators). When the project proponent takes the lead on community engagement, the FAA plays an oversight role, providing advice and guidance on good community engagement practices.

For I28, community engagement needs to focus on more than just airspace and it will involve DOT/FAA and other agency offices. It is important that the public understand how these new aircraft operations will impact their communities. Many other stakeholders, such as AAM operators, vertiport sponsors, and airport operators, will be part of bringing AAM to an operational reality and will have a role in community engagement.

6 Innovate28 Integrated Schedule

The Integrated Master Schedule (IMS) contains a comprehensive list of activities that must be achieved by FAA LOBs and staff offices, industry, and local governments and stakeholders to enable AAM operations at a key site. The IMS is generic for a key site and will be tailored for each individual implementation, including the I28 building blocks, as more information is available. Not all activities included in the comprehensive generic IMS will be required for every implementation, and individual implementations will require additional site-specific activities. As a result, the IMS will be iterative as the team learns from each implementation. The IMS utilizes dependencies between activities which are included in Table 1. The IMS requires further refinement both within the agency and through collaboration with external stakeholders, including industry.

The following lists some considerations for the IMS as displayed in Figure 1:

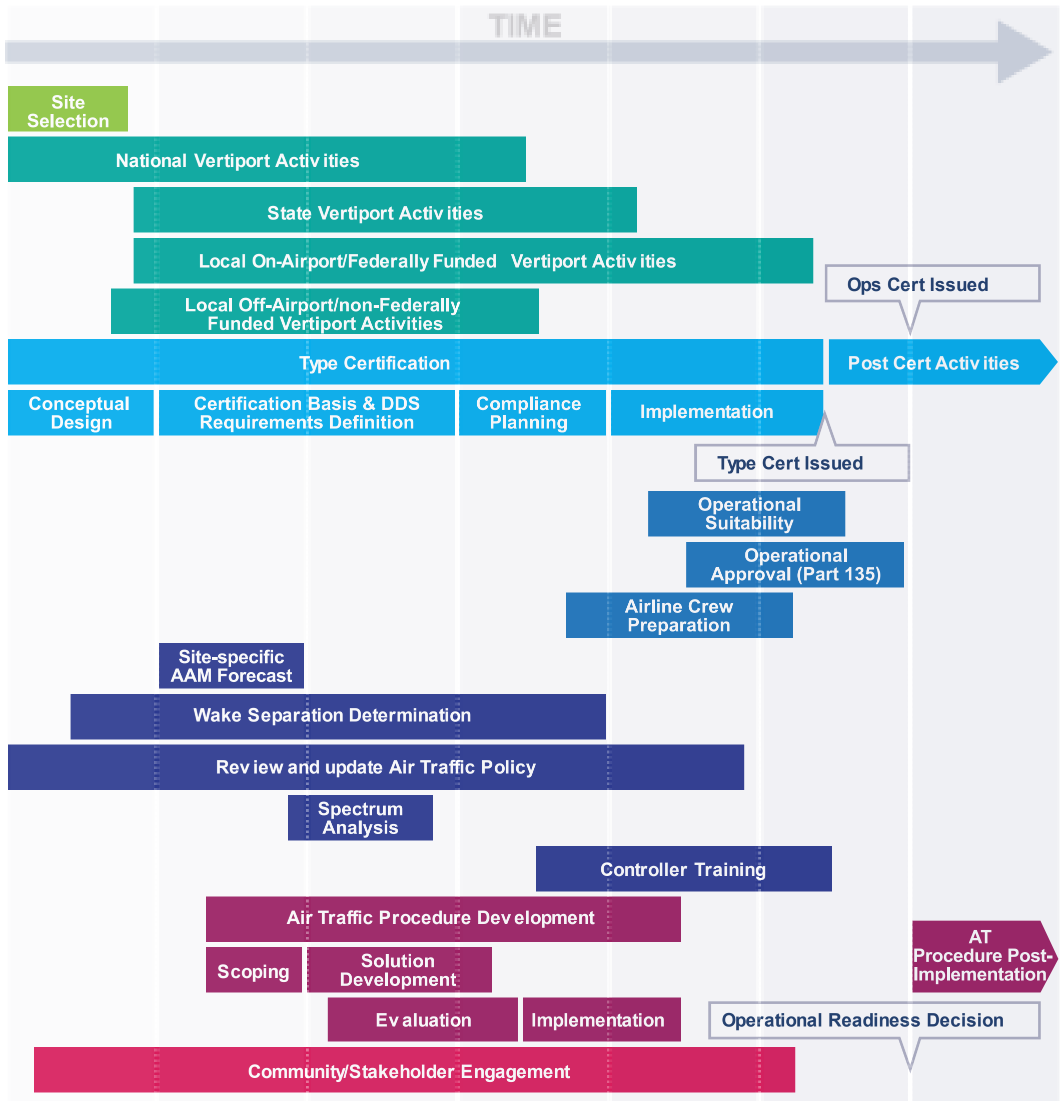
- The Type Certification and Operational Certification paths shown in the IMS are examples for a typical OEM/operator. The certification timelines can vary significantly depending on the maturity and responsiveness of the OEM/operator. Some OEMs have already completed part(s) of the certification processes shown here.

- The Environmental Review timeline is based off a typical Environmental Assessment. This timeline can range significantly based on site-specific factors that can either reduce the Environmental Review to a Categorical Exclusion when the proposed federal action does not individually or cumulatively have a significant effect on the human environment and the proposed action falls within the scope of the approved agency categorical exclusions; or increase it to an Environmental Impact Statement which is required under NEPA when a proposed federal action significantly affects the human environment.

- The timelines of some activities could potentially be significantly reduced or eliminated if it is determined that existing infrastructure can be leveraged with little to no modification.

The final state of the IMS will list a duration and point of contact for each activity so its status can be tracked at routine check-in meetings.

Figure 1. Integrated Master Schedule Version 1.0



Note : The IMS is a depiction of the activities that may be required to allow an operator to enter into service at a location. Depending on the scope and concept of use for their planned operation, not all activities may be required for every implementation; the duration of a step may vary by project as well. Some companies have already completed some of these activities.

Table 1. Detailed List of Activities in the Integrated Master Schedule Version 1.0

High-level Activity	Sub-activities
Select Site	Local discussions and buy-in
National Vertiport Activities	Vertiport Operational Testing data collection and analysis
Vertiport AC	Vertiport AC
	Rulemaking project for Part 77 and 157
State Vertiport Activities	Update zoning ordinances
	Update licensing requirements to address vertiports
	State environmental policy review
Local On-Airport/Federally Funded Vertiport Activities	Airport planning activities
	Airport Layout Plan (ALP) development, submission, and approval process
	Section 163 review
	NEPA Environmental Review
	Site Engineering
	7460 process
	Receive state licensing
	Construction
	Publication and charting
Local Off-Airport/non-Federally Funded Vertiport Activities	7480 process
	Receive state licensing
	Design and Construction
Type Certification	
Conceptual Design	Process Orientation
	Pre-Project Guidance
	Familiarization Briefing
Application Requirements Definition	Application for TC and PC
	Establishment of TC Project
	Certification Project Notification
	Form the Certification Team
Certification Basis and DDS Requirements Definition	The Preliminary TCB Meeting
	Issue Paper Identification
	G-1 Certification Basis
	Notice of proposed airworthiness criteria
	G-2 Detailed Design Standards
	G-3 Noise Standards
	Mean/Method of Compliance
Compliance Planning	Review and Acceptance of Certification Plans
Implementation	Conformity Inspections
	Detail-level compliance plan
	Product-level compliance plan
	Safety Review Board
	TIA & Conformity Inspection
	Flight Tests
	Type Inspection Report
	Final Type Certification Board
	Issue Type Certificate
Post Certification Activities	

High-level Activity	Sub-activities
Operational Certification	
Operational Suitability	Flight Standardization Board (FSB) and Report (FSBR)
	Maintenance Review Board (MRB) and Report (MRBR)
	Conduct Flight Operations Evaluation Board (FOEB)
	Issue Master Minimum Equipment Listing (MMEL)
	Review and Concur with all Instructions for Continued Airworthiness (ICA's)
	Review and Concur with all Flight Manuals and Flight Manual Supplements
Operational Approval (Part 135)	Phase 1: Pre-application
	Phase 2: Formal Application
	Phase 3: Design Assessment
	Phase 4: Performance Assessment
	Phase 5: Administrative Functions
Review and Update Air Traffic Policy	7110.65 Document Change Proposal (DCP)
	Review and Update 7400.2 Airport Airspace Chapter
	Review and update FAA Forms 7460-1 and 7480-1
Spectrum Analysis	
Controller Training	Develop training plan
	Schedule controller training
	Train controllers
Develop and Implement Air Traffic Procedure(s)	
Phase 1: Scoping	
Phase 2: Procedure Solution Development (6 months or more)	Initial design activities, refinement, and validation
Phase 3: Evaluation (12-18 months)	Initial Environmental look
	SMS/SRM Panel and Process
	Environmental Review
Phase 4: Implementation	Finalize SOP and LOA
	Procedure processing and publication, including flight inspection
	Charting
	Aircraft type automation update
Phase 5: Post-Implementation	
Wake Separation Determination	Develop performance data package (e.g. weights, aircraft specifications, flight command/control performance, etc.)
	Wake Separation Assessment
	Update 7360.1
Community/Stakeholder Engagement	Messaging development
	Website development
	Continued Regional Office Community Engagement (local officials, community roundtables)
	Airspace Implementation Community Engagement
Airline Crew Preparation	Identify, vet, and train crew
Site-specific AAM forecast	
Rulemaking	Rulemaking for Pilot Training
	Powered-lift NPRM

7 AAM Evolution Framework

The FAA's approach to supporting the operationalization of AAM encompasses a series of incremental changes and advancements to the regulatory, technological, and operational frameworks that govern the NAS. This approach aims to ensure safety, while also facilitating efficiency and innovation in the AAM industry and will result in a continuum of AAM capabilities that evolves over time as the tempo of operations increases, driving the need for more advanced supporting infrastructure, regulations, and processes. This will allow the collection of early benefits and lessons learned while maintaining progress toward the fully mature state of AAM.

The agency is working on a regulatory framework that will allow AAM aircraft to be fully integrated into the airspace and operate alongside traditional aircraft in the near-term and beyond. The FAA and industry are developing the necessary technologies to support AAM operations, including aircraft and traffic management systems, communication networks, and autonomous capabilities. Finally, the FAA is working to establish operational frameworks that ensure the safe integration of AAM aircraft into the NAS, including training pilots, air traffic controllers, and other stakeholders on new procedures and regulations.

This evolutionary approach to AAM provides advantages. By initially supporting lower complexity operations in the near-term, as with I28, implementation can be achieved by maximizing the use of current capabilities that meet performance requirements and do not require full-scale regulatory and operational infrastructure changes.

With increased tempo, AAM operations will evolve through changes to governing regulations augmented by AAM infrastructure, automation, and cooperative traffic management practices supported by third party services. The evolution to a collaborative, information-rich, data-sharing environment will require new technologies and capabilities. AAM operators and other stakeholders will share information with the FAA having on-demand access to information as needed.

The FAA's ANG organization developed an initial AAM framework that categorizes the evolving phases of AAM and provides context on the AAM roadmap to operationalization. The framework describes the anticipated operational capabilities for both FAA and industry stakeholders as the AAM ecosystem develops and matures over time. The framework also serves to identify key areas that require prioritization and coordination among the various stakeholders across the AAM ecosystem. The framework will inform FAA efforts, but also can be used by industry and other government agencies.

AAM Coordination Areas

The AAM framework consists of five high-level coordination areas, shown in Table 2, within which key AAM capabilities pertaining to both FAA and industry stakeholders are highlighted. AAM capabilities are expected to progress independently toward a mature state. The pace of development may vary within and between coordination areas. Maturity is capability dependent, and not bound by a specific timeline. Regional maturity rates may vary as well, with some communities embracing AAM operations more rapidly than others.

It should be noted that community engagement, although not shown here, will be an integral and required step for each coordination area.

Table 2. AAM Coordination Areas

Area	Considerations for FAA and Industry Stakeholders
Aircraft System	Aircraft, equipment, automation, certification
Infrastructure	Facilities, data systems related standards, federated networks, CNS
Operations	Operational density and modes, procedures, pilot knowledge and training
Airspace	Routes, waivers, cooperative areas, charting and publication
ATC Procedures	Standard operating procedures, LOAs, public-private responsibilities

AAM Maturity Levels

The evolution of capabilities addresses initial, intermediate, and mature states of AAM, and is described across six maturity levels (0-5). Each maturity level is characterized by a set of expected outcomes, as shown in Table 3. One or more triggering events indicate progression from one maturity level to the next.

Table 3. AAM Maturity Levels

Level	Description	Trigger Events (for reaching level)
0	Late-stage certification testing in limited environments, aircraft certification testing and operational evaluations with conforming prototypes and existing rules/procedures, and early industry development and prototyping.	
1	Exploratory operations of minimal density and complexity, type certified aircraft, early FAA procedures development, and initial Provider of Services for UAM (PSU) services.	Completion of relevant NPRMs and rulemaking to allow for vehicle type certification, initial public standards to support data exchanges between industry participants and the FAA.
2	Low-density scheduled commercial operations in urban areas and around airports, as well as an established federated service network* with several PSUs and Supplementary Data Service Providers (SDSPs). Designated cooperative airspace is limited (see UAM ConOps, Version 2.0). **A federated service network is one that is provided and supported by the operators and third-party service providers to exchange the information and agreements needed for FAA-approved cooperative operating practices.*	Increased operational density, new operational modes (e.g., remotely piloted), and the evaluation of cooperative airspace and a federated service network with multiple operating PSUs.
3	Medium-density scheduled and unscheduled commercial operations using an increased number of vertiports and routes in specific geographical areas that make continued use of limited, designated cooperative airspace. Established PSUs and federated service networks support increased levels of automation and instances of remotely piloted aircraft with a safety pilot on board.	Continued evolution of the modes of operations, implementation of designated cooperative airspace in more geographical areas, and the establishment of certification standards for automated and remotely operated large aircraft.
4	Medium-density scheduled and unscheduled commercial operations in an AAM network that make widespread use of cooperative airspace. Fully remotely-piloted operations are supported.	Certification of fully remote piloted aircraft and the availability of enhanced CNS capabilities that can support long distance and fully remote operations, complete implementation of new regulatory frameworks, widespread implementation of cooperative airspace and vertiports, and the ability to support operations in instrument meteorological conditions (IMC).
5	Mature AAM ecosystem, characterized by high density scheduled, unscheduled, and on-demand operations that are geographically dispersed and served by aircraft able to operate autonomously.	Certification of fully autonomous aircraft and the satisfactory performance of highly integrated automation within the federated service network.

FAA and Industry Coordination

The AAM evolution framework embraces independent advancement within coordination areas, but also acknowledges the need for coordination across the areas for the AAM ecosystem to come to fruition. It considers both FAA and industry activities and capabilities to support AAM maturation.

Rulemaking

The FAA uses the same rulemaking process for AAM operations as it does for other aviation-related regulations. To carry out its responsibilities, the FAA must issue regulations that are clear and provide direction to the aviation industry and the public. Through the rulemaking process, the FAA engages with stakeholders, including industry groups, pilots, and the public, to develop regulations that are informed by their inputs. The process provides an opportunity for all interested parties to provide comments and feedback on proposed regulations, which helps to ensure that the final regulations are effective, practical, and above all, ensure safety.

Standards Development

Industry stakeholders, including aircraft manufacturers, operators, and infrastructure providers, play a critical role in developing standards for AAM operations. Industry-driven standards are essential to ensure that AAM vehicles and infrastructure are safe, reliable, and interoperable. Long lead times and the level of stakeholder participation required to develop standards is a high priority area that requires establishing relationships among all the stakeholders, identifying standards development needs, and generating multi-year plans to address those needs and associated actions.

Technology Development and Deployment

Industry's development of technology often moves faster than the regulations addressing the use of the technologies. The FAA needs to establish and maintain close ties with industry to ensure that emerging technologies are designed with safety and NAS integration in mind and that regulations do not unduly constrain technology and market development. This includes the need for industry to consider the complexity of aviation operations and human factors, especially when proposing highly automated solutions. Additionally, the FAA needs to work closely with foreign regulatory counterparts and Air Navigation Service Providers to align and harmonize AAM-related regulations, policies and procedures, as applicable, given this sector's global, entrepreneurial, and innovative ecosystem.

The long lead time for development and deployment of FAA capabilities also makes identifying FAA technology/capability requirements and establishing roadmaps for acquisition and development a high priority activity.

Network Development

The mature state vision for AAM involves industry-built networks for data exchange to support many functions that the FAA has traditionally performed, including aspects of airspace management. These networks and the processes implemented for using them must be compatible with FAA data exchange mechanisms and airspace design and procedures.

Airspace Design and Management

Initial AAM operations that are low density and low complexity will be conducted using existing airspace design and charting processes, and airspace constructs available today (e.g., VFR corridors/flyways, T-routes). As the operations continue to increase in volume and complexity, novel airspace design may be needed to accommodate operations. The concept of designating cooperative areas for AAM operations envisions safe and efficient operations that may not require traditional ATC services in certain situations. They will be available to any aircraft appropriately equipped to meet the performance requirements and are created and implemented when operationally advantageous.

Moving Forward

The FAA will continue to work with AAM stakeholders to refine and further mature this framework and move towards an AAM ecosystem that supports innovation and scalability. The FAA is committed to ensuring the appropriate resources are allocated, workgroups are established to address areas that require research and development, and policy and regulatory decisions keep AAM moving forward into the future.

Acronyms

Acronym	Definition	Acronym	Definition
AAM	Advanced Air Mobility	IMC	Instrument Meteorological Conditions
AC	Advisory Circular	IMS	Integrated Master Schedule
ADS-B	Automatic Dependent Surveillance – Broadcast	I28	Innovate28
AGC	Office of the Chief Counsel	LOA	Letter of Agreement
AEE	Office of Environment and Energy	LOB	Line of Business
AFX	Flight Standards Service	MOC	Means of Compliance
AIM	Aeronautical Information Manual	MOU	Memorandum of Understanding
AIP	Aeronautical Information Publication	NAS	National Airspace System
AIR	Aircraft Certification Service	NASA	National Aeronautics and Space Administration
ANG	Office of NextGen	NEPA	National Environmental Policy Act
ARC	Aviation Rulemaking Committee	NOTAM	Notice to Air Mission
ARP	Office of Airports	NREL	National Renewable Energy Lab
ASOS	Automated Surface Observing System	NTSB	National Transportation Safety Board
ATC	Air Traffic Control	OEM	Original Equipment Manufacturer
ATM	Air Traffic Management	NPRM	Notice of Proposed Rulemaking
ATO	Air Traffic Organization	PHMSA	Pipeline and Hazardous Materials Safety Administration
ATR	Airport Technology Research and Development Branch	PIC	Pilot in Command
AWOS	Automated Weather Observing System	PSU	Provider of Services for Urban Air Mobility
CFR	Code of Federal Regulations	SDSP	Supplementary Data Service Provider
CNS	Communications Navigation Surveillance	SFAR	Special Federal Aviation Regulation
DOT	Department of Transportation	SFRA	Special Flight Rules Area
EB	Engineering Brief	SMS	Safety Management System
EIS	Entry into Service	STOL	Short Takeoff and Landing
EMS	Emergency Management Services	TFR	Temporary Flight Restriction
eVTOL	Electric Vertical Takeoff and Landing	TLOF	Touchdown and Liftoff Area
FAA	Federal Aviation Administration	UAM	Urban Air Mobility
GA	General Aviation	U.S.C.	United States Code
HMR	Hazardous Materials Regulation	VMC	Visual Meteorological Conditions
ICAO	International Civil Aviation Organization	VFR	Visual Flight Rules