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March 14, 2024

The Honorable Maria Cantwell
Chair
The Honorable Ted Cruz
Ranking Member
Committee on Commerce, Science, and Transportation
United States Senate

The Honorable Sam Graves
Chairman
The Honorable Rick Larsen
Ranking Member
Committee on Transportation and Infrastructure
House of Representatives

Advanced Air Mobility: Legal Authorities and Issues to Consider for Operations

Advanced Air Mobility (AAM) is an emerging concept of air transportation that will leverage new types of aircraft and an array of innovative technologies, such as electrified propulsion systems. According to proponents, AAM could be transformational, in part, because it offers the potential to expeditiously move people and goods while operating more quietly, with reduced aircraft emissions, and at lower costs than traditional aircraft. In addition, industry leaders anticipate that these aircraft will eventually be capable of autonomous flight.

As noted in our 2022 report, stakeholders said that for AAM to be successful, the federal government—including the Federal Aviation Administration (FAA) within the Department of Transportation (DOT)—and industry will need to address a variety of issues, including bringing the first AAM aircraft into commercial use.¹ AAM manufacturers are currently testing their aircrafts, and FAA has stated that it is working to support the industry’s goal of initial, piloted commercial operations in 2025, with more widespread operations in 2028 and beyond.

The Advanced Air Mobility Coordination and Leadership Act, enacted in October 2022, included a provision for GAO to conduct a study on the roles, responsibilities, and interests of federal, tribal, state, and local governments regarding AAM.² The act also directed us to review legal authorities as well as provide information on actions to facilitate the growth of the AAM industry and the integration of AAM aircraft into the national airspace. This report describes (1) the legal authorities held by DOT relevant to the future regulation of civilian AAM operations, and actions taken relevant to these authorities, (2) relevant legal authorities of selected tribal, state, and

¹GAO, *Transforming Aviation: Stakeholders Identified Issues to Address for ‘Advanced Air Mobility,’* [GAO-22-105020](#) (Washington, D.C.: May 9, 2022).

²Pub. L. No. 117-203, § 3, 136 Stat. 2227, 2230 (2022).

local governments, and (3) issues to consider as the AAM industry develops, as identified by selected government entities and other stakeholders.

To address our objectives, we focused on five key areas that we have previously found to be important to the development of AAM operations:³

1. certification and safety of aircraft,
2. pilot and mechanic training,
3. airspace management,
4. vertiport construction,⁴ and
5. noise management.

To describe DOT's legal authorities and actions taken relevant to these authorities, we requested and reviewed the legal authorities that DOT identified as related to these five selected topic areas.⁵ With the exception of legal authorities related to environmental protection, we focused on regulatory authorities, orders, and guidance identified by DOT. In general, while DOT identified pertinent statutory provisions, we do not describe the typically broadly worded underlying statutes in this report that grant DOT or FAA the authority to issue the cited rules or regulations. We also asked FAA to provide information about the actions the agency has taken or plans to take related to its legal authorities.

To describe the relevant legal authorities of selected tribal, state, and local governments, we identified two Tribes, seven state governments, and four local governments that were poised to host some of the earliest planned AAM commercial operations, had partnered with FAA on relevant research, or had passed laws or resolutions related to AAM, among other considerations.⁶ We obtained their perspectives on their legal authorities on the five selected topic areas. We also interviewed officials from DOT and FAA to obtain their perspectives on these authorities.

To identify issues for consideration as the AAM industry develops, we interviewed officials from DOT, FAA, and the selected Tribes, states, and localities. We also interviewed eight additional stakeholders with relevant expertise, including AAM manufacturers, airport operators, and industry trade groups, among others. We identified these eight additional stakeholders through

³See [GAO-22-105020](#) and GAO, *Transforming Aviation: Congress Should Clarify Certain Tax Exemptions for Advanced Air Mobility*, [GAO-23-105188](#) (Washington, D.C.: Nov. 30, 2022).

⁴For the purposes of this report, we refer to all ground-based infrastructure serving future AAM aircraft as "vertiports." This could include modified or unmodified infrastructure at existing airports, modified or unmodified heliports, or new facilities that serve AAM aircraft.

⁵While there are several federal agencies that have roles in regulating, supporting, and developing the AAM industry and its workforce, we describe legal authorities and relevant actions taken by DOT and FAA. As we previously reported, FAA's responsibilities include certificating aircraft and workers, such as pilots and aviation maintenance technicians, as well as establishing requirements for operations programs and conducting continuing surveillance to ensure regulatory compliance and continued operational safety. FAA also operates the air traffic control system, which is responsible for the safe conveyance of air traffic within the national airspace system. FAA also has a limited role in promoting the development of the aerospace workforce, accomplished largely through programs for building awareness of aerospace careers. See [GAO-22-105020](#).

⁶When selecting locations, we also considered geographic diversity and the range of companies that had publicly announced plans to operate in those locations.

a literature search of industry publications, as well as consultations with subject matter experts. We focused our discussions on issues related to the five selected topic areas.

Using the information received from discussions with these 23 interviewees, we conducted a content analysis to identify key themes for consideration. When summarizing interviewees' perspectives, we use the term "a few" if two or three of the 23 interviewees expressed a particular view, "some" when four through 11 of these interviewees expressed a particular view, and "many" if 12 or more interviewees expressed a view.

While the Advanced Air Mobility Coordination and Leadership Act includes a definition of AAM,⁷ interpretations of AAM vary.⁸ We focused on regulations and issues related to larger aircraft—such as electric vertical takeoff and landing (eVTOL) aircraft.⁹ In planning for AAM operations in the near term, FAA is focusing on eVTOL aircraft operated by a pilot on board for passenger or cargo operations. Some designs outwardly resemble helicopters in that they have multiple rotors but no fixed wing. Other eVTOL designs have a fixed wing and various ways to take off and move forward in flight, such as lift propellers, ducted fan jets, tilt propellers, or rotors combined with a pusher propeller. See figure 1 for examples of AAM eVTOL aircraft.¹⁰

Figure 1: Examples of Advanced Air Mobility Aircraft



Sources: Joby Aviation (left) and Archer (right). | GAO-24-106451

⁷The terms "advanced air mobility" and "AAM" are defined in the Advanced Air Mobility Coordination and Leadership Act to mean a transportation system that transports people and property by air between two points in the United States using aircraft with advanced technologies, including electric aircraft or electric vertical takeoff and landing aircraft, in both controlled and uncontrolled airspace. Advanced Air Mobility Coordination and Leadership Act § 2(i)(1), 136 Stat. at 2229.

⁸Approximately half of the officials and stakeholders we interviewed indicated that they consider small, unmanned aircraft—such as delivery drones—to be included under AAM, while approximately half indicated that they consider only larger aircraft to be included. A few interviewees were undecided. Small, unmanned aircraft are defined as "an unmanned aircraft weighing less than 55 pounds, including the weight of anything attached to or carried by the aircraft." 49 U.S.C. § 44801(9).

⁹eVTOLs are one type of larger AAM aircraft. AAM aircraft might also feature conventional takeoff and landing or short takeoff and landing capabilities. In addition, some AAM manufacturers are pursuing hybrid options that include a combustion element.

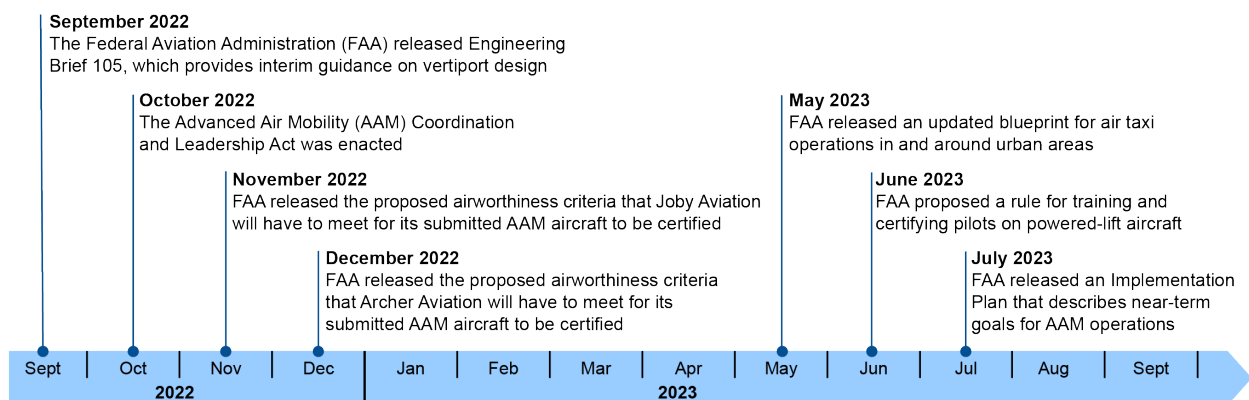
¹⁰Fixed-wing aircraft achieve lift via airflow around stationary wings, while helicopters achieve lift through spinning rotors. In both cases, the lift mechanism at takeoff is the same as the in-flight lift mechanism. Some eVTOLs defined as powered-lift under FAA regulations (see 14 C.F.R. § 1.1 - General definitions) share both technologies, with rotors for lift at takeoff and a fixed wing to provide lift in flight. A fixed wing can allow such eVTOLs to take off and land on runways like a traditional fixed-wing aircraft, and benefit from the energy efficiencies of fixed-wing flight. Vertical takeoff and landing capabilities, like a helicopter, allow eVTOLs to hover and access remote sites. However, not all AAM designs propose using a powered-lift design.

We conducted this performance audit from December 2022 to March 2024 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives. This report provides a summary of our findings related to these objectives. For more detailed information on our findings, see the attached enclosure.

Background

Federal, tribal, state, and local government entities have begun to plan how they will integrate AAM operations into the existing aviation environment. The federal government has played a key role to help coordinate such efforts. For example, in August 2022, the White House Office of Science and Technology Policy, in coordination with the National Security Council, hosted a summit to discuss AAM integration with various government officials. In addition, in early 2023, DOT hosted the first meeting of the AAM Interagency Working Group.¹¹ The working group is charged with developing an AAM National Strategy that identifies roles and responsibilities of federal, tribal, state, and local governments to support the evolution of AAM operations. Figure 2 shows a timeline highlighting key legislative, policy, and regulatory developments in 2022 and 2023.

Figure 2: Timeline Highlighting Key Advanced Air Mobility (AAM) Legislative, Policy, and Regulatory Developments in 2022 and 2023



Source: GAO analysis of FAA information. | GAO-24-106451

As part of its responsibilities for the safety of U.S. civil aviation, FAA reviews AAM aircraft design, production, and operations; develops ground-based infrastructure requirements; and ensures regulatory compliance. FAA also operates the air traffic control system and is responsible for the safe and efficient flow of air traffic. In July 2023, FAA released its AAM Implementation Plan, also known as “Innovate28.” The plan affirmed the agency’s approach to support the industry to meet a goal of piloted commercial operations in 2025 and more widespread operations in 2028 and beyond.¹² According to the Implementation Plan, the agency

¹¹The establishment of an AAM Interagency Working Group by the Secretary of Transportation was required by the Advanced Air Mobility Coordination and Leadership Act. Pub. L. No. 117-203, § 2, 136 Stat. at 2227.

¹²FAA, *Advanced Air Mobility (AAM) Implementation Plan: Near-Term (Innovate28) Focus with an Eye on the Future of AAM, Version 1.0* (Washington, D.C.: July 2023).

is implementing a “crawl-walk-run” methodology that identifies issues to address in the short and long term.

To date, the AAM industry in the U.S. has been largely focused on designing, building, and pursuing FAA certification to commercially operate its aircraft. We previously reported that stakeholders said initial, piloted operations would likely be limited in terms of the number of locations where AAM services are offered and the number of aircraft that are operating.¹³ For example, initial operations might consist of small numbers of aircraft with pilots on board in two to five metropolitan areas.

In addition, AAM operations using electric aircraft will require ground infrastructure to take off, land, charge, and load or unload passengers and cargo. Communities must plan for the integration of AAM operations using either existing infrastructure or developing new facilities, such as vertiports where AAM aircraft can take off and land. Proponents of AAM have proposed locating such infrastructure at airports, cargo logistics hubs, hospitals, and on top of parking garages. According to FAA, initial AAM operations in the 2025-2028 time frame are expected to primarily use existing airports and heliports.

The AAM industry plans for these aircraft to eventually operate with a high degree of autonomy, which could include operating without a pilot onboard the aircraft. We previously reported that stakeholders did not anticipate widespread autonomous AAM operations until 2032 or later, with widely varying predictions for when such operations could be achieved.¹⁴

DOT Has Legal Authorities in All Five Selected Topic Areas and Has Taken Actions in Each

DOT identified a variety of legal authorities that are relevant to the future regulation of civilian AAM operations in all five selected topic areas, including aircraft certification and safety, pilot and mechanic training, airspace management, vertiport construction, and noise management. FAA has taken actions relevant to all five of these authorities, including publishing proposed rules, developing interim guidance, and reviewing existing policies. For example:

- **Aircraft certification.** FAA is in the process of certifying initial AAM aircraft designs using existing certification processes and rules. In late 2022, the agency published the proposed airworthiness criteria for two companies' AAM aircraft designs.¹⁵ The companies continue to work with FAA towards AAM type certification for each of their products.
- **Pilot and mechanic training.** In a June 2023 notice of proposed rulemaking, FAA proposed temporary pilot training standards that would apply to initial groups of AAM pilots.¹⁶ In the same rulemaking, the agency said that it would develop rules on AAM mechanic certification at a later time, if needed. FAA intends to issue a final rule by the end of 2024.

¹³[GAO-22-105020](#).

¹⁴[GAO-23-105188](#).

¹⁵FAA, *Airworthiness Criteria: Special Class Airworthiness Criteria for the Joby Aero, Inc. Model JAS4-1 Powered-Lift*, 87 Fed. Reg. 67399 (Nov. 8, 2022) and *Airworthiness Criteria: Special Class Airworthiness Criteria for the Archer Aviation Inc. Model M001 Powered-Lift*, 87 Fed. Reg. 77749 (Dec. 20, 2022).

¹⁶FAA, *Integration of Powered-Lift: Pilot Certification and Operations; Miscellaneous Amendments Related to Rotorcraft and Airplanes*, 88 Fed. Reg. 38946 (June 14, 2023).

- **Airspace management.** FAA developed an AAM Implementation Plan in 2023, which provides a general approach for airspace management.¹⁷ The plan says that near-term AAM operations can be managed with existing air traffic control tools, procedures, and protocols. In addition, in the June 2023 notice of proposed rulemaking, FAA proposed temporary operational requirements that would apply to certain AAM aircraft.
- **Vertiport construction and noise management.** FAA issued interim guidance on vertiport design standards and is considering the impact of AAM operations as the agency reviews its noise policy.¹⁸

Officials from DOT and selected tribal, state, and local government officials generally agreed that FAA has exclusive legal authority over three of these areas—certification and safety of AAM aircraft, pilot and mechanic training and certification requirements, and airspace management.

Tribes, States, and Localities Have Some Legal Authorities Related to Vertiport Construction and Noise Management

Selected tribal, state, and local government officials stated that they have some legal authorities relevant to two of our selected five topic areas: vertiport construction and noise management issues. Tribal, state, and local governments have traditionally exercised the authority to develop and enforce zoning regulations, which would determine where vertiports could be built and could influence how communities experience noise from AAM aircraft. Similarly, according to FAA, many state, local, or other entities require prior approval such as through licenses or permits to build and operate aircraft landing facilities. According to FAA, these entities could require that privately funded vertiports adhere to federal design guidance.¹⁹

Some interviewees said it is challenging to know what current zoning or permitting authorities might apply to AAM because many aspects of AAM operations have yet to be determined. Furthermore, some interviewees said there might need to be clarification on airspace management and the jurisdiction of non-federal entities in the future, in part, because they believe there is uncertainty regarding how and where AAM aircraft may operate.

Interviewees Identified Issues to Consider in All Five Selected Topic Areas as the AAM Industry Develops

According to interviewees, there are certain issues to consider in the short term as the AAM industry develops (present day through 2028), while other issues may be more relevant in the long term as AAM operations evolve (after 2028).²⁰

¹⁷FAA, *Advanced Air Mobility (AAM) Implementation Plan: Near-Term (Innovate28) Focus with an Eye on the Future of AAM, Version 1.0* (Washington, D.C.: July 2023).

¹⁸FAA, *Engineering Brief 105, Vertiport Design* (Washington D.C.: September 2022) and *Request for Comments on FAA's Review of Its Civil Aviation Noise Policy*, 88 Fed. Reg. 26641 (May 1, 2023).

¹⁹According to FAA, the agency's final vertiport design guidance will not automatically apply in cases where sponsors or operators of a vertiport do not receive federal financial assistance. In such cases, FAA will not be able to require, for example, that the vertiport have certain landing pad sizes or firefighting equipment consistent with FAA's design guidance. However, according to FAA, states or localities could require compliance with FAA design guidance even if a vertiport sponsor or operator does not receive federal financial assistance.

²⁰According to FAA's AAM Implementation Plan, "near-term" operations are those that are expected to occur between 2025-2028, and longer-term operations are those that will take place after 2028. For the purposes of this report, we refer to "short-term" and "long-term" considerations, with "short-term" encompassing the present day up

- **Issues for consideration in the short term.** Officials with whom we spoke noted that in the short term, DOT should finalize rules or guidance on key topics such as pilot training, airspace management, and vertiport construction to help guide related efforts. For example, some state and local officials said that it would be premature to discuss changes to existing requirements for aircraft landing infrastructure until FAA completes its recommendations for the clearance needed around AAM aircraft takeoff and landing locations. In addition, some selected tribal, state, and local officials and other stakeholders noted that it will be important that FAA’s regulatory approach for certifying AAM aircraft be timely and predictable.
- **Issues for consideration in the long term.** In the longer term, some interviewees expressed the view that issues might arise in aircraft certification and safety, airspace management, and noise management as the industry develops and the tempo of AAM operations increase. For example, a few interviewees noted that the current approach for certifying AAM aircraft—in which FAA individually approves each aircraft design as opposed to certifying that it meets more standardized requirements—might become too time-consuming if manufacturers seek to certify numerous diverse AAM designs. In addition, some interviewees anticipated that current federal airspace management regulations will be appropriate for initial, piloted AAM operations, but will not be sufficient to manage uncrewed, autonomous AAM aircraft. Consequently, they stated that FAA will eventually need to determine how to integrate such flights into the national airspace.

For a detailed discussion of the results of our interviews, see enclosure I, which addresses: (1) certification and safety of aircraft; (2) pilot and mechanic training; (3) airspace management; (4) vertiport construction; and (5) noise management.

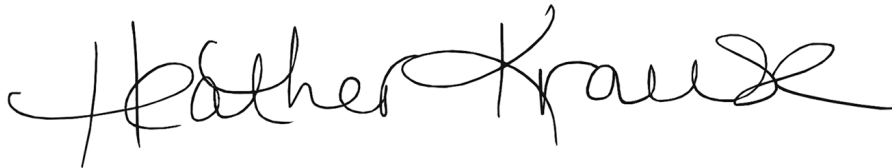
Agency Comments

We provided a draft of this report for review and comment to the Department of Transportation. DOT provided technical comments, which we incorporated as appropriate.

We are sending copies of this report to the appropriate congressional committees, the Secretary of Transportation, and other interested parties. In addition, this report will be available at no charge on the GAO web site at <http://www.gao.gov>.

through 2028. In cases where interviewees did not specifically identify a time horizon for the issues they raised, we used professional judgment to determine whether the issue was most appropriately described as one that was relevant to operations up through or after 2028.

If you or your staff have any questions about this report, please contact me at (202) 512-2834 or krauseh@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report were Jean Cook (Assistant Director), Alison Snyder (Analyst-in-Charge), Tammy Conquest, Shidi Dai, Allison Henn, Geoffrey Hamilton, Delwen Jones, Chi Mai, Josh Ormond, Madeline Welter, and Elizabeth Wood.

A handwritten signature in black ink that reads "Heather Krause". The signature is written in a cursive, flowing style.

Heather Krause
Managing Director, Physical Infrastructure

Enclosure

March 2024



Source: GAO (icon). | GAO-24-106451

Certification and Safety for Advanced Air Mobility

Bottom Line

Department of Transportation (DOT) officials stated that the Federal Aviation Administration (FAA) has exclusive legal authority over the certification and safety of advanced air mobility (AAM) aircraft. Officials we interviewed from selected tribal, state, and local governments recognized that FAA holds exclusive authority.²¹ According to FAA, there are no tribal, state, or local authorities relevant to the certification and safety of AAM aircraft. Some selected tribal, state, and local government officials, as well as other selected stakeholders, said that FAA's existing approach for certifying AAM aircraft will need to further develop in a timely and predictable way.

Federal Legal Authorities and Actions

FAA prescribes rules for aircraft certification and safety. Table 1 notes federal authorities identified by DOT as relevant to the future regulation of AAM aircraft certification and the safety of AAM operations. FAA officials said the application of these authorities will depend on an aircraft's design.

Background

FAA is responsible for aviation safety, in part by issuing certificates for new aircraft, aircraft parts and equipment, and new air operators. Generally, before aviation products, (including AAM aircraft) can be manufactured for use in the U.S., the agency must review and certify the design, production, and airworthiness of an aircraft, including certifying that the aircraft meets the noise and emission standards.

Steps towards certification and examples of relevant activities include:

Conceptual design. Company develops a design concept and consults with FAA staff.

Requirements definition. Company and FAA identify the certification basis.

Compliance planning. Company and FAA commit to requirements in a project-specific certification plan.

Implementation. Company works with FAA to ensure all product-specific certification requirements are met, and the agency issues the certificate.

Post-certification activities. Continued operational safety activities throughout the life of the aircraft.

²¹For more information on our interviews with selected officials and stakeholders, see the report that precedes this enclosure.

Key Federal Resources

FAA, *Advanced Air Mobility (AAM) Implementation Plan, Near-term (Innovate28) Focus with an Eye on the Future of AAM*, Version 1.0 (Washington, D.C.: July 2023).

FAA, *Urban Air Mobility (UAM) Concept of Operations*, Version 2.0 (Washington, D.C.: April 2023).

FAA, "License and Certificates" (Washington, D.C.: Apr. 13, 2023). Accessed November 29, 2023, https://www.faa.gov/licenses_certificates.

Key Federal Rulemaking Activities

Integration of Powered-Lift: Pilot Certification and Operations; Miscellaneous Amendments Related to Rotorcraft and Airplanes. FAA published a Notice of Proposed Rulemaking (NPRM) that would establish requirements for pilot certification and operation of powered-lift aircraft. The NPRM also includes a proposal for a Special Federal Aviation Regulation (SFAR) to create temporary alternatives for pilot certification as well as temporary operating rules for powered-lift aircraft to enable FAA to gather additional information and determine the most appropriate permanent rulemaking path for these aircraft. 88 Fed. Reg. 38946 (June 14, 2023).

Airworthiness Criteria: Special Class Airworthiness Criteria for the Joby Aero, Inc. Model JAS4-1 Powered-Lift. FAA published proposed airworthiness criteria for Joby's submitted powered-lift aircraft design. 87 Fed. Reg. 67399 (Nov. 8, 2022).

Airworthiness Criteria: Special Class Airworthiness Criteria for the Archer Aviation Inc. Model M001 Powered-Lift. FAA published proposed airworthiness criteria for Archer's submitted powered-lift aircraft design. 87 Fed. Reg. 77749 (Dec. 20, 2022).

Table 1: Authorities Identified by DOT as Relevant to the Future Regulation of Certification and Safety of Advanced Air Mobility Aircraft

Category	Authorities ^a	Description
Certification process	Title 14 C.F.R. Part 21	With respect to certification procedures for products ("product" is defined to mean an aircraft, aircraft engine, or propeller) and articles ("article" is defined to mean a material, part, component, process, or appliance), prescribes procedural requirements for issuing and changing design approvals, production approvals, airworthiness certificates, and airworthiness approvals.
	Title 14 C.F.R. Parts 23, 25, 26, 27, 29, 31, 33, 35	Prescribe airworthiness standards relating to normal category airplanes, propellers, normal category rotorcraft, transport category airplanes, transport category rotorcraft, manned free balloons, aircraft engines, and requirements for support of the continued airworthiness of and safety improvements for transport category airplanes.
Certification standards	Title 14 C.F.R. Part 36	Prescribes noise certification requirements that applicants must comply with as part of the overall aircraft certification requirements identified in 14 C.F.R. Part 21.
	Title 14 C.F.R. Part 34	Prescribes requirements for fuel venting and exhaust emission for certain gas turbine engine powered airplanes.
Additional certification and operational requirements	Title 14 C.F.R. Part 39	Provides the Federal Aviation Administration's (FAA) legally enforceable rules that apply to specified products, for example, aircraft, aircraft engines, and propellers through the issuance of airworthiness directives to address, for example, when FAA finds that an unsafe condition exists in a product.
	Title 14 C.F.R. Part 43	Prescribes requirements for maintenance, preventative maintenance, rebuilding, and alteration of aircraft having a U.S. airworthiness certificate; foreign-registered civil aircraft used in common carriage or carriage of mail; and airframe, aircraft engines, propellers, appliances, and component parts.
	Title 14 C.F.R. Part 45	Prescribes requirements for identification and registration marking.
	Title 14 C.F.R. Part 47	Prescribes requirements for aircraft registration.
	Title 14 C.F.R. Part 49	Prescribes requirements for recording of aircraft titles and security documents.
	Title 14 C.F.R. Part 91	Prescribes general operating and flight rules governing the operation of aircraft within the United States.
	Title 14 C.F.R. Part 119	Prescribes the certification requirements for air carriers and commercial operators seeking to transport persons and property by air for compensation or hire, and further designates under what part of the operating rules a particular operation should be conducted.
	Title 14 C.F.R. Part 125	Prescribes a set of certification and operational rules for large airplanes having a seating capacity of 20 or more passengers or a maximum payload capacity of 6,000 pounds or more when common carriage is not involved.
	Title 14 C.F.R. Part 135	Prescribes operating requirements for commuter and on demand operations and rules governing persons on board such aircraft.
	Title 14 C.F.R. Part 136	Commercial air tours and national parks air tour safety standards.
Hazardous materials requirements	Title 49 C.F.R. Parts 171-180	Prescribe multimodal requirements governing the transportation of hazardous materials in interstate, intrastate, and foreign commerce, that are applicable to carriers, shippers, passengers, and other entities. This includes Part 175, which prescribes requirements specific to the transportation of hazardous materials in commerce aboard (including attached to or suspended from) an aircraft.

Source: Department of Transportation (DOT). | GAO-24-106451

^aWe focus on the regulatory provisions that DOT identified. While DOT identified pertinent statutory provisions, we do not discuss the typically broadly worded underlying statutory provisions that grant DOT and FAA the authority to issue the cited rules and regulations.

Certification process and standards. FAA has two processes under 14 C.F.R. § 21.17 to use in certifying a new design, including AAM aircraft: (1) existing aircraft class with special conditions (14 C.F.R. § 21.17(a)) and (2) special aircraft class (14 C.F.R. § 21.17(b)).²² According to FAA, all of the AAM powered-lift aircraft designs currently under the agency’s review are being evaluated using the special class regulatory provision following a spring 2022 decision.²³ However, some AAM aircraft might be certified under existing class certification regulations with special conditions, depending on the exact specifications of the proposed design, according to FAA officials.²⁴

Both certification processes use airworthiness standards prescribed in other FAA regulations, depending upon the type of aircraft for which certification is sought (see fig. 3). For example, an aircraft that is to be certified as a “normal category” airplane would be regulated based on the airworthiness standards set by 14 C.F.R. Part 23.²⁵ If an aircraft design does not fit into one of the existing categories (e.g., normal category airplanes or rotorcraft), it will be regulated based on standards from the existing airworthiness regulations or based on other airworthiness criteria that FAA finds appropriate.

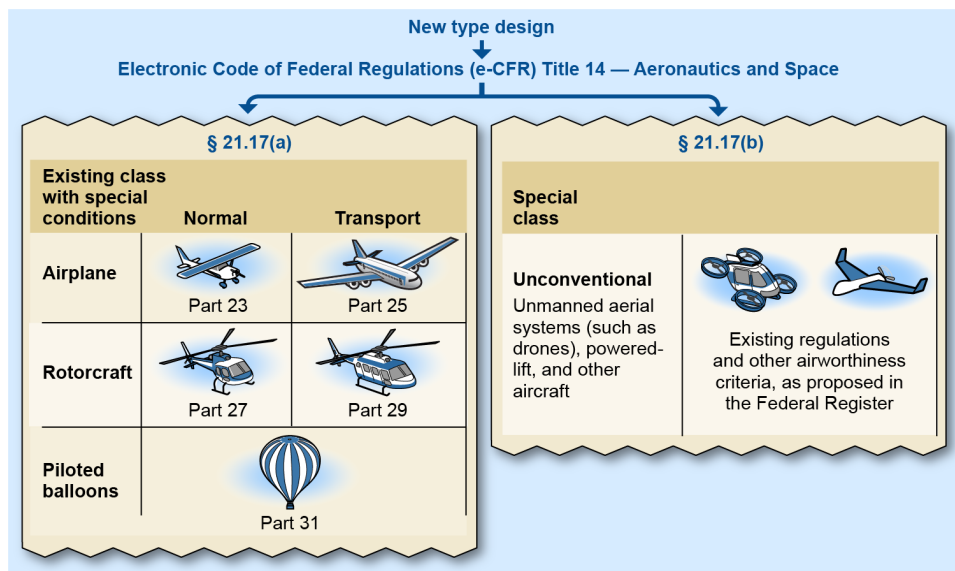
²²In general, FAA’s existing certification regulations include three aircraft classes—airplanes, rotorcraft (e.g., helicopters), and manned free balloons—each with its own set of rules, operating characteristics, and airworthiness standards. If FAA determines that the proposed new aircraft design meets one of these three classes and existing aircraft definitions, FAA uses the process in 14 C.F.R. § 21.17(a) to designate the applicable standards for certification. For any new aircraft design elements, FAA could create a special condition only applicable to that particular design. If FAA determines that the proposed new aircraft design does not fit into existing aircraft definitions and corresponding airworthiness standards, FAA uses the 14 C.F.R. § 21.17(b) path to designate it as a special class aircraft. FAA can then apply regulatory standards from any and all applicable classes (e.g., airplane, rotorcraft, or balloons) to form the certification basis.

²³Section 21.17(b) of title 14 C.F.R. provides: “For special classes of aircraft, including the engines and propellers installed thereon (e.g., gliders, airships, and other nonconventional aircraft), for which airworthiness standards have not been issued under this subchapter, the applicable requirements will be the portions of those other airworthiness requirements contained in Parts 23, 25, 27, 29, 31, 33, and 35 found by the FAA to be appropriate for the aircraft and applicable to a specific type design, or such airworthiness criteria as the FAA may find provide an equivalent level of safety to those parts.”

²⁴DOT officials cited an all-electric or hybrid aircraft that uses a traditional, existing airframe design, like an airplane or rotorcraft, as a hypothetical example of an AAM aircraft that could potentially be certificated under 14 C.F.R. § 21.17(a) with special conditions.

²⁵Normal category airplanes are those with a maximum takeoff weight of 19,000 pounds or less and with a passenger-seating configuration of 19 or fewer seats.

Figure 3: Federal Aviation Administration (FAA) Type Certification Regulations for New Aircraft Type Designs



Source: GAO analysis of Federal Aviation Administration information; GAO (illustrations). | GAO-24-106451

Note: According to FAA, for products type approved in accordance with § 21.17(a), FAA may issue special conditions when it determines that existing airworthiness regulations do not provide adequate or appropriate safety standards because of a novel or unusual design feature of the product. Special conditions are issued in accordance with FAA’s general rulemaking procedure regulations and contain such safety standards for the product as FAA finds necessary to establish a level of safety equivalent to that established in the regulations. 88 Fed. Reg. 38946, 38953 (June 14, 2023). FAA also notes that it may grant an exemption from the requirements of a regulation when an applicant petitions for relief under its general rulemaking procedure regulations. Id.

As of October 2023, FAA reported that eight U.S. based companies were undergoing FAA “type certification” for their AAM aircraft.²⁶ FAA published in late 2022 the proposed airworthiness criteria for two of these companies’ aircraft designs—Joby Aero and Archer Aviation—pursuant to this special class regulation.²⁷ These proposed criteria lay out the applicable regulations and any additional airworthiness standards specific to each particular aircraft design. The proposed criteria were open for public comment until December 2022 and January 2023, respectively.

Additional operating requirements. According to FAA’s July 2023 AAM Implementation Plan, in the near term, AAM commercial operators are expected to be certified to operate under 14 C.F.R. Part 135, which prescribes operating requirements for commuter and on demand operations. These operating requirements prescribe, for example, initial and recurrent pilot testing requirements for each type of aircraft to be flown by the pilot.

²⁶FAA officials noted that, in addition to the several active certification projects underway, FAA continues to communicate with numerous companies on the requirements for type certification. In general, the number of certification projects could increase or decrease for any number of reasons at any time.

²⁷See key rulemaking activities in the left column. According to FAA, because FAA has not yet established powered-lift airworthiness standards in 14 C.F.R., it uses the 14 C.F.R. § 21.17(b) certification path applicable to special class aircraft. As part of the certification process under 14 C.F.R. § 21.17(b), FAA publishes the entire airworthiness criteria in the Federal Register for each individual aircraft design.

Hazardous materials requirements. According to FAA’s July 2023 AAM Implementation Plan, the expected certification of initial AAM operations under current operating requirements for commuter and on demand operations will also require AAM operators to have hazardous materials training programs and other hazardous materials-related information approved by FAA.

Tribal, State, and Local Legal Authorities

No tribal, state, or local certification and safety authorities were applicable to AAM operations according to all federal, tribal, state, and local officials we interviewed.

Issues for Consideration

Short-term. Some selected tribal, state, and local officials and other stakeholders noted that FAA’s regulatory approach needs to further develop in a timely and predictable way.

Timeliness. Some selected tribal, state, and local officials and other stakeholders noted the importance of FAA’s leadership in completing initial AAM aircraft certification in a timely manner so that the AAM industry can begin operations. For example, officials from one selected state said that the industry as a whole is “standing by” for FAA to complete initial certification of AAM aircraft.

In June 2023, DOT’s Office of Inspector General reported that regulatory, management, and communication challenges have hindered FAA’s progress in certifying AAM aircraft. According to the June report, FAA will likely continue to face challenges as it carries out the certification process.²⁸ FAA officials told us that FAA’s Aircraft Certification Service is improving certification planning and communication for the certification process. They also said that they are committed to meeting design-specific milestones and are regularly meeting and communicating with applicants to manage expectations.

Predictability. In addition to timeliness, some industry stakeholders indicated that the predictability of the regulatory process for certifying AAM aircraft is crucial for the future of AAM operations. A representative from one industry stakeholder said that for 5 years, FAA had initially communicated to the industry that the agency would certify AAM aircraft under existing class certification regulations with added special conditions.

²⁸Department of Transportation, Office of Inspector General, *Regulatory Gaps and Lack of Consensus Hindered FAA’s Progress in Certifying Advanced Air Mobility Aircraft, and Challenges Remain*, AV2023037 (Washington, D.C.: June 2023). The Office of Inspector General stated that although FAA has determined a path forward for aircraft certification, significant work remains. This work includes addressing communication shortcomings—including those related to harmonization with other countries’ certification processes—and sustaining adequate staffing expertise for increased AAM certification in the future.

Related GAO Work

Aircraft Certification: Comparison of U.S. and European Processes for Approving New Designs of Commercial Transport Airplanes, [GAO-22-104480](#) (Washington, D.C.: June 30, 2022).

Transforming Aviation: Stakeholders Identified Issues to Address for 'Advanced Air Mobility, [GAO-22-105020](#) (Washington, D.C.: May 9, 2022).

Aviation Certification: FAA Needs to Strengthen Its Design Review Process for Small Airplanes, [GAO-21-85](#) (Washington, D.C.: Nov. 16, 2020).

Similarly, we previously reported that companies that publicly announced how they planned to approach certification said they would seek certification as “normal category” airplanes with special conditions using the FAA airworthiness standards for these aircraft outlined in 14 C.F.R. Part 23.²⁹ Instead, as previously described, FAA officials said that in spring 2022, the agency made a determination that most AAM aircraft would be certified under special class regulations.

Specifically, FAA officials said that the agency determined that, given the unique characteristics of many AAM aircraft, the special class regulations were the most appropriate certification path. FAA officials said this “special class” process is designed to address the many novel features of unique aircraft such as emerging powered-lift designs. They said this approach is consistent with international standards.

According to a few industry stakeholders and a DOT Inspector General report, this was an unexpected development, which required the industry to suddenly change course.³⁰ A few selected industry stakeholders said they are still targeting early 2025 for early operations.

Long-term. A few interviewees identified challenges related to certification and safety in the longer term. FAA officials acknowledged that initial certification projects may require more time and resources for both FAA and the companies. However, FAA officials said that as the criteria mature, the certification process will be more streamlined. In its concept of operations for AAM, issued in April 2023, FAA identified regulatory evolution as a key part of supporting an increased tempo of operations.³¹ However, a few interviewees still consider this to be an area of potential concern in the long run. They pointed to uncertainty regarding how the evolution will take place and the diversity of designs that may be brought to the agency for approval. For example, a tribal official said that while historically, aircraft development took long enough for FAA’s certification process to keep pace, the rapid development of aircraft technology in recent years is outpacing FAA’s creation of certification standards. Additionally, two interviewees specifically recommended that FAA revisit any initial standards in at least the next 10 years.

²⁹GAO, *Transforming Aviation: Stakeholders Identified Issues to Address for 'Advanced Air Mobility*, [GAO-22-105020](#) (Washington, D.C.: May 9, 2022). As we reported, stakeholders said that because electric vertical takeoff and landing (eVTOL) aircraft incorporate many new characteristics for airplanes—such as vertical flight capabilities, electric propulsion, batteries for primary energy storage, and highly automated flight control systems—FAA’s Part 23 regulations and existing industry standards do not apply to all areas of the aircraft. At that time, FAA officials said that if they certificated an AAM aircraft as normal category airplanes under 14 C.F.R. Part 23, they would do so with special conditions that would cover the specific design.

³⁰Department of Transportation, Office of Inspector General, *Regulatory Gaps and Lack of Consensus Hindered FAA’s Progress in Certifying Advanced Air Mobility Aircraft, and Challenges Remain*.

³¹Federal Aviation Administration, *Urban Air Mobility (UAM) Concept of Operations*, Version 2.0 (Washington, D.C.: Apr. 26, 2023). The term “urban air mobility” is generally viewed by FAA as a subset of operations under the broader umbrella term of AAM and refers to AAM operations in an urban environment. FAA considers its concept of operations to be key in developing AAM overall.



Source: GAO (icon). | GAO-24-106451

Background

The aviation industry relies on a highly skilled workforce, which includes pilots to operate aircraft and aircraft mechanics to perform maintenance on aircraft. We have previously reported that meeting FAA’s certification qualifications to become a pilot or mechanic requires years of training and experience.

AAM aircraft undergoing the certification process have diverse designs and capabilities relative to other traditional aircraft. For example, some designs outwardly resemble helicopters in that they have multiple rotors, while others have a fixed wing. Additionally, AAM aircraft designs have various ways to take off and move forward in flight. To fly and repair these aircraft, pilots and mechanics will need to be trained and certificated by FAA.

Pilot and Mechanic Training for Advanced Air Mobility

Bottom Line

Officials from DOT stated that FAA holds the sole relevant legal authorities to prescribe pilot and mechanic training and certification. Officials we interviewed from selected tribal, state, and local governments recognized that FAA holds exclusive authority. FAA is in the process of developing rules on pilot training for initial AAM powered-lift aircraft, which are capable of vertical takeoff, landing, and low speed flight. More specifically, in June 2023, FAA issued a Notice of Proposed Rulemaking (NPRM) with alternative training requirements to approve initial groups of powered-lift AAM pilots, on a temporary basis. In the same NPRM, FAA stated that it would develop rules on AAM mechanic certification at a later time, as needed. FAA is currently reviewing the public comments it received before finalizing the rule by the end of 2024.

Federal Legal Authorities and Actions

FAA has authority regarding pilot and mechanic training, which involves prescribing rules for (1) training, certification, and operations requirements for pilots, instructors, mechanics, and repairmen; (2) certification of schools and training equipment; and (3) repair stations and aircraft maintenance. Table 2 notes the federal authorities identified by DOT as relevant to the future regulation of pilot and mechanic training for civilian AAM operations.

Table 2: Authorities Identified by DOT as Relevant to the Future Regulation of Pilot and Mechanic Training for Advanced Air Mobility

Category	Authorities ^a	Description
Training, certification, and operations	Title 14 C.F.R. Parts 61, 63, 65 (Subparts D and E), 67, 121 (Subparts N and O), 125 (Subpart I), 135 (Subparts E, G, and H)	Prescribe certification requirements for pilots, flight instructors, and ground instructors; rules governing knowledge, experience, and skill requirements for pilots, flight engineers, mechanics, and repairmen; as well as medical certification for airmen. These parts also prescribe operating requirements for crewmembers such as requisite certificates, category, class, and type rating, instrument rating, flight time, and operating experience.
Certification of pilot schools, training centers, and training equipment	Title 14 C.F.R. Parts 60, 141, 142, and 147	Prescribe certification requirements for pilot schools, training centers, operator training programs, flight simulation training devices, as well as aviation maintenance technician schools.
Repair stations and aircraft maintenance	Title 14 Part 43, and 145	Prescribe rules governing the maintenance, preventive maintenance, rebuilding, and alteration of aircraft. These parts also prescribe certification requirements for repair stations.

Source: Department of Transportation (DOT). | GAO-24-106451

^aWe focus on the regulatory provisions that DOT identified. While DOT identified pertinent statutory provisions, we do not discuss the typically broadly worded underlying statutory provisions that grant DOT and the Federal Aviation Administration (FAA) the authority to issue the cited rules and regulations.

Key Federal Resources

FAA, *Advanced Air Mobility (AAM) Implementation Plan, Near-term (Innovate28) Focus with an Eye on the Future of AAM*, Version 1.0 (Washington D.C.: July 2023).

FAA, *Urban Air Mobility (UAM) Concept of Operations*, Version 2.0 (Washington, D.C.: April 2023).

Key Federal Rulemaking Activities

Update to Air Carrier Definitions.

In July 2023, FAA issued a final rule adding “powered-lift” to its definitions of certain air carrier and commercial operations. AAM aircraft currently undergoing certification will now be certified as powered-lift aircraft. 14 C.F.R. §1.1.

Integration of Powered-Lift: Pilot Certification and Operations; Miscellaneous Amendments Related to Rotorcraft and Airplanes.

In June 2023, FAA published an NPRM, which in part proposes alternate eligibility requirements to safely certificate initial groups of powered-lift pilots. 88 Fed. Reg. 38946 (June 14, 2023).

Recognition of Pilot in Command Experience in the Military Toward Required Experience to Serve as Pilot in Command in Air Carrier Operations.

A September 2022 final rule allows military pilots to, for example, credit selected flight time in military powered-lift aircraft flown in horizontal flight toward the 250 hours required to fly as pilot in command (PIC) or supervised PIC in airplanes. This change was designed to facilitate the entry of military pilots with specified powered-lift experience into Part 121 air carrier operations. 87 Fed. Reg. 57578 (Sept. 21, 2022).

Training, certification, and operations. FAA is in the process of developing rules on pilot training for initial AAM “powered-lift” aircraft, which are capable of vertical takeoff, landing, and low speed flight.³² Until recently, FAA’s regulations in Title 14 C.F.R. Part 119 and the corresponding definitions in §110.2 only allowed traditional airplanes or rotorcraft (e.g., helicopters) to be used in air carrier or commercial service operations. Some AAM powered-lift aircraft share both fixed aircraft and helicopter technologies, with rotors for lift at takeoff and a fixed wing to provide lift in flight.

In a June 2023 NPRM, FAA proposed a Special Federal Aviation Regulation with alternative eligibility requirements to approve initial groups of powered-lift pilots, on a temporary basis, to fly certain AAM aircraft. In its proposed rule, FAA indicates that there are existing regulations in Part 61 for training and certificating powered-lift flight instructors and pilots. However, FAA further explains that it believes that existing regulations do not adequately address the unique challenges of a new category of civil AAM aircraft. These challenges include a diversity of AAM aircraft designs, no approved AAM aircraft for pilots to train on, and an absence of specific regulations addressing qualifications needed. More specifically, FAA noted:

- First, the existing regulations for pilot training and certification did not anticipate the diversity in design of the powered-lift AAM aircraft that have been submitted to date to FAA for certification.
- Second, the existing aeronautical experience requirements for powered-lift aircraft pilots contain what FAA characterized as roadblocks for training the initial cadre of powered-lift AAM flight instructors and pilots. For example, pilots traditionally perform training flights aboard the aircraft they are learning to fly, but to date there are no approved powered-lift aircraft available for civilian pilots to use for this purpose.
- Finally, FAA stated that because the regulations for certain commercial operations in Part 135 do not contain specific regulations addressing qualifications for powered-lift pilots, there is a safety gap when compared to the Part 135 requirements for pilots of more traditional airplanes and helicopters.

In its June 2023 proposed rule, FAA also recognized that, once the agency certifies the first powered-lift aircraft, there will be an insufficient number of qualified flight instructors to train pilots. FAA therefore proposed allowing certain pilots employed by AAM manufacturers to obtain the necessary training and experience for powered-lift through the test flights and crew training activities necessary for aircraft certification.

³²In July 2023, FAA updated its air carrier definitions to include “powered-lift” aircraft, a category which will apply to AAM aircraft that are capable of vertical takeoff, vertical landing, and low speed flight. FAA defines powered-lift aircraft as being “heavier-than-air aircraft capable of vertical takeoff, vertical landing, and low-speed flight that depends principally on engine-driven lift devices or engine thrust for lift.... and on non-rotating air foils for lift during horizontal flight.” 14 C.F.R. § 1.1. As mentioned in the report that preceded this enclosure, AAM aircraft will not be exclusively powered-lift and may also feature conventional takeoff and landing or short takeoff and landing capabilities.

In the same NPRM, FAA said that it would develop rules on AAM mechanic certification at a later time, if needed.³³ FAA accepted public comments on its NPRM until August 2023, and the agency intends to issue a final rule by the end of 2024.

Schools and training facility requirements. FAA has authority to set certification requirements for pilot and maintenance technician schools and training centers, including those that will train pilots and mechanics to fly and repair AAM aircraft. The agency likewise has the authority to approve operator training programs and qualify flight simulation training devices. Under these authorities, FAA, for example, sets instructor requirements and minimum passage rates for these training facilities. The agency also prescribes rules governing the use of flight simulators and other training devices through these regulations. Under these requirements, pilots, for example, may complete parts of their training using qualified simulators.

Repair stations and aircraft maintenance. FAA has authority to set forth certification requirements for repair stations engaged in the maintenance, inspection, and alteration of aircraft and aircraft products, including for AAM aircraft. This authority includes setting application requirements for approving a repair station to operate, equipment requirements, and quality controls. FAA also prescribes rules governing the maintenance, preventative maintenance, rebuilding, and alteration of aircraft. For example, FAA sets performance rules for aircraft maintenance, including record-keeping requirements for maintenance activities.

Tribal, State, and Local Legal Authorities

No tribal, state, or local legal authorities are applicable to the certification of AAM pilots or mechanics, according to selected tribal, state, and local government officials.

Issues for Consideration

Short-term. Some interviewees said that the most pressing issue for AAM pilot training is the resolution of the June 2023 NPRM on pilot certification for powered-lift aircraft. The NPRM raised a variety of concerns for some interviewees. For example, a few industry stakeholders said that AAM aircraft currently undergoing FAA certification have one set of operator controls. However, the NPRM noted that pilots are required to be trained in powered-lift aircraft with dual controls (i.e., an instructor at one set of controls and a trainee at the other set) under the existing requirement in 14 C.F.R. §91.109. A few industry stakeholders said that if this established requirement for flight training operations continues to be applied to powered-lift aircraft, manufacturers would need to create and certify a new aircraft for use in training. Some interviewees suggested sophisticated flight simulators as a training alternative to dual-control aircraft.

³³88 Fed. Reg. 38946 (June 14, 2023). In the proposed rule, FAA stated that it will evaluate the existing testing standards for mechanics and repairmen under 14 C.F.R. Part 65 to see if any revisions to those standards are necessary to incorporate powered-lift aircraft. FAA stated that if updates are needed, it will promulgate those updates to correspond with the issuance of a final rule.

Related GAO Work

Aviation Workforce: Current and Future Availability of Airline Pilots and Aircraft Mechanics, [GAO-23-105571](#) (Washington, D.C.: May 17, 2023).

Transforming Aviation: Stakeholders Identified Issues to Address for 'Advanced Air Mobility,' [GAO-22-105020](#) (Washington, D.C.: May 9, 2022).

Collegiate Aviation Schools: Stakeholders' Views on Challenges for Initial Pilot Training Programs, [GAO-18-403](#) (Washington, D.C.: May 15, 2018).

Some interviewees said that their concern about the dual-control requirement needs to be addressed for industry to be able to move forward in building the initial group of AAM pilots. Interviewees said that finalizing this rulemaking, which FAA stated it intends to do by the end of 2024, will be an important step towards beginning AAM operations.

Long-term. While interviewees did not identify issues related to pilot and mechanic training that were strictly longer-term concerns, our past findings may have implications for the AAM industry. Specifically, we have previously reported that overall, there is strong demand for pilots and that meeting that demand has been difficult at times for existing airlines. Similarly, we have also reported that aviation businesses have reported challenges maintaining a sufficient number of mechanics. Moreover, stakeholders have previously raised concerns about whether the AAM industry will likewise struggle to meet workforce demands. See cited reports under "Related GAO Work" for more information.



Source: GAO (icon). | GAO-24-106451

Background

FAA's mission is to ensure the safe and efficient use of the national airspace system. The system is a complex network that includes airports, aircraft, and air traffic control facilities.

Within FAA, the Air Traffic Organization (ATO) is responsible for identifying airspace requirements, procedures, uses, and rules, including for safe and scalable AAM operations. For example, if future AAM operations take place in FAA-controlled airspace—airspace where air traffic controllers are actively communicating with, directing, and separating all air traffic—ATO will have to determine how to safely and efficiently integrate AAM operations with commercial airlines and other types of operations. If future AAM operations occur in uncontrolled airspace, or airspace where air traffic controllers are not providing services, ATO will play an integral part in developing the operating rules in those airspace areas.

Airspace Management for Advanced Air Mobility

Bottom Line

According to DOT officials, FAA's authority to manage U.S. airspace applies to all aircraft operations, including future civilian AAM operations. Officials from selected tribal, state, and local governments generally recognized that FAA holds exclusive legal authority over airspace management. Some government officials and other stakeholders we interviewed said FAA's regulatory structure for managing the airspace will be suitable for early operations, but noted the need for regulatory and procedural changes as AAM operations increase and include autonomous operations. Specifically, interviewees identified potential longer-term issues related to the integration of AAM operations with other airspace users and managing air traffic.

Federal Legal Authorities and Actions

In carrying out its responsibility to manage the national airspace, FAA has issued numerous regulations and orders that govern aircraft operations and airspace management requirements, such as setting minimum and maximum flight altitudes. FAA also issues guidance related to airspace management, but DOT officials cautioned that guidance is not enforceable. Table 3 shows federal authorities and policies that DOT identified as relevant to the future regulation of AAM operations with respect to airspace management.

Key Federal Resources

FAA, *Advanced Air Mobility (AAM) Implementation Plan, Near-term (Innovate28) Focus with an Eye on the Future of AAM*, Version 1.0 (Washington D.C.: July 2023).

FAA, *Urban Air Mobility (UAM) Concept of Operations*, Version 2.0 (Washington, D.C.: April 2023).

Key Federal Rulemaking Activities

Integration of Powered-Lift: Pilot Certification and Operations; Miscellaneous Amendments Related to Rotorcraft and Airplanes: In June 2023, FAA published an NPRM which proposes an SFAR. Among other things, the SFAR would determine which operating rules to apply to powered-lift on a temporary basis. FAA anticipates that the temporary SFAR would also enable the agency to gather additional information to inform future permanent rulemaking for these aircraft. 88 Fed. Reg. 38946 (June 14, 2023).

Table 3: Authorities and Policies Identified by DOT as Relevant to the Future Regulation of Airspace Management for Advanced Air Mobility Operations

Category	Authorities and policies ^a	Description
Designation of certain airspace areas, air traffic service routes, and reporting points^b	Title 14 C.F.R. Part 71	Prescribes rules governing the establishment of airspace and routes within the national airspace system, including the development of routes and airways.
General operating rules	Title 14 C.F.R. Part 91	Prescribes rules governing the general operation and flight of aircraft within the U.S., including operating requirements for controlled airspace and criteria for issuing temporary flight restrictions.
Airspace management rules	Title 14 C.F.R. Part 93	Prescribes special air traffic rules for operating aircraft in certain specified areas, such as in the vicinity of Los Angeles International Airport and the Anchorage, Alaska, Terminal Area.
	Title 14 C.F.R. Part 95	Prescribes flight altitudes governing the operation under instrument flight rules on air traffic services routes or other direct routes for which a minimum en route altitude is designated.
	Title 14 C.F.R. Part 97	Prescribes standard instrument approach procedures to U.S. civil airports and the weather minimums that apply to landings under instrument flight rules at those airports. Additionally, prescribes obstacle clearance departure procedures for certain U.S. civil airports and the weather minimums that apply to takeoffs under instrument flight rules at U.S. civil airports.
Air traffic control operational responsibilities	Order JO 7110.65AA – Air Traffic Control	Prescribes air traffic control procedures and phraseology for use by personnel providing air traffic control services.
Security procedures and requirements	FAA Order JO 7110.67L	Establishes air traffic management security procedures and requirements to support certain classified and sensitive unclassified special operations.
Additional guidance	FAA Advisory Circulars 90-113B, 90-112A, 90-107, 90-102A, 90-100A, Chapter 32 of JO 7400.2P Aeronautical Information Manual (AIM)	Provide, for example, guidance for submission and approval of special instrument flight procedures developed by non-FAA service providers; guidance on the Airspace Flow Program, including changes to the traffic management process for flights through constrained areas (e.g., areas affected by thunderstorm activity or periods of excess demand); guidance and procedures to assist air traffic personnel in determining the level of environmental study appropriate for proposed air traffic actions; and basic flight information and air traffic control procedures for use in the National Airspace System.

Source: Department of Transportation (DOT). | GAO-24-106451

^aWe focus on the regulatory provisions, orders, and additional guidance that DOT identified. While DOT identified the pertinent statutory provisions, we do not discuss the typically broadly worded underlying statutory provisions that grant DOT and the Federal Aviation Administration (FAA) the authority to issue the cited rules and regulations.

^bAirspace areas include Class A, B, C, D, and E. FAA defines “reporting point” to mean a geographical location in relation to which the position of an aircraft is reported. 14 C.F.R. § 1.1.

Airspace management during initial AAM operations. FAA’s 2023 AAM Implementation Plan (see “Key Federal Resources”) provides both the general approach developed by ATO for airspace route design and usage as well as traffic management designed to support near-term AAM operations (2025-2028). According to the plan, under this approach, AAM aircraft are expected to operate, for example:

- out of key locations with site-specific airspace and air traffic management policies;
- from the surface to 4,000 feet above ground level in urban and metropolitan areas, and in relatively close proximity to or directly on airports;
- with a pilot on board; and
- with predetermined flight schedules that are provided in advance of operations and coordinated with local air traffic control and other identified stakeholders.

According to this plan, because of the way AAM aircraft are expected to operate, initial AAM operations should have minimal interaction with other types of aircraft. Additionally, FAA's plan states that near-term AAM operations can be managed with existing air traffic control tools, procedures, and protocols.³⁴

Proposed AAM operating rules. In its June 2023 Notice of Proposed Rulemaking, FAA proposed a SFAR to apply specified airplane, rotorcraft, and helicopter operational requirements, as appropriate, to AAM powered-lift aircraft on a temporary basis. For example, under the proposed rule, FAA would apply a current commercial air tour operator requirement to complete helicopter performance plans to powered-lift aircraft. FAA also anticipates that the temporary requirements under the SFAR will enable it to gather additional operational data of emerging powered-lift aircraft to help inform future permanent regulations. FAA proposed a 10-year duration to the AAM SFAR after finalization (anticipated by the end of 2024), followed by more permanent regulations.

Tribal, State, and Local Legal Authorities

No existing tribal, state, and local legal authorities related to airspace management were applicable to AAM, according to tribal, state, and local officials we interviewed. However, some of these officials said there might need to be clarification on airspace management and the jurisdiction of non-federal entities in the future, in part, because they believe there is uncertainty regarding how and where AAM aircraft may operate.³⁵ In addition, a few interviewees noted that non-federal legal authorities related to land use inherently influence where aircraft can operate, as we discuss later.

Issues for Consideration

Short-term. FAA and a few interviewees said that they anticipate existing legal authorities related to airspace management will be sufficient to support early AAM operations. However, a few industry stakeholders said that they are awaiting more information from FAA on operating standards and rules for AAM aircraft. For example, one of these stakeholders said it

³⁴The plan stated that FAA will likely treat near-term AAM aircraft similarly to other fixed wing/rotorcraft to the extent they are able to comply with existing rules, regulations, and procedures.

³⁵Similarly, the Congressional Research Service reported in June 2023 that the future introduction of AAM technologies could raise various policy issues, including privacy concerns and the appropriate role of federal, state, and local governments in regulating and managing airspace. See Congressional Research Service, [R47608](#). "Federal Aviation Administration (FAA) Reauthorization Issues for the 118th Congress." (Washington, D.C., June 28, 2023).

is crucial for FAA to meet its 2024 deadline on the SFAR so commercial operations can move forward as planned.

Long-term. As the number of AAM operations increase, serve more locations, and also function autonomously, FAA officials, selected government officials, and industry stakeholders said that the existing legal authorities related to airspace management will need to evolve. Some interviewees raised concerns about how FAA will integrate increasing numbers of AAM operations in the airspace with other airspace users. According to FAA's 2023 AAM Implementation Plan, such users may include commercial and general aviation traffic, as well as low-altitude airspace users, such as drones. In its plan, FAA envisions that the highest level of AAM maturity will be characterized by a high-density mixture of scheduled, unscheduled, and on demand operations that are geographically dispersed and served by aircraft with autonomous capabilities. Our prior reports, cited under "Related GAO Work," examined the challenges FAA has faced in integrating new operations, such as commercial space operations and drone operations, into the national airspace.

A few interviewees noted that managing airport operations and airspace is already a challenging task. One airport operator said that as AAM aircraft increasingly share airspace with traditional aviation users, including at or near airports, there should be communication between airport authorities and different government entities to prevent additional complications related to terminal and airspace congestion.

In its 2023 Concept of Operations (see "Key Federal Resources"), FAA recognizes that it is currently unclear how airspace management will need to change to integrate AAM operations and will depend on the number and complexity of operations, as well as AAM aircraft capabilities. FAA officials said that adoption and implementation of any new practices will require the resolution of a range of questions and challenges, such as determining what rules are necessary and how they will be managed. The agency has identified some topics for further exploration, such as:

- **Operating practices.** In its concept of operations, FAA described the potential for FAA, operators, and industry to collaboratively develop cooperative operating practices to manage AAM flight corridors.³⁶ Figure 4 depicts a potential AAM flight corridor concept, similar to other, non-exclusionary corridors currently employed by FAA.

³⁶In its AAM Implementation Plan, FAA says that in the near-term, AAM routes will be based on existing or modified routes and constructs when possible. AAM aircraft will potentially share routes with other types of aircraft. The plan further says that dedicated airspace structures or corridors for AAM are not expected to be implemented until longer-term operations. According to FAA officials, while the intent is to integrate AAM without establishing exclusionary corridors, the FAA would need to engage in rulemaking if FAA pursues establishing corridors that would segregate AAM and limit the public's right of transit.

Related GAO Work

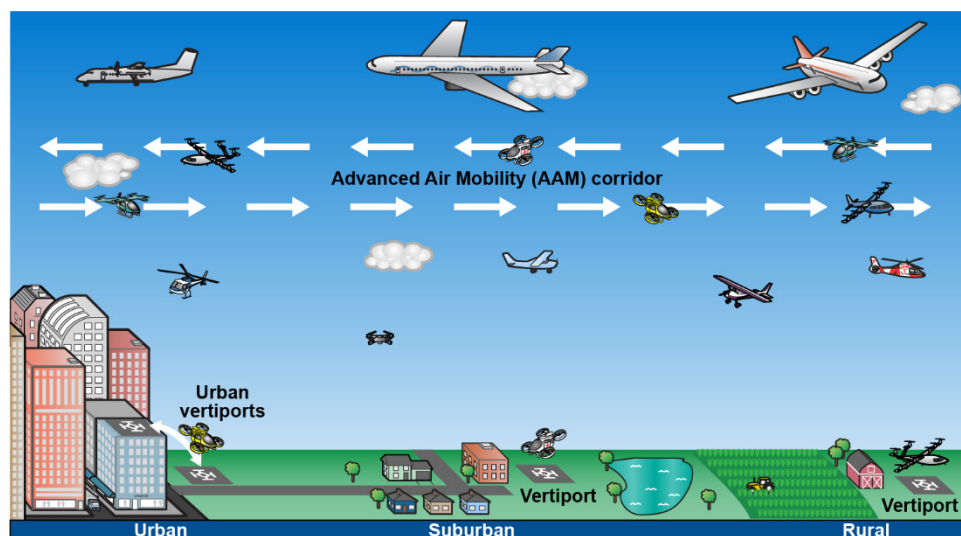
Drones: FAA Should Improve Its Approach to Integrating Drones into the National Airspace System, [GAO-23-105189](#) (Washington, D.C.: Jan. 26, 2023).

Transforming Aviation: Congress Should Clarify Certain Tax Exemptions for Advanced Air Mobility, [GAO-23-105188](#) (Washington, D.C.: Nov. 30, 2022).

Commercial Space Transportation: FAA Continues to Update Regulations and Faces Challenges to Overseeing an Evolving Industry, [GAO-21-105268](#) (Washington, D.C.: June 16, 2021).

Commercial Space Transportation: Improvements to FAA's Workforce Planning Needed to Prepare for the Industry's Anticipated Growth, [GAO-19-437](#) (Washington, D.C.: May 23, 2019).

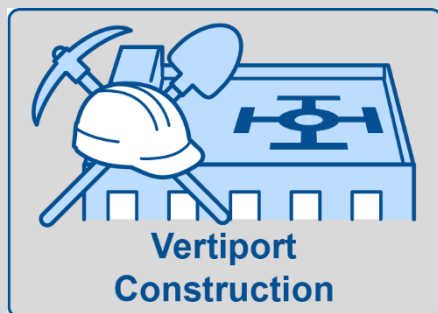
Figure 4: Example of an AAM Flight Corridor Concept



Source: GAO analysis of Federal Aviation Administration (FAA) information; GAO (illustration). | GAO-24-106451

- Training and resources.** FAA stated in its AAM Implementation Plan that it will need to develop the training that pilots, air traffic controllers, and other stakeholders would require for new procedures and regulations. FAA stated that an increasing number of AAM operations may challenge the current capabilities and resources of the air traffic management workforce, but the degree to which AAM aircraft will require air traffic services is still undefined.

Going forward, both FAA and some tribal, state, and local government officials we interviewed expressed the importance of collaboration. As noted above, FAA has identified potential opportunities to collaborate on developing operating practices. Its AAM Implementation Plan also speaks more broadly of the need to continue to work with AAM stakeholders, as well as communities. Officials from some selected tribal, state, and local governments identified flight corridors and data sharing as potential opportunities where different levels of government, along with airports and other entities, could work together on airspace management issues. Some interviewees also emphasized the importance of FAA communicating with various non-federal entities and clearly delineating their respective roles in airspace management.



Source: GAO (icon). | GAO-24-106451

Background

Infrastructure will be needed for AAM aircraft to take off, land, and load passengers and cargo safely. In addition, because some AAM aircraft will be battery-powered, infrastructure will be needed to provide electrical charging and appropriate fire suppression.

For initial AAM operations, operators have proposed using existing infrastructure, such as airports and heliports (i.e., where helicopters take off and land). In the longer term, AAM aircraft might also use new ground-based infrastructure that is not colocated at an existing airport or heliport.

Existing infrastructure will likely require modification or enhancements to accommodate AAM aircraft and their unique operations. For example, if existing heliports are used as vertiports for electrically-powered AAM aircraft, the site may need charging infrastructure or the ability to store replacement batteries. Moreover, according to FAA, the agency may need to revise its existing regulatory provisions and orders to fully account for AAM operations when evaluating a site.

For the purposes of this report, we refer to all ground-based infrastructure serving future AAM aircraft as “vertiports.” This could include modified or unmodified infrastructure at existing airports, modified or unmodified heliports, or new facilities that serve AAM aircraft.

Vertiport Construction for Advanced Air Mobility

Bottom Line

FAA prescribes guidance for the design of vertiports—infrastructure where AAM aircraft can take off and land—whereas tribal, state, and local governments traditionally have authority over land use and many set design requirements through licenses or permits for infrastructure in their communities, according to FAA. FAA issued initial interim guidance for vertiport design standards and plans to finalize the standards in 2025. According to FAA, recipients of federal financial assistance may be required to follow this guidance pursuant to the terms of their federal financial assistance agreement. However, these finalized design standards will not automatically apply in cases where sponsors or operators do not use federal financial assistance to support a new or existing vertiport (although states or localities could require compliance), according to FAA. Some state and local government officials we interviewed said it will be important for FAA to finalize these design standards for other government entities to make decisions about how to regulate AAM infrastructure.

Federal Legal Authorities and Actions

FAA’s legal authorities relevant to the regulation of vertiports are related to (1) design, such as developing requirements for AAM takeoff and landing infrastructure, (2) proposed construction in navigable airspace and/or on civil or joint-use (civil/military) airports, and (3) protection of the environment. The federal authorities and policies that DOT indicated are relevant to the future regulation of vertiports are shown in Table 4.

Key Federal Resources

FAA, *Advanced Air Mobility (AAM) Implementation Plan, Near-term (Innovate28) Focus with an Eye on the Future of AAM*, Version 1.0 (Washington, D.C.: July 2023).

National Aeronautics and Space Administration, *Advanced Air Mobility Community Integration Considerations Playbook* (Washington, D.C.: May 2023).

FAA, *Engineering Brief 105, Vertiport Design* (Washington D.C.: September 2022).

Table 4: Authorities and Policies Identified by DOT as Relevant to the Future Regulation of Vertiports

Category	Authorities and policies ^a	Description
Design standards	FAA Engineering Brief No. 105, Vertiport design	Provides interim guidance for the design of vertiports for aircraft with vertical takeoff and landing (VTOL) capabilities. ^b
Proposed construction affecting navigable airspace or at certain airports	Title 14 C.F.R. Part 77	Establishes, for example, requirements to provide notice to the Federal Aviation Administration (FAA) of certain proposed construction, or the alteration of existing structures.
	Title 14 C.F.R. Part 157	Prescribes requirements for persons proposing to construct, alter, activate, or deactivate a civil or joint-use (civil/military) airport or to alter the status or use of such an airport.
	FAA Order JO 7400.2	Specifies procedures for use by all personnel in the joint administration of the airspace.
Protection of the environment	Title 40 C.F.R. Parts 1500 – 1508	Provides direction to and prescribes requirements for federal agencies for compliance with the National Environmental Policy Act (NEPA), as amended. NEPA requires that federal agencies consider the environmental consequences of proposed actions in their decision-making and disclose significant impacts to the public.
	FAA Order 1050.1F	FAA policy and procedures for compliance with NEPA and Council on Environmental Quality implementing regulations.

Source: Department of Transportation (DOT). | GAO-24-106451

^aWe focus on the regulatory provisions and applicable order that DOT identified. With the exception of NEPA, while DOT identified pertinent statutory provisions, we do not discuss the typically broadly worded underlying statutory provisions that grant DOT and FAA the authority to issue the cited rules and regulations.

^bFAA officials said they expect to publish finalized standards related to vertiport design in an Advisory Circular in 2025.

Design. FAA issued initial interim guidance for vertiport design standards in September 2022 as Engineering Brief 105.³⁷ The interim guidance covers safety-related vertiport elements, such as takeoff and landing area size. FAA officials said that because the agency did not have enough validated performance data for AAM aircraft when they drafted the proposed vertiport guidance, the interim guidance uses a prescriptive and conservative approach. However, according to officials, FAA intends to treat its interim guidance as a living document and update the guidance over time to address new aircraft and technology as performance data is received from researchers and manufacturers.³⁸ FAA officials said the final vertiport design guidance will be published in an Advisory Circular in 2025.

According to FAA, recipients of federal financial assistance (such as airports) may be required to follow this guidance pursuant to the terms of their federal financial assistance agreement. However, the final vertiport design guidance will not automatically apply in cases where the sponsors or operators of a vertiport do not receive federal financial assistance. In such cases, according to FAA, the agency would not be able to require, for example, that the vertiport have certain landing pad sizes or firefighting equipment consistent with FAA’s design guidance. However, according to FAA, states or localities could require compliance with FAA

³⁷Federal Aviation Administration, *Engineering Brief No. 105, Vertiport Design*, EB-105 (Washington, D.C.: September 2022).

³⁸With respect to aircraft performance data, FAA noted that it is preferred to use conforming (non-prototype) aircraft, otherwise there is risk involved in developing policy based on non-final/unapproved designs because the final aircraft could vary.

design guidance even if a vertiport sponsor or operator does not receive federal financial assistance.

Proposed construction. The proposed construction of a vertiport may require notification to and consideration by FAA. Specifically, 14 C.F.R. Parts 77 and 157 require individuals to provide advanced notification to FAA if certain actions are proposed. The applicability of these notice requirements is not dependent upon whether the sponsor receives federal financial assistance. The proposed actions that trigger notification under each Part are different, as is the nature of the evaluations FAA must make:

- **Part 77.** FAA regulations under 14 C.F.R. Part 77 relate to how construction could affect aspects such as navigable airspace. This Part requires a facility's sponsors to provide notice to FAA for any proposed alteration of existing structures that meet certain criteria, such as height.³⁹ According to the regulations, FAA uses these notices to, among other things: (1) evaluate the effect of the proposed construction or alteration on safety in air commerce; (2) evaluate the efficient use of the navigable airspace and of airport traffic capacity at public use airports; and (3) notify the aviation community of the construction or alteration of objects that affect the navigable airspace, including the revision of charts, when necessary.
- **Part 157.** FAA regulations under 14 C.F.R. Part 157 relate to assessing the impact of proposed construction, alteration, activation, or deactivation of airports, which can include heliports, helistops, and vertiports.⁴⁰ This Part requires persons to notify FAA of the intended construction before construction is to begin on the landing or takeoff area, among other requirements.⁴¹ According to the regulations, FAA must conduct an aeronautical study to determine the potential effects of the proposed construction on air traffic, among other things.

FAA is exploring the possibility of initiating a rulemaking project to clarify the applicability of 14 C.F.R. Parts 77 and 157 to vertiports and supporting infrastructure.⁴² In October 2023, DOT officials said that the agency is still assessing the need for rulemaking. Officials said no specific timetable is available for when the agency will decide whether to proceed with rulemaking for either Part.

Environmental review. According to FAA's 2023 AAM Implementation Plan, new vertiport facilities that require approval or funding from FAA will be required to undergo an environmental review. The National

³⁹See, e.g., 14 C.F.R. §§ 77.5, 77.9. Federal Aviation Administration, *Advanced Air Mobility (AAM) Implementation Plan, Near-term (Innovate28) Focus with an Eye on the Future of AAM*, Version 1.0 (Washington, D.C., July 2023). Specifically, airport sponsors submit a Form 7460-1, *Notice of Proposed Construction or Alteration*. Vertiport support infrastructure includes charging stations, fueling stations, and AAM terminals, among other things.

⁴⁰See, e.g., 14 C.F.R. §§ 157.1, 157.2, 157.3, 157.7.

⁴¹14 C.F.R. §§ 157.1, 157.2, 157.3, 157.5. Specifically, notice is to be submitted on a FAA Form 7480-1, *Notice of Landing Area Proposal*.

⁴²FAA officials noted that Part 157 currently includes vertiports in its definition of airports. However, officials noted, vertiports will need to be included in references and any edits could impact other changes in the future.

Environmental Policy Act of 1969 (NEPA), as amended, and implementing regulations issued by the Council on Environmental Quality (CEQ) require federal agencies, including FAA, to evaluate certain proposed federal actions that significantly affect the quality of the human environment.⁴³ FAA Order 1050.1F describes when and how the agency will conduct such evaluations.⁴⁴ The order applies to actions directly undertaken by FAA and to actions undertaken by a non-federal entity where FAA has authority to condition a permit, license, or other approval.

Tribal, State, and Local Legal Authorities

According to FAA and other interviewees, Tribes, states, and localities will likely be responsible for the zoning and permitting processes relevant to AAM infrastructure. Zoning relates to land use issues, such as where AAM infrastructure can be constructed. Permitting relates to the granting of permission to undertake certain activities. For example, according to FAA, many state departments of transportation, aeronautics commissions, or similar government entities require prior approval and, in some instances, a license or permit to establish and operate aircraft landing facilities. Some interviewees said it is challenging to know what current zoning or permitting authorities might apply to AAM because many aspects of AAM operations have yet to be determined.

In addition, FAA and some other interviewees noted that zoning ordinances and permitting requirements do not reflect the novel characteristics of AAM infrastructure and will need to be updated. Some state and local officials told us that when revising requirements, their respective governments would likely adhere as closely as possible to any federal guidance related to AAM infrastructure. However, a few officials indicated that it might not be feasible to adopt certain concepts in dense urban areas, such as the proposed landing pad sizes in FAA's interim design guidance.

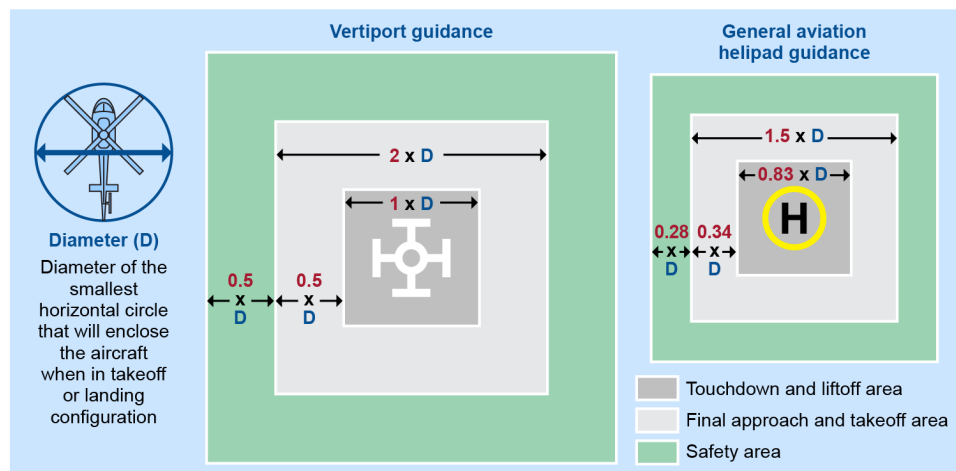
Issues for Consideration

Short-term. Some officials from state and local governments told us they are waiting to move forward on specific vertiport regulations until FAA's interim vertiport design standards guidance is finalized. As shown in figure 5, as of December 2023, the interim guidance calls for a significantly larger physical footprint than what is currently recommended for helicopters.

⁴³See 42 U.S.C. § 4332; 40 C.F.R. Parts 1500 – 1508. See also 42 U.S.C. §§ 4336, 4336a.

⁴⁴FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*.

Figure 5: Federal Aviation Administration (FAA) Interim Advanced Air Mobility Vertiport Guidance Compared to Traditional Helipad Guidance



Source: GAO presentation of Federal Aviation Administration information; GAO (illustration). | GAO-24-106451

A few interviewees also said that, given that many AAM aircraft will rely on battery-powered electrified propulsion systems, information on how to suppress fires involving AAM aircraft batteries would be valuable. One local official noted that electric ground transportation fires can be challenging to extinguish and expressed concern about the implications for AAM. Similarly, an airport operator said that emergency response procedures are a life-safety priority that it believes FAA must study. The airport operator explained that airports rely on FAA guidance to develop their emergency plans.

According to FAA, the firefighting techniques for AAM aircraft are still unknown and may differ depending on the aircraft model. Furthermore, according to the agency, providing adequate fire protection at vertiports will require a full understanding of the hazards related to the specific AAM aircraft that will be using the vertiport. FAA's Airport Engineering Division is collaborating with the National Fire Protection Association to update and establish minimum fire safety requirements for AAM operations at heliports, vertiports, and other similar locations. In addition, FAA recently began a research project at the William J. Hughes Technical Center to explore the aircraft rescue firefighting techniques, operations, materials, and equipment needed for electric aircraft fire and rescue.

Related GAO Work

Airport Infrastructure: Selected Airports' Efforts to Enhance Electrical Resilience, [GAO-23-105203](#) (Washington, D.C.: Aug. 29, 2023).

Transforming Aviation: Congress Should Clarify Certain Tax Exemptions for Advanced Air Mobility, [GAO-23-105188](#) (Washington, D.C.: Nov. 30, 2022).

Transforming Aviation: Stakeholders Identified Issues to Address for 'Advanced Air Mobility', [GAO-22-105020](#) (Washington, D.C.: May 9, 2022).

Airport Infrastructure: Information on Funding and Financing for Planned Projects, [GAO-20-298](#) (Washington, D.C.: Feb. 13, 2020).

Long-term. Some interviewees raised concerns about the availability of electricity at vertiports to support AAM operations. A few interviewees also noted that clarity on electric charging standards is needed. In 2023, we reported that of the 30 commercial service airports we surveyed, half reported that electric aircraft will have either a major or moderate impact on their electrical infrastructure over the next 10 years.⁴⁵ According to a 2023 report by the National Renewable Energy Laboratory under the Department of Energy, a range of charging stations with a variety of charging speeds will be needed at airports to accommodate various types of electric aircraft.⁴⁶

Some interviewees also raised questions about costs. Specifically, they said that it is not clear how the electrical infrastructure upgrades that will be needed to support AAM aircrafts' expected energy needs will be funded. Costs for such upgrades can include initial installation (e.g., equipment, labor, and materials) as well as annual costs (e.g., information technology services, power consumption, and maintenance).

⁴⁵[GAO-23-105203](#).

⁴⁶A range of charging speeds could include slow charging that would charge aircraft within 1 to 8 hours and fast charging that would charge aircraft within as little as 15 minutes. This range of charging times corresponds to a range of electric aircraft applications. For example, it is anticipated that some electric cargo planes will fly to a location in the morning and stay all day, only to return in the evening, whereas some passenger planes will land and take off as quickly as they can exchange passengers, maximizing operational efficiency of the aircraft. See Jordan Cox, Tom Harris, Kathleen Krah, James Morris, Xiangkun Li, and Scott Cary, *Impacts of Regional Air Mobility and Electrified Aircraft on Airport Electricity Infrastructure and Demand* (Washington, D.C: National Renewable Energy Laboratory, Feb. 2023).



Source: GAO (icon). | GAO-24-106451

Background

According to FAA, aircraft noise mitigation is a shared responsibility between airport authorities, airlines, tribal, state, and local governments, communities, and FAA.

There are several known factors contributing to how individuals perceive noise—that is, unwanted sound—including the intensity (measured in decibels) and regularity of the noise as well as the time of day that the noise is experienced.

Studies have suggested that aircraft noise can be a source of community annoyance, disrupt sleep, adversely affect academic performance of children, and could increase the risk for cardiovascular disease.⁴⁷

AAM aircraft that use electric engines may be less noisy than existing aircraft, which use internal combustion engines. For communities that currently experience high levels of aviation noise, AAM could be a quieter alternative to traditional aircraft, such as helicopters. For other communities, however, AAM may introduce aviation noise into areas where there previously was none.

Noise Management for Advanced Air Mobility

Bottom Line

FAA is authorized to regulate aircraft noise, including AAM aircraft noise, and is responsible for setting aircraft noise certification standards and evaluating the impact of aircraft noise. Tribal, state, and local governments have no authority to directly regulate the source of aircraft noise, according to DOT. However, these jurisdictions have traditionally exercised authorities over certain issues—such as land use and zoning—that might mitigate AAM aircraft noise by, for example, limiting or prohibiting AAM takeoff and landing sites near noise-sensitive areas. A few interviewees expressed concern about potential impacts of future higher-tempo AAM operations. FAA is in the process of conducting a noise policy review and plans to consider the appropriateness of its noise metrics for AAM and other aircraft.

Federal Legal Authorities and Actions

According to DOT, the agency's legal authorities regarding aircraft noise involve (1) setting aircraft noise standards to limit how much noise an aircraft can emit and (2) evaluating the significance of environmental impacts for aviation operations and disclosing those impacts to the public. Table 5 summarizes the federal authorities and policies that DOT identified as relevant to the future regulation of AAM operations with respect to noise.

⁴⁷M. Basner, C. Clark, A. Hansell, J. I. Hileman, S. Janssen, K. Shepherd, and V. Sparrow, "Aviation Noise Impacts: State of the Science," *Noise & Health*, vol. 19, no. 87 (2017).

Key Federal Resources

FAA, *Advanced Air Mobility (AAM) Implementation Plan, Near-term (Innovate28) Focus with an Eye on the Future of AAM*, Version 1.0 (Washington, D.C.: July 2023).

National Aeronautics and Space Administration (NASA), *Advanced Air Mobility Community Integration Considerations Playbook* (Washington, D.C.: May 2023).

NASA, *Acoustic Flight Test of the Joby Aviation Advanced Air Mobility Prototype Vehicle* (May 2022).

FAA, *FAA Community Involvement Manual* (Washington, D.C.: February 2016).

Key Federal Rulemaking Activities

Request for Comments on FAA’s Review of Its Civil Aviation Noise Policy. FAA is considering changes to its civil aviation noise policy and invited public comment on several key considerations, including how the agency measures exposure to aircraft noise. 88 Fed. Reg. 26641 (May 1, 2023).

Overview of FAA Aircraft Noise Policy and Research Efforts: Request for Input on Research Activities to Inform Aircraft Noise Policy. FAA published a summary of the research programs it sponsors on civil aircraft noise that could potentially inform future aircraft noise policy. The agency invited public comment on the scope and applicability of the research programs. 86 Fed. Reg. 2722 (Jan. 13, 2021).

Table 5: Authorities and Policies Identified by DOT as Relevant to the Future Regulation of Noise for Advanced Air Mobility Operations

Category	Authorities and policies ^a	Description
Aircraft noise standards	Title 14 C.F.R. Part 21	Prescribes procedural requirements for issuing and changing design approvals, production approvals, airworthiness certificates, and airworthiness approvals, which include showing compliance with noise requirements.
	Title 14 C.F.R. Part 36	Prescribes noise standards for the issuance of specified certificates (such as type certificates), changes to those certificates, and standard airworthiness certificates, for certain aircraft.
	14 C.F.R. Part 91 Subpart I	Prescribes operating noise limits and related requirements that apply to the operation of civil aircraft.
Protection of the environment	Title 40 C.F.R. Parts 1500 – 1508	Provides direction to and prescribes requirements for federal agencies for compliance with the National Environmental Policy Act (NEPA), as amended. NEPA requires that federal agencies consider the environmental consequences of proposed actions in their decision-making and disclose significant impacts to the public
	FAA Order 1050.1F	Sets out the Federal Aviation Administration’s (FAA) policy and procedures for compliance with NEPA and Council on Environmental Quality regulations.

Source: Department of Transportation (DOT). | GAO-24-106451

^a We focus on the regulatory provisions and applicable order that DOT identified. With the exception of NEPA, while DOT identified pertinent statutory provisions, we do not discuss the typically broadly worded underlying statutory provisions that grant DOT and FAA the authority to issue the cited rules and regulations.

Aircraft noise standards. Aircraft need to meet certain noise standards set forth in Title 14 C.F.R. Part 36 to be certified by FAA.⁴⁸ According to FAA, the agency will examine each certification application for AAM aircraft and determine whether existing Part 36 requirements are appropriate, as it does for all applicants whose aircraft are subject to noise certification. If the current standards cannot be appropriately applied, the agency may issue what is referred to as a "special condition," which is a rule of particular applicability for that applicant’s aircraft to establish appropriate noise parameters, according to FAA. As of July 2023, one AAM aircraft had completed the second phase in the certification process, in which FAA determined that the existing testing procedures and requirements in Part 36 were applicable. FAA is currently evaluating other AAM certification applications and will determine the noise certification basis for each.

FAA also prescribes air traffic regulations under Title 14 C.F.R. Part 91, including minimum or maximum flight altitudes and other operational factors that may affect how those on the ground experience aircraft noise. According to FAA officials, in general, the agency makes flight routing decisions based on safety, and secondary benefits may include noise reduction. However, with respect to flight paths near airports, an airport operator may voluntarily develop an Airport Noise Compatibility Program, which FAA then reviews.⁴⁹ In addition, FAA can develop air traffic arrival or departure procedures that help reduce noise by routing flights over areas with smaller populations and lower noise sensitivity if a location has

⁴⁸The issuance of airworthiness certificates is conditioned upon compliance with noise standards set out in 14 C.F.R. Part 36. 14 C.F.R. § 21.183(e).

⁴⁹Title 14 C.F.R. Part 150. According to FAA, it also provides federal funds to mitigate the adverse impacts of aircraft noise in homes and schools near airports.

What is the Day-Night Average Sound Level (DNL)?

DNL, which is expressed in decibels, is a cumulative noise metric that aims to account for a location's total potential noise exposure over an average annual day. The DNL metric accounts for the noise intensity, duration, time of occurrence, and number of flights above a particular location over an average day. In 1974, the U.S. Environmental Protection Agency identified DNL as the best metric to describe the effects of environmental noise in a simple, uniform, and appropriate way.

Current statute requires the Secretary of Transportation to establish a single system of measuring noise and to establish a single system for determining the exposure of individuals to noise resulting from airport operations, including noise intensity, duration, frequency, and time of occurrence. 49 U.S.C. § 47502. FAA adopted the DNL metric in 1981 in response to a requirement in the Aviation Safety and Noise Abatement Act of 1979. Pub. L. No. 96-193, § 102, 94 Stat. 50 (1980).

a significant level of aviation noise.⁵⁰ Similarly, FAA officials said that they would collaborate with leaders of Tribal Nations and attempt to reach a mutually agreeable resolution if AAM aircraft flights pose a disturbance to culturally important areas or events.

In addition, FAA is funding research to better understand AAM aircraft noise. In April 2023, FAA announced that it had awarded \$19 million in “Quiet Skies” research grants to 14 U.S. universities to further assist the agency in understanding and mitigating noise, including noise related to AAM. The Massachusetts Institute of Technology, for example, received a grant to develop noise models for different types of AAM aircraft to make community noise predictions. In general, proponents expect AAM aircraft to be significantly quieter than comparably sized traditional aircraft.

Protection of the environment. FAA is still evaluating how to conduct environmental reviews for AAM operations. The National Environmental Policy Act of 1969 (NEPA), as amended, and implementing regulations issued by the Council on Environmental Quality require federal agencies, including FAA, to consider the environmental consequences of proposed actions in their decision-making and disclose significant impacts to the public.⁵¹ In order to determine whether a NEPA review is required, FAA must first determine whether an action constitutes a “major federal action” that would trigger such a review. According to FAA, FAA approval of modifications to existing routes or creation of new routes establishing where AAM aircraft fly could trigger a NEPA review. In those instances, FAA anticipates that it will be required to evaluate the impact of AAM aircraft, including noise and visual disturbances, on the surrounding environment.

Currently, FAA uses a metric called the Day-Night Average Sound Level (DNL) to assess the potential noise impact of flight paths on environments surrounding an airport. A finding of “significant” noise impacts triggers additional reporting requirements and may lead to noise mitigation efforts (see “Related GAO Work”). For instance, people living in areas exposed to significant aircraft noise may be eligible for sound insulation programs funded by both FAA and local airports. According to FAA, in order to conduct an analysis of AAM noise impacts, the agency will need additional information from manufacturers as well as aircraft operational data.

Tribal, State, and Local Legal Authorities

Tribal, state, and local governments have no authority to directly regulate the source of aircraft noise, according to DOT. However, these jurisdictions have traditionally exercised authorities over certain issues—such as land use and zoning—that might mitigate AAM aircraft noise. Such actions could include, for example, limiting or prohibiting AAM takeoff and landing sites near noise-sensitive areas such as schools. Laws traditionally related to state and local police power—such as land use, zoning, and law enforcement operations—generally are not subject to federal regulation, according to FAA.

NASA’s Advanced Air Mobility Community Integration Playbook (see “Key Federal Resources”) and interviewees indicated that local governments might issue zoning laws or regulations to require that new AAM vertiports

⁵⁰FAA considers noise to be significant if there is a predicted increase in the Day-Night Average Sound Level (DNL) of 1.5 decibels or more in noise-sensitive areas (such as residential areas) that have a total DNL of 65 decibels and higher.

⁵¹42 U.S.C. § 4332; 40 C.F.R. Parts 1500-1508. See also 42 U.S.C. §§ 4336, 4336a.

be located in areas that reflect community noise preferences.⁵² For example, a city might issue a zoning ordinance requiring that vertiports be located away from residential areas and prevent noise-incompatible land use nearby.

Tribal, state, and local governments might also promote voluntary noise reduction practices. A few local government officials said that they encourage helicopter pilots operating in their respective jurisdictions to take steps to reduce disruption to people on the ground. For example, local governments can encourage helicopter pilots to follow “Fly Neighborly” procedures and guidance, a voluntary set of guidelines developed by FAA in collaboration with the helicopter industry that identify noise mitigation practices.⁵³ Table 6 shows examples of these noise mitigation practices.

Table 6: Examples of “Fly Neighborly” Noise Mitigation Practices for Helicopters

Flight characteristic	Examples of noise mitigation practices
Takeoff and landing	<ul style="list-style-type: none"> Minimize rotor and engine operation while on the ground Descend and ascend steeply near landing areas
Altitude	<ul style="list-style-type: none"> Fly at highest practical altitude when approaching metropolitan areas Avoid flying low over populated areas
Routing	<ul style="list-style-type: none"> Fly over major roads, rail lines, or waterways Vary routes taken for regular flights Avoid noise-sensitive areas, such as hospitals or schools
Speed and maneuvers	<ul style="list-style-type: none"> Avoid rapid and high-angled turns Fly normal cruising speeds or slower over noise-sensitive areas

Source: GAO analysis of Helicopter Association International Information. | GAO-24-106451

Issues for Consideration

Short-term. Given the expectation that initial AAM operations will consist of relatively few flights, tribal, state, and local government officials we interviewed did not express concern over noise in the short term. Rather, a few local government officials expressed optimism that AAM flights could reduce overall aviation noise in their cities if quieter eVTOLs replace noisier helicopters.

Long-term. In the longer term, FAA and interviewees expect the number of AAM flights per day will increase. As noted previously, FAA considers aircraft noise to be “significant” in areas exposed to a total DNL of 65 decibels and higher, among other factors. A few interviewees expressed concern that regardless of audible noise, numerous AAM flights overhead would be visually unpleasant and produce “visual noise.”

We previously found that DNL does not provide a clear picture of the flight activity at a given location.⁵⁴ For example, as shown in figure 6, 100 flights per day over a given location can yield the same DNL as one flight per day at a higher decibel level, due to the averaging effect of FAA’s metric. One stakeholder we interviewed expressed concern that DNL will not accurately convey the impacts of future AAM operations.

⁵²National Aeronautics and Space Administration (NASA), *Advanced Air Mobility Community Integration Considerations Playbook* (Washington, D.C.: May 2023).

⁵³GAO-21-200.

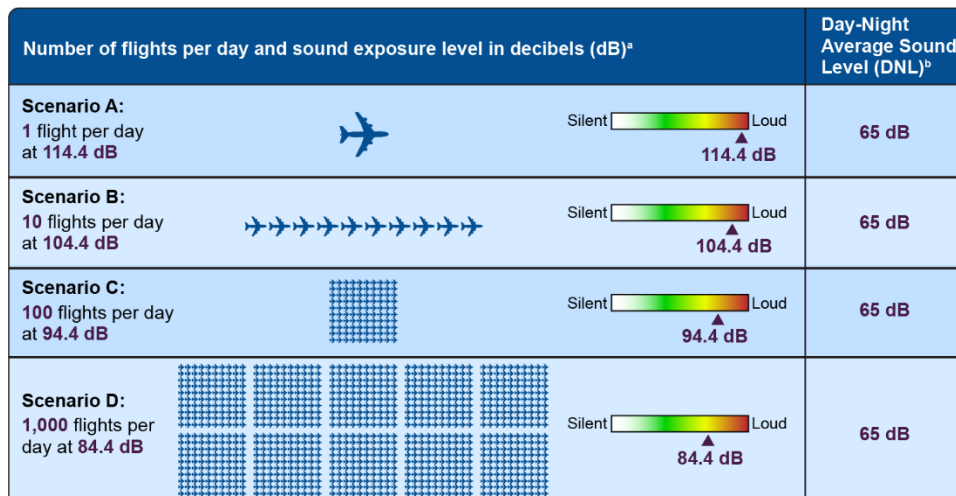
⁵⁴GAO-21-103933.

Related GAO Work

Aircraft Noise: FAA Could Improve Outreach Through Enhanced Noise Metrics, Communication, and Support to Communities, [GAO-21-103933](#) (Washington, D.C.: Sept. 28, 2021).

Aircraft Noise: Better Information Sharing Could Improve Responses to Washington, D.C. Area Helicopter Noise Concerns, [GAO-21-200](#) (Washington, D.C.: Jan. 7, 2021).

Figure 6: Aircraft with Varying Noise Levels and Flight Occurrences, as Represented by Estimated Day-Night Average Sound Level (DNL) Exposure



Source: GAO analysis of Federal Aviation Administration information; GAO (icons). | GAO-24-106451

^aDecibel (dB): A measure of sound intensity, or loudness.

^bDay-Night Average Sound Level (DNL): A cumulative measure of aircraft noise exposure at a particular location.

In light of DNL’s limitations, we previously recommended that FAA evaluate its noise policy and consider if or when other noise metrics might be appropriate. FAA is currently conducting a noise policy review and plans to consider whether and under what circumstances supplemental, companion, or alternative noise metrics are appropriate to inform research and policy considerations for AAM and legacy aircraft. In May 2023, FAA published a request for comments on its civil aviation noise policy. The comment period ended in late September 2023, and the agency received more than 4,800 comments. FAA has begun the process of reviewing and considering the public’s input.

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