

Up, Up, *and* Away


Innovations in Advanced Air Mobility

A U.S. DOT Volpe Center and
Federal Aviation Administration
Thought Leadership Series

Final Report

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The U.S. DOT Volpe National Transportation Systems Center and Federal Aviation Administration's thought leadership series considered how to embrace new technologies and prepare the future aviation workforce while ensuring the aviation system of the future is safer, more efficient, equitable, and sustainable for all.

The views of the speakers cited in this document do not necessarily reflect the views of the U.S. DOT.

Introduction

A new era in air transportation is emerging at an unprecedented pace – one that presents more efficient, sustainable, and equitable transportation options. Electric vertical takeoff and landing (eVTOL) aircraft, urban air mobility, drones, and other innovations have the potential to help the U.S. Department of Transportation (U.S. DOT), National Aeronautics and Space Administration (NASA), the Department of Defense (DoD), and the greater transportation enterprise tackle difficult local, regional, national and international challenges, achieve major breakthroughs, and deliver a critical public good.

The Advanced Air Mobility (AAM) ecosystem leverages an array of innovative technologies. AAM vehicles are highly automated, battery-powered aircraft that can be used to transport cargo and passengers, help with firefighting activities, assist with search and rescue operations and agricultural use, and more. AAM has the potential to connect underserved and rural communities to vital services. Today's growing AAM industry has the potential to create new jobs.

The U.S. DOT Volpe National Transportation Systems Center (U.S. DOT Volpe Center) and the Federal Aviation Administration (FAA), in coordination with the Office of the Under Secretary of Transportation for Policy, convened a thought leadership series focused on AAM. The seven-part, virtual series, *Up, Up, and Away: Innovations in Advanced Air Mobility*, was held from November 2023 to February 2024. The series featured 23 experts who considered how to

embrace new technologies and prepare the future aviation workforce while ensuring the aviation system of the future is safer, more efficient, equitable, and sustainable for all.

Leaders from the federal government, private sector, academia, and nonprofit organizations shared bold visions, insights, and experience related to AAM and associated technologies in the context of safety, economic strength and global competitiveness, innovation, the environment, equity, international collaboration, and workforce requirements.

This document is the final report on the *Up, Up, and Away: Innovations in Advanced Air Mobility* series. U.S. DOT Volpe Center Director Anne Aylward hosted and moderated the series.

Key Themes and Takeaways

A Broad and Diverse Set of Stakeholders Are Engaged in AAM

The AAM series was global in reach. More than 1,800 representatives from across the federal government, state and local agencies, tribal governments and organizations, metropolitan planning organizations (MPOs), the private sector, nonprofit organizations, academia, and international organizations attended the live webinars, and there were over 2,700 registrants. Representatives from fifty states and five continents linked in. The viewpoints and insights of speakers sparked thoughtful questions from participants during Q&A periods that enriched the series.

Transformation and the safe integration of AAM require a collaborative and holistic approach.

Transforming the aviation system and the safe integration of AAM technologies requires leadership, policy direction, and collaboration across the transportation sector, including close partnerships between FAA, NASA, other federal agencies, industry, state, local and tribal government organizations, and international partners.

U.S. DOT is working with local and national leaders, innovators, and external stakeholders to develop a national strategy, a fully integrated long-term vision that will shape the next era of aviation. This strategy will outline a path for AAM operations and full integration of this traffic into every other part of the transportation system and the communities AAM will serve. The AAM Interagency Working Group, called for by Congress, was launched in March 2023, and the U.S. DOT has had more than 100 engagements with stakeholders to discuss infrastructure development, security requirements, air traffic control needs, automation strategies, communications, and community roles, all of which are critical for the future of AAM operations.

The foundational goal of AAM is the safe integration of these innovative technologies into our cities, suburbs, and underserved and rural communities. For AAM to be successful, a holistic approach to safety is needed. Safety is U.S. DOT's top priority, and the FAA is responsible for the safe and efficient integration of AAM and other new entrants into the national airspace. Public confidence in AAM's safety and reliability is essential for its short and long-term success. Manufacturers

of eVTOLs will need to demonstrate their aircraft are safe in order to gain the confidence of the general public.

The AAM ecosystem represents a dramatic and transformative change in aviation. The introduction of AAM innovations brings many incentives and opportunities to make the entire aviation industry safer, more efficient, and more modern.

Addressing disparities in access to transportation can uplift underserved communities.

Under the leadership of U.S. Transportation Secretary Pete Buttigieg, U.S. DOT has centered equity as a Department-wide strategic goal. AAM has the potential to create new opportunities for underserved populations and connect remote communities with vital services and essential products. When transportation systems are designed with equity in mind, they provide fair and accessible options for all individuals, regardless of socioeconomic status, race, or location. The technology push that led to the advent of AAM has created new opportunities that communities can leverage for future growth and transportation needs.

AAM has the potential to reduce the discrepancy between affordable housing and jobs, expand access to critical amenities like education and medical services, stimulate economic development, and revitalize neighborhoods around vertiports. Today, autonomous drone companies have developed robust logistic systems with the goal of reaching populations and communities that are not being served and expanding these services to all communities. AAM is already solving real-world problems.



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Community engagement and acceptance are key to successful, sustainable AAM integration.

As we prepare for the integration of AAM, we must work together to understand environmental impacts and community concerns and collaborate to mitigate and address them. For AAM to scale, a widespread network of vertiports is needed. Before new infrastructure, like vertiports, is built in and around communities, consideration must be given to the different types of impacts, including air congestion, flight paths and noise issues, privacy, visual pollution, and other effects. It is also important to understand the unintended consequences of integrating AAM into existing transportation systems and the impacts on public resources at federal, state, and local levels. FAA, NASA, aircraft manufacturers, AAM operators, vertiport operators, state, local, and tribal governments will play an important role.

Active stakeholder engagement in AAM implementation is critical and will increase trust and acceptance among community members. It will also help promote equity inclusion and compliance with federal environmental regulations.

International leadership and collaboration will expand AAM technologies.

AAM is in its early stages and is developing all over the world. International leadership and coordination will be fundamental in helping the United States capture this opportunity and lead in markets that are developing worldwide. The U.S. DOT is establishing AAM standards and practices that will serve as a worldwide model for the production, certification, and operation of AAM aircraft and related systems.

In addition to certifying aircraft, FAA will look closely at the airspace, security issues, and manufacturing facilities, and take the steps needed to establish future use cases. By focusing on early AAM engagement with global partners and building a long-term vision, U.S. DOT is assuring cross-governmental, within government, and between government buy-in today that will make AAM a fully functioning part of the future global airspace.

AAM will create new opportunities for the future aviation workforce.

A well-trained and well-prepared workforce is foundational to the future of our aviation system and to the future of AAM. The AAM workforce will require a diverse set of skills, viewpoints, and people. In most aviation occupations, for example, women make up less than 20 percent of the workforce, and there is a lack of representation in race and ethnicity.

Megatrends in electrification, digitalization, sustainability, shared mobility, and new ways of learning are influencing how we build the future aviation system and train the future workforce. The broader AAM sector will require specific skills in the areas of pilot training and testing, battery development and integration, customer relations and interfacing, vertiport constructure and infrastructure, risk assessment and flight monitoring, software development, digital skills, multitasking, and countless others. This requires a collaborative effort—government, industry, nonprofit organizations, and academia need to talk about the exciting possibilities that lie ahead in this field.

Research shows that what draws people to aviation is the fun, the passion for the field, the excitement, and the desire to be challenged. Certificates, professional education, two-year, four-year, and master's programs are pathways for those interested in an AAM-related career. Many job opportunities exist within the AAM field that do not require an advanced degree, and the aviation industry must prepare to train those individuals as well. AAM also offers us the opportunity to consider AAM pilot training, its curriculum, cost, and the length of time it takes to complete it.

Series Kickoff: Innovations in Advanced Air Mobility

NOVEMBER 30, 2023

A National Strategy for Advanced Air Mobility

In October 2022, President Joseph R. Biden signed into law the [Advanced Air Mobility Coordination and Leadership Act](#), which directed the Secretary of Transportation to establish the Advanced Air Mobility Interagency Working Group (AAM IWG). The purpose of the AAM IWG is to plan for and coordinate efforts to integrate AAM aircraft into the national airspace system (NAS), particularly passenger-carrying aircraft, in order to grow new transportation options, amplify economic activity and jobs, advance environmental sustainability and new technologies, and support emergency preparedness and competitiveness.

During the *Up, Up, and Away: Innovations in Advanced Air Mobility* series kickoff, Under Secretary of Transportation Carlos Monje addressed the work currently underway at U.S. DOT to develop a national AAM strategy that complements FAA's work on safety. The Office of the Under Secretary leads the congressionally mandated AAM IWG, which is examining all of the issues related to this emerging technology to enable its safe and efficient deployment. U.S. DOT has engaged hundreds of stakeholders to discuss AAM infrastructure development, security requirements, air traffic control requirements, automation strategies, and community roles, all of which are critical to the future of AAM.

Research, Technology, and Innovation

Dr. Robert Hampshire framed AAM from a research, technology, and innovation perspective. He underscored U.S. DOT's vision for the future of AAM and addressed the prominent role government at all levels will play in operating and regulating the domain. Dr. Hampshire also spoke about U.S. DOT's leadership role in shaping the direction of AAM development and the national strategy that will be put in



Carlos Monje

Under Secretary of Transportation
for Policy, U.S. DOT

“Our job within the Office of the Secretary is to lead the congressionally mandated interagency working group on AAM, which is examining all of the wraparound issues beyond safety that impact AAM so we can mitigate barriers to deployment and address the negative externalities that this revolution could bring. Many of the communities we have talked to are looking to AAM as a possible means to address inequities in transportation access, bring jobs to underserved communities, or deliver medical services to areas ambulances just can't reach in time. Some of these communities are urban, and some rural—but they can each benefit from AAM in different ways.”

place for the safe deployment of AAM. “This is a huge step into the next era of aviation,” said Dr. Hampshire. “We cannot predict how these technologies will reshape our lives or how quickly these transformations may occur. However, we can anticipate dramatic and dynamic changes to our future transportation system.”

The Research, Development, and Technology (RD&T) Strategic Plan, developed by Dr. Hampshire's office, presents the U.S. DOT's transportation research priorities and strategies and outlines a national transportation research vision to guide America's research priorities and improve coordination of transportation research. “The plan helps

to frame some of the huge strategic challenges but also the changing pace of the transportation sector,” said Dr. Hampshire.

AAM’s Operational Ecosystem

FAA is taking the lead in establishing an operational AAM ecosystem in the United States and is working to safely and responsibly launch this AAM across the aviation industry. FAA is committed to ensuring the safe and efficient integration of AAM into existing national and international airspace systems that will serve the public in the coming decades.

Flying is safer than any other mode of transportation in history, and FAA continues to work closely with industry partners and the aviation community to ensure safety is always a top priority. As AAM is introduced into the nation’s cities, suburbs, and underserved rural communities, safety will remain FAA’s main focus. FAA Deputy Administrator Katie Thomson underscored the agency’s commitment to safety as AAM continues to evolve and build momentum across the aviation industry.

Deputy Administrator Thomson shared progress that has been made to develop an updated blueprint for airspace and procedure changes to accommodate future air taxis and other AAM operations. “It provides for AAM operations to begin at a low rate with air taxis flying with designated corridors, much as helicopters do today. They will use existing routes and infrastructure such as helipads and early vertiports. We began testing the blueprint this summer with our industry partners,” said Thomson. And, in June 2023, FAA took another step toward safely enabling AAM by proposing a comprehensive rule for training and certifying pilots. Shortly thereafter, the agency released the [Advanced Air Mobility \(AAM\) Implementation Plan \(Innovate28\)](#), which supports increasing scale and automation of AAM operations and integration with other aircraft types. In addition, FAA and the U.S. Air Force recently signed an agreement on data exchange and capability sharing for AAM testing.

Assistant Administrator Wildgoose underscored the strategic framework for the thought leadership series and stressed the importance of safety, purpose-driven research and innovation, the opportunity that AAM presents to look at inequities across the transportation system and communities,



Robert Hampshire, PhD
Deputy Assistant Secretary for
Research and Technology and
Chief Science Officer, U.S. DOT

“We all know that in transportation, transformative change doesn’t happen spontaneously, and the future isn’t simply manifested. It requires leadership, policy direction, and hard work from across the ecosystem. . . . As a nation we have this great opportunity to continue our global leadership and set a national strategy for the safe deployment of AAM, and, just like our first flight or our first steps on the moon, this is a huge next step in the new era of aviation.”



Katie Thomson
Deputy Administrator, FAA

“Today, FAA is hard at work to advance AAM integration in ways that are safe, efficient, equitable, and sustainable. Our unique role is to ensure all aviation safety aspects of AAM integration are met, including operating rules, aircraft certification, and pilot certification. We’re involved in every aspect of supporting AAM flights. This includes the aircraft itself, the framework for operations, access to the airspace, operator training, infrastructure development, environmental impacts, and community engagement.”



Laurence Wildgoose
Assistant Administrator for Policy,
International Affairs, and
Environment, FAA

“In discussing the integration of AAM into our national airspace system, we understand that there are tremendous opportunities ahead; however, we must proceed with a steadfast commitment to safety.”

the importance of collaborating with international partners, and the new jobs that will be created from pilots and dispatchers to technicians and engineers.

Customer Buy-In for AAM's Success

Keynote speaker, Elan Head provided a retrospective look at the aviation industry and the evolution of naval airships and compared some of the same challenges facing AAM and the adoption of eVTOL aircraft today. "Thus far, eVTOL companies have been very successful in gaining support for their vision from high-level government leaders. That's why we're all here today. But they still need to win over the people who will actually use their aircraft," Head remarked. "In the case of naval airships, the customer was the operating navy. In the case of urban air mobility, which is the target market for most eVTOL companies, the customer is the general public," she said.

Some communities and cities have already pushed back against the widespread adoption of urban air mobility. Elan suggested eVTOL companies must do a better job of communicating the benefits of their products to potential customers. "The support of high-level leaders can be essential at the early stages of an industry, but leaders come and go," said Head. "To have staying power, you really need the support of a broad and committed customer base that buys into your use case," she said.

Infrastructure Networks

Compared to naval airship and modern-day aviation infrastructure, eVTOLs will rely on a smaller footprint of scalable infrastructure networks. To this point, Head commented, "Commercial airship companies were never able to create the critical mass they needed to become economically viable. Fortunately for eVTOL developers, eVTOLs need much less infrastructure than do airships." This is critically important for AAM to realize its full economic potential in the coming years. "But the economic success of urban air mobility will still hinge on reaching a critical mass of passengers and vertiports," continued Head.

Ensuring Operational Safety

Overcoming the public's apprehensions about AAM safety will be a major challenge for FAA and eVTOL developers. Ensuring the safe operation of eVTOLs in urban and rural settings will be a difficult undertaking, but developers and

federal leaders must be successful in order to gain the public's trust.

"I sometimes hear people say that one fatal accident could destroy the Advanced Air Mobility industry. I don't think that's actually the case," remarked Head. "I think the public will be able to move on from one fatal crash, but they probably won't be able to tolerate many fatal crashes." Following the deadly crash of the airship *USS Akron* in 1933, many assumed future flights would meet a similar demise. This way of thinking could have been disastrous for future innovations in the aviation industry. Elan was cautiously optimistic about the future of AAM. "I think this accident illustrates why we can't expect to guarantee the safety of Advanced Air Mobility solely through aircraft design," noted Head. "We need to take a holistic approach to safety that emphasizes safe operations, which will sometimes mean conservative operations, which will sometimes mean less profitable operations."

In closing, Elan offered her insights and wishes for the future of AAM, "One hundred years from now, some eVTOL entrepreneur's granddaughter could be telling a very different story. Hopefully, in a world that has built on today's innovations to solve the great existential challenge of our time. I want this technology to succeed in a way that benefits everyone. To that end, I hope these lessons from the past can help."



Elan Head
Senior Editor, The Air Current

"If communities don't allow that network of vertiports to be built, urban air mobility will never scale."

Safety and Advanced Air Mobility

DECEMBER 7, 2023

The [Safety and Advanced Air Mobility](#) session focused on the safe integration of AAM and related technologies into the NAS.

FAA's Top Priority in an Era of Innovation

As FAA looks to integrate highly automated eVTOL aircraft into the NAS in the coming years, ensuring safety of passengers and aircraft will be an ongoing priority. FAA provides programmatic support, collaborates with national and international partners on projects and research, and works with eVTOL manufacturers to achieve safety standards.

Derek Morgan discussed FAA's work to enable initial safe, near-term operations in AAM through Innovate28, an agency-wide collaborative effort that draws members and expertise from across FAA and works with companies making early progress in AAM. Companies have ambitious plans to operate as early as 2025 and maybe even begin revenue-type service soon after. Some companies in the AAM space have no prior experience of working with FAA or with bringing an unconventional, certified aircraft to market. "I am simply amazed at how large-scale innovation unfolds," said Morgan.

Morgan is principally focused on advancing organizational improvement through strategic engagement initiatives including those aimed at new entrants. He currently leads the FAA Innovate28 Certification i-Team and serves as a member of U.S. DOT's Interagency Work Group Automation Strategy Subgroup. Morgan stressed FAA's number one priority—safety—and the importance of keeping it in focus while moving toward a new era of innovation. "Most of the work in support of AAM integration is being performed daily by the



Derek Morgan
Chief Operations Manager, Aircraft
Certification, Aviation Safety, FAA

"For over half a century, the FAA and the Department of Transportation have been at the forefront of progress and aviation safety, and today in partnership with a mature, safety-minded industry, we've realized the safest era in U.S. air operations. That progress has resulted in technological advancements to reveal an all-new manner of air transportation. Advanced Air Mobility, in all its various forms—from powered lift, electric vertical takeoff and landing aircraft to fixed-wing, conventional take-off and landing aircraft—it represents a sea change in aviation."

same FAA workforce responsible for ensuring the safety of the existing fleet and infrastructure," said Morgan.

Safely Unlocking the Benefits of AAM

Cindy Comer provided an overview of Wisk Aero, a U.S.-based autonomous eVTOL aircraft manufacturer that is committed to safety and unlocking the potential scale, benefits, and accessibility of AAM. In 2022, Wisk was accepted into FAA's Safety Management System Voluntary Program, which will set the framework for a proactive safety approach.

Comer discussed Wisk's sixth-generation four-seater aircraft and their goal to roll this aircraft out for commercial service and short hop flights. Wisk does not have a pilot in its aircraft but does have a human on the ground,



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“a multi-vehicle supervisor,” to provide oversight for the autonomous aircraft. Wisk also recently partnered with the city of Sugar Land, Texas to bring autonomous AAM capabilities to the Greater Houston area. As part of this new partnership, Wisk will develop vertiport infrastructure that will enable autonomous air taxi operations throughout the region.

Safely Meeting Demand in Urban Areas

Joby Aviation’s mission is “to enable the public to spend less time traveling and more time living,” said Eric Allison. They are accomplishing this with an eVTOL aircraft that will meet the demand of short-duration trips in urban areas. Allison discussed Joby’s focus on urban air mobility and the air taxi market. As major population centers become increasingly dense, “the promise of the air taxi mission is that instead of taking people an hour and a half to get to work, they can get there in 15 minutes,” noted Allison. Joby, with Uber and Delta as partners, is also looking to take advantage of aggregate demand of those traveling to major airports, like JFK International Airport.

Joby’s full-scale prototype aircraft have flown more than 30,000 miles and are designed to meet the strict safety standards set by FAA and global aviation regulators. In 2023, Joby Aviation delivered its first eVTOL aircraft to Edwards Air Force Base. The aircraft will be used for on-base operations that will demonstrate a range of logistics missions, including cargo and passenger transportation.



Cindy Comer
Director, Certification and Safety
Management System, Wisk

“Safety is our absolute first priority. We are designing our aircraft to meet and exceed in some places the highest possible aviation standards of safety. We partner with the FAA and other regulators as well to talk about advancing safety in this industry, but also about how we are going to ensure that our aircraft is safe.”



Eric Allison
Head of Product, Joby Aviation

“At the core of what we’re doing is safety. So, we are architecturally taking a system safety approach to how we design and build this aircraft. So, for example, we don’t have single points of failure in our propulsion system, which for a vertical take-off and landing aircraft is something that’s pretty unusual. So, the approach that we have taken is that we have dual-wound motors. For example, each motor is actually two motors that are completely, electrically independent of each other. We have isolated battery packs. So, we have chains and layers of redundancy built into what we do.”



Blain Newton
Chief Operating Officer,
BETA Technologies

“Flying in real-world conditions to test the systems becomes really, really important as you think about safety... The safety and redundancy of systems is critical ... but, equal to that is what FAA has been so good at in the U.S. air system is a holistic approach to safety from ground support stations but also through pilot training.”

Safety and Sustainability

BETA Technologies is focused on building an electric aircraft and becoming an aerospace original equipment manufacturer. BETA's aircraft will use zero-emission propulsion systems and a line of batteries that will safely, quickly, and efficiently charge the next generation of eVTOLs. BETA is also partnering with industry leaders to develop a shared charging system for electric aircraft that any eVTOL or electric vehicle can use. A unified charging system will enable electric aviation to develop at scale and will help reduce the costs associated with electrifying existing infrastructure at airports and vertiports.

“There's multiple opportunities to improve and move toward a mission of decarbonized aviation, whether it's through autonomous air taxi or the great work that Joby's doing in urban air mobility, and we're just thrilled to continue to push forward, very much aligned with the FAA's goals of maintaining the safest air space in the world,” said Blain Newton. Currently, Beta is partnering with United Parcel Service, United Therapeutics, and Air New Zealand—and recently partnered with Archer on chargers and charger safety infrastructure. Looking to the future, BETA envisions great opportunities to continue working with FAA and other aviation partners as AAM follows an upward trajectory.

Transformation: Urban Air Mobility Concept of Operations

DECEMBER 19, 2023

The [Transformation: Urban Air Mobility Concept of Operations](#) session focused on FAA and NASA's ongoing work to move innovative ideas and technologies forward that will enable the safe integration of AAM into the existing NAS.

NextGen: Moving Innovative Ideas Forward

Through the Next Generation Air Transportation System (NextGen) initiative, FAA aims to modernize the current air traffic infrastructure in communications, navigation, surveillance, automation, and information management to increase the safety, efficiency, capacity, and resiliency of the aviation sector. As FAA's Assistant Administrator for NextGen, Paul Fontaine is responsible for providing strategic direction and oversight, modernizing air transportation, conducting aviation research, and supporting the overall advancement of aviation, including the introduction of AAM.

"For us, it really begins with the conceptualization of a future end state, taking that idea and conceiving it, validating it, and articulating it," Fontaine said. Key to maturing the urban air mobility concept, FAA, in partnership with NASA and industry partners, released Version 2.0 of the Urban Air Mobility Concept of Operations in April 2023. Fontaine discussed FAA's efforts to validate some of the elements of ConOps 2.0 through lifelike demonstrations in California. "This demonstration successfully showcased industry-developed concepts, and proposed solutions for managing UAM operations alongside traditional operations. FAA will continue to use demonstration activities to give shape and definition to these new ideas," noted Fontaine. "And more importantly, to build consensus among the user community," he concluded.

NASA's Research Helps Validate AAM Concepts and Requirements and Explore Use Cases

The focus of NASA's AAM research is to change the way people and goods move within and between cities, communities, and rural areas. NASA envisions an air transportation system of the future where AAM will support low-altitude passenger transport, efficient cargo delivery, public service capabilities, improved search and rescue operations, and help fight wildfires in remote areas.

Robert Pearce, NASA's Associate Administrator for the Aeronautics Research Mission Directorate, spoke on NASA's work in this area and the integration of AAM into flight operations. Over the past several years, NASA has worked with FAA, industry, and stakeholders to develop concepts of operations and innovative approaches to solve the many challenges associated with urban air mobility and AAM.



Paul Fontaine
Assistant Administrator for Next Generation Air Transportation System (NextGen), FAA

"NextGen is really responsible for moving innovative ideas and technologies through a developmental phase to implementation and helping enable the safest, most efficient aerospace system in the world. [The] NextGen [office] is really the focal point on Advanced Air Mobility helping to organize and coordinate a wide array of activities across the FAA that will be needed to support the development and implementation of an ecosystem which will be needed to support Advanced Air Mobility."

NASA released an airspace research roadmap that is aligned with both FAA and industry ConOps and identifies high-level requirements and research needs. NASA has also developed urban air mobility (UAM) arrival/departure scheduler requirements related to the strategic scheduling and tactical separation services that are critical to urban air mobility. Pearce discussed NASA's plans to conduct a series of demonstrations between now and 2030 that will bring technologies and architecture together and demonstrate it in an incremental way. "This will help validate requirements, concepts, and technologies and bring the industry readiness up for operation as well as FAA's ability to take this and turn it into operational procedures and standards," noted Pearce.

FAA Collaborates with Stakeholders to Streamline NAS Operations

The future NAS will look quite different from today and will include diverse types of vehicles and aircraft with many different operations and service capabilities. While FAA will still manage and oversee the airspace, the agency will work with stakeholders and traffic management services to share information and streamline operations in the NAS.

FAA's Chief Scientific and Technical Advisor for Architecture and NextGen Air Transportation Development Steve Bradford touched on this complex and collaborative relationship and provided information on the UAM ConOps 2.0, which is focused on crewed and uncrewed aircraft operations,



Version 2.0 of the Urban Air Mobility (UAM) Concept of Operations (ConOps), released by FAA's NextGen Office, is a key element in maturing the overall AAM concept.

incorporation of UAM operations into the NAS where traditional air traffic control operations exist, and the evolution of aircraft technology and increasing levels of automation.

"In the ConOps, we're not talking about a new class of airspace," said Bradford. "We're talking about you participating in the existing class of airspace. But within the cooperative area, you'll have additional requirements. This is not to say that every eVTOL has to participate in the cooperative areas. This is a matter of choice, and in some locations, it will be unnecessary," said Bradford.



Robert Pearce
Associate Administrator for
Aeronautics Research Mission
Directorate (ARMD), NASA

"This is enormously exciting. It's got a lot of use cases, everything from urban air mobility... it could be air taxi-type operations, it could be first responder-type operations, it could be interregional operations."



Steve Bradford
Chief Scientific and Technical Advisor
for Architecture and Next Generation
Air Transportation System (NextGen)
Development, FAA

"Our concept specifies a type of cooperative operation that occurs within what we call cooperative areas. An example would be the definition of a UAM corridor or pathway. And it's conducted in compliance with specific rules, procedures, and performance requirements and operated under what we call cooperative operating practices... that's key. Any aircraft utilizing this area must participate in this confederated ecosystem by obtaining a confirmed operational intent for the provider of service for UAM. You must share your intent. You must deconflict your intent strategically from other operators."

Environmentally Responsible Advanced Air Mobility

JANUARY 17, 2024

The [Environmentally Responsible Advanced Air Mobility](#) discussion focused on the work underway to understand the environmental impacts and community concerns around AAM and the steps being taken to address issues and facilitate the smooth integration of AAM into the NAS.

Reducing the Impacts of Aviation

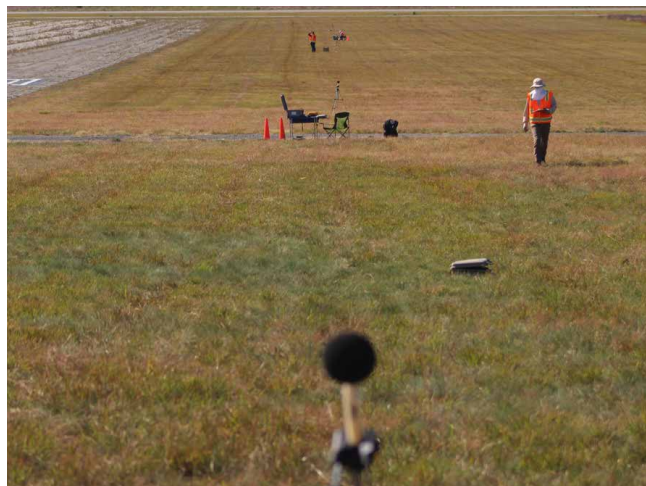
FAA's Office of Environment and Energy (AEE) works to reduce the environmental impacts of global aviation through research, technological innovation, policy, and community outreach. AEE is comprised of aviation professionals who develop, recommend, and coordinate national and international standards, policy and guidance, research and studies, and analytical expertise to solve aviation-related issues.

Julie Marks spoke about the mission of her team as U.S. DOT prepares to integrate AAM into the NAS.

"A large number of AAM operations will not require an FAA environmental review. In those cases, a state, local, or tribal entity, the vertiport operator, and the AAM vehicle operator are responsible for environmental considerations and community engagement," said Marks. "Only a subset of AAM actions, situations where there is an FAA approval, will trigger an FAA environmental review such as a proposed vertiport on a federally funded airport or a project that would require a development or changes to air traffic procedures," she concluded.

Environmentally Responsible Integration of AAM

Christopher Roof provided an historical perspective on the U.S. DOT Volpe Center's noise modeling and certification work. The U.S. DOT Volpe Center team has worked closely



Microphones form a linear array for dynamic flight operation tests at Fitchburg Municipal Airport (MA). Source: U.S. DOT Volpe Center/Chris Roof.

with FAA, NASA, industry, and international partners on noise measurement, modeling, and analysis for decades. Over a decade ago, the FAA and the U.S. DOT Volpe Center launched a new environmental analysis tool, the Aviation Environmental Design Tool (AEDT), which offered a robust, integrated way to quantify the environmental impact of aviation—from a single flight up to full-scale global impacts. Today, AEDT is FAA's *de facto* standard worldwide and is required for use around airports in the U.S.

"Work done on traditional noise certification may inform noise certification for UAVs," said Roof. "The metrics we use for new entrants, like AAM, are being considered by FAA, NASA, and industry partners in a number of working groups. In addition, community engagement is always a very important aspect of the environmental process," he noted.

"Given the airport-centric nature of commercial aviation over the past several decades, there are procedures in place to

either reach out to the noise ombudsman at FAA or your local airport noise office if you have a complaint or issue with noise. Thinking of operations not specifically focused on commercial airports, what is the protocol?” Roof asked. “This is another AAM-related issue that impacts people.”

NASA Develops Prediction Models to Reduce Aircraft Noise

Dr. Steven Rizzi leads a diverse team that is focused on developing innovative tools and methods for perception influence and acoustic design of air vehicles with application to many of NASA’s research programs. During his talk, Rizzi highlighted some software tools developed by NASA to analyze noise levels of VTOL and eVTOL vehicles.

“To assess community noise impact, you first need to know something about the source, and there are a couple of ways of determining that, one is through acoustic flight tests, and another is through predictions,” said Rizzi. Predictions can be used to help understand and mitigate community noise impact. Rizzi discussed NASA’s work to develop innovative software prediction tools to assess aircraft noise and the steps being taken to help eVTOL makers reduce community noise impacts.

NASA works with eVTOL manufacturers to measure the acoustic profile of specific aircraft. The data gathered from these tests will be used to develop design tools manufacturers can use to reduce the noise impacts of eVTOLs.



Julie Marks
Acting Executive Director, Office of Environment and Energy, FAA

“While the FAA can have an important role in facilitating environmentally responsible AAM operations, other stakeholders have important roles as well, e.g., NASA, aircraft manufacturers, AAM vehicle operators, the vertiport operators, and importantly—state, local, and tribal entities, and the communities themselves.”



Christopher Roof
Chief, Environmental Measurement and Modeling Division, U.S. DOT Volpe Center

“As it (the Aviation Environmental Design Tool) pertains to AAM, the Volpe Center conducted an audibility or d-Prime analysis using the advanced acoustic model. Volpe leveraged multiple ambient environments directly from the U.S. DOT Bureau of Transportation Statistics National Noise Map. Additionally, the Volpe Center provided noise model improvements to the advanced acoustics model directly to the industry. They came to us for greater fidelity in the frequency domain.”



Stephen Rizzi, PhD
Senior Researcher for Aeroacoustics, NASA Langley Research Center

“A NASA prediction toolchain has been developed and validated, and improvements continue to be made in that. With these tools, NASA is in a good position to assist stakeholders reduce UAM community noise impacts by helping to reduce noise at the source by providing tools to support land-use planning and environmental analyses, and by identifying noise abatement procedures—three elements of the ICAO (International Civil Aviation Organization) balanced approach.”

Considerations for Equity in Advanced Air Mobility

JANUARY 23, 2024

The [Considerations for Equity in Advanced Air Mobility](#) discussion focused on the work of FAA, U.S. DOT, and stakeholders in our future aviation system to sustainably and equitably integrate AAM across communities through education, communication, and collaboration with state, local, and tribal government decision makers, urban planners, and the public.

Equity: A U.S. DOT Strategic Goal

U.S. DOT is working to institutionalize equity across the Department's policies and programs, with the aim of reducing inequities throughout the nation's transportation systems in communities impacted the most. "U.S. DOT is focused on addressing disparities across transportation and supporting projects that connect underserved communities and people to essential services like healthcare, education, and new employment opportunities," said Anne Aylward, Director of the U.S. DOT Volpe Center and series moderator. An equitable approach fosters engagement with affected communities, incorporating their perspectives and needs into the ecosystem's design and implementation. By integrating equity considerations into the AAM ecosystem, overall societal well-being will be enhanced by breaking down barriers and promoting economic development in historically marginalized areas.

Identifying the Benefits and Opportunities of AAM

AAM has become a prevalent topic of discussion across the transportation sector, due in large part to a technology push in the areas of electronic propulsion, data networks, autonomy, and the introduction of new materials, which have driven the development of new types of aircraft and aircraft systems. The Community Air Mobility Initiative (CAMI) is a nonprofit organization that works to connect communities



Anne D. Aylward
Director, U.S. DOT Volpe Center
and Series Moderator

"An equitable approach fosters engagement with affected communities, incorporating their perspectives and needs into the project, design, and implementation. While I am referencing equity considerations related to the delivery of infrastructure projects nationwide, it's also applicable to today's discussion on the future of AAM."



Yolanka Wulff
Executive Director and Co-founder,
Community Air Mobility Initiative
(CAMI); Member, FAA AAM
Advisory Committee

"So, as we think about the possible potential benefits of AAM in the context of equity, I think it's important to understand that AAM has the potential to bridge spatial, topographical, and built environment gaps, such as water, mountains, and sprawling mega-ridges. It has the potential to reduce the mismatch between affordable housing and jobs, to expand access to employment and critical services like education and medical, to create new employment opportunities, and create opportunities for economic development to revitalize neighborhoods around vertiports."

and industry with the appropriate stakeholders to develop AAM that meshes with existing and future urban and regional transportation systems.

“AAM is a technology opportunity that communities can consider for their future growth and transportation needs,” said Yolanka Wulff of CAMI. Wulff works at the community level to understand the demand for AAM technologies and how they can benefit communities. Wulff highlighted the potential benefits of AAM, including reduced emergency response times, access to the urban core, workforce development, increased electrification, better use of general aviation infrastructure, and elimination of transportation deserts. Integration of AAM will also require time and public resources from state and local agencies. “Since resources are limited, what are we pulling away from?” asked Wulff. Potential community concerns with AAM include the location and time of operations, congestion, environmental impacts, accessibility, and affordability.

The University of California Berkeley’s Transportation Sustainability Research Center study on public sector perspectives on AAM and their Spatial, Temporal, Economic, Physiological and Social Barriers (STEPS) Equity Framework were cited by Wulff. Cities and MPOs were most concerned with affordability and environmental justice, and state DOTs were most concerned with affordability and economic impacts of vertiports on neighborhoods.

Saving Lives with Autonomous Drones

“Zipline International operates in seven countries across three continents and has flown more than 60 million miles using autonomous electric drones to deliver critical blood and medical supplies, consumer products, food, and more. Zipline has made over 890,000 commercial deliveries including more than 100,000 emergency blood deliveries and 1 million vaccines delivered—all while reducing the environmental impact by 97 percent when compared to gas-powered cars,” said Okeoma Moronu of Zipline International. Moronu works alongside regulators, policymakers, and experts in emerging technologies to advance safe and reliable autonomous operations that benefit communities around the globe including Ghana, Rwanda, Nigeria, Kenya, Côte d’Ivoire, Japan, and the



Okeoma Moronu

Head of Global Aviation Regulatory Affairs, Zipline International

“What we hear from our healthcare partners is how excited they are to get better health outcomes for their patients, and what our research has shown is that patients are 42 percent less likely to miss a vaccine in places where Zipline operates. There are also 67 percent fewer blood products wasted at locations served by Zipline, and one of my favorite numbers is, there are 51 percent fewer maternal deaths due to postpartum hemorrhaging. Those are actual lives saved and families kept whole.”

U.S. Zipline is focused on reaching populations and communities that are not served by current logistic systems, as well as expanding equality of service to all communities.

During her talk, Moronu spoke about the impact Zipline is having across the world, particularly in remote areas.

“We must strive not to deploy this AAM technology in a way that benefits a few at the expense of some,” said Moronu. “AAM provides an opportunity to open up aviation to a diverse talent pool to attract a broader spectrum of people into aviation. Zipline is able to provide on-the-job training to new employees, which lowers the barrier for qualified, smart, and passionate individuals from marginalized communities. This is critical to fostering innovation that will serve a broader range of society—we can do better,” said Moronu.

International Collaboration in Advanced Air Mobility

FEBRUARY 6, 2024

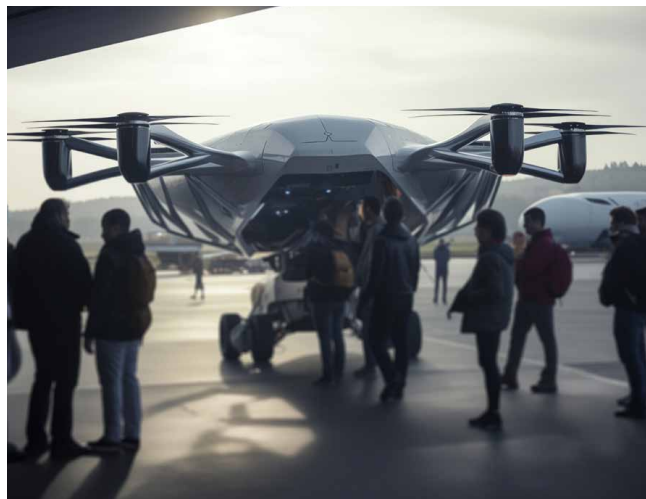
The [International Collaboration in Advanced Air Mobility](#) session focused on building relationships with international partners to integrate AAM into the air transportation system safely and efficiently.

Global Leadership and Collaboration in AAM

“In the United States and in many different countries, AAM has the potential to generate benefits and change the way we travel. International coordination and leadership will be fundamental in helping the United States capture this opportunity,” said U.S. DOT Assistant Secretary Petsonk. Petsonk’s office is responsible for advancing AAM by coordinating across government to develop a national strategy that will fully integrate AAM into the current air transportation system. International collaboration and leadership will play a fundamental role in helping the U.S. capitalize on this important opportunity.

“The U.S. must maintain its global leadership while it welcomes AAM developments around the world,” said Petsonk. “And we do that by establishing AAM standards and practices that serve as worldwide models,” she remarked.

Petsonk highlighted several AAM advancements occurring around the globe including the following: in Korea, air carriers like High Air and Korean Air are partnering with Supernal and Plana to deliver new eVTOL vehicles; the Japan Airlines group has set a goal of commercial eVTOL air taxi service starting in 2025; in Europe, Volcopter, a German company is partnering with Lufthansa Industry Solutions to provide real-time digital visibility of AAM operations; and in Sweden, Heart Aerospace, a hybrid aircraft design company, is working with KLM on design, development, and commercialization of facilities to handle these aircraft. In the Middle



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East, Lilium is partnering with Etihad Airwaves and Saudia Airlines to procure 100 new eVTOL aircraft and develop solutions, not just for the flight, but for ground operations, maintenance, and training for these new types of aircraft. In South America, Vertical Aerospace is partnering with the Brazilian airline Gol to procure 250 new eVTOL aircraft.

AAM Growth in the Asia-Pacific Region

FAA controls the largest Flight Information Region (FIR) in the Asia-Pacific (APAC) region and is a full member of the Asia Pacific Directors General of Aviation. Based in Singapore, the APAC consists of 39 states accredited to the International Civil Aviation Organization—Asia and Pacific (ICAO APAC) Office in Bangkok, Thailand. Each of the states is very different with diverse demographics and cultures, and their aviation systems vary in maturity and scope. “As a result, there are many unserved or underserved parts of the population due

to a lack of critical infrastructure and other socioeconomic factors,” said Chris Carter, Director of FAA’s Asia-Pacific Office in Singapore.

“Historically, aviation has lagged in the Asia-Pacific region compared to others. And what that means is, we have had a lot of unserved or underserved swaths of the population, due to lack of infrastructure and other socioeconomic factors,” said Carter, “But that’s changing,” he said. Carter cited an International Air Transport Association 2022 report that predicts the APAC region will be the fastest growing region over the next 20 years. To meet future demand, the region is quickly trying to build infrastructure and international aviation manufacturers have begun scaling-up production of eVTOLs to transport passengers and goods in underserved areas. Thirteen companies are engaged in developing operational procedures and ConOps in the region, according to Carter.

Carter also referenced a study conducted by Rolls-Royce in 2022 on the anticipated growth of AAM and the potential impact on the Asia-Pacific region. The study concluded from the worldwide AAM market, the APAC region could account for more than half of all operated eVTOL aircraft and over 40 percent of global revenue by 2050. The study estimated that 82,500 autonomous aircraft could be in operation in the APAC by 2050, with 1,000 of those by 2030.

“This is a natural opportunity for the FAA to lead,” said Carter. “Not only by sharing, but by learning from the experience in this region,” he continued. “The U.S. has a wealth of data and experience over the last 120 years of flying. Much of this data is unique to our vast system and can be applied to enable development of operational procedures in AAM,” said Carter.

Maintaining Aircraft Safety through Certification

FAA’s Aircraft Certification Service is comprised of engineers, test pilots, and other experts who oversee the design, production, airworthiness programs for all U.S. civil aircraft and foreign imported aviation products. In this role, the FAA Aircraft Certification Service collaborates with ICAO and national and international aviation stakeholders to maintain the safety of the global air transportation system.

Even as manufacturers develop and build new eVTOLs, FAA is responsible for ensuring safety and airworthiness of aircraft



Anne D. Aylward
Director, U.S. DOT Volpe Center
and Series Moderator

“Close collaboration with our international partners is critical to successfully and safely integrate these new technologies.”



Annie Petsonk
Assistant Secretary for Aviation and
International Affairs, U.S. DOT

“Part of our vision is that the United States will remain the world’s leader in Advanced Air Mobility, just as we have been in aviation for the past century. We must build quickly and holistically, developing our Advanced Air Mobility concepts and capabilities and workforce. That’s why, already across the world, air carriers and innovators are engaging in partnerships with Advanced Air Mobility companies and concepts to try to deliver this new type of transportation, always with safety as our North Star.”



Chris Carter
Director, Asia-Pacific Region, FAA

“As you can see, the APAC region is the fastest growing region over the next 20 years. You can see the impact of some of this growth as you read about the mega orders that have been placed with Boeing and Airbus recently, especially in India. As you can imagine, as these states spool up for passenger traffic, they also need to figure out how to service the underserved and unserved communities within their states.”

entering the U.S. civil fleet. Lirio Liu, Executive Director for Aircraft Certification Service, provided a historical perspective on FAA's role of safely introducing new aircraft technology into the NAS, including Automatic Dependent Surveillance-Broadcast (ADS-B), uncrewed aircraft systems (UAS), and others. With the emergence of AAM, Liu spoke about the mission of her office, and the importance of bilateral partnerships and declarations of cooperation to advance the safety mission of U.S. DOT.

"We have been integrating AAM operations into our work planning to integrate operations into our national airspace system to ensure the maximum flexibility within our existing regulations," said Liu. "The FAA has released a series of documents to inform the integration of AAM into the national airspace so the agency can obtain feedback on these plans to inform decision-making and be prepared for the future. Our goal is to ensure the transferability of these new technologies across the globe," she said. "Collaboration really does lead us to safe solutions."

The Power of International Partnerships

International bilateral partnerships create a natural opportunity for the FAA to lead, not only by sharing valuable information and data on AAM technologies, but to learn from the experiences of other countries. FAA actively engages with the ICAO through the Air Mobility Study Group, the European Aviation Safety Agency, and other civilian aviation authorities to exchange expertise and promote the harmonization of AAM integration strategies. FAA is part of the National Aviation Authority Network, a partnership with the United Kingdom, Canada, Australia, and New Zealand. This collaborative international aviation network addresses potential alignment issues related to certification processes and standards for AAM aircraft. FAA has also signed declarations of cooperation with Japan and South Korea on integrating and certifying AAM aircraft. The FAA is also a full member of the Asia-Pacific Directors General of Civil Aviation, the Asia/Pacific Air Navigation Planning and Implementation Regional Work Group, and the Regional Aviation Safety Group Asia and Pacific Regions.



Lirio Liu
Executive Director, Aircraft Certification Service, FAA

"We really are in the midst of a new golden age of aviation. And, as we discuss these topics, I want to remember our greatest challenge will be establishing and maintaining the appropriate levels of safety for the new and novel technologies and working with our partners across the globe on this shared goal."

Series Finale: The Advanced Air Mobility Workforce of the Future

FEBRUARY 15, 2024

The thought leadership series finale focused on [*The Advanced Air Mobility Workforce of the Future*](#).

Building the AAM Workforce of the Future

Throughout the series, experts spoke about the potential benefits and opportunities of the emerging AAM ecosystem. Several speakers touched on the need to safely integrate AAM into the existing airspace, and the progress that has been made to develop new concepts, validate aircraft, and streamline the regulatory process. For AAM to launch successfully in the coming decade, the future workforce will need to possess a unique set of skills.

“AAM is here, and the hard work is happening now,” said Assistant Administrator Wildgoose. “So, what does that mean for today’s FAA workforce? Well, it’s easy to talk about the unique skills that we need. We need engineers and scientists. We always need engineers and scientists at the FAA. But we also need policy experts, communication practitioners, accountants, finance administrators, and even lawyers, and more. The aviation sector needs people across the full range of skill sets,” noted Wildgoose.

A Well-Trained, Educated, and Diverse Workforce

If AAM products launch on the intended scale, new jobs will be created including pilots, technicians, engineers, software engineers, and dispatchers. This will require highly trained and educated workers who are ready to solve the challenges presented by AAM as it enters the global transportation system.

Professor Lutte issued a call to action and encouraged participants to consider three important areas that will shape the AAM workforce of the future—**workforce development, training and education, and research**.

According to a McKinsey & Company report cited by Lutte, AAM’s workforce needs are extensive and will include pilot scheduling, battery integration and development, crew assignments, vertiport airspace control, flight operations, quality assurance, flight data monitoring, emergency response, security screening, predictive maintenance, and more. Regarding the future workforce, it is critical to maintain a focus on the human system safety interaction portion of our workforce development, noted Lutte. “We need to make sure that we’re focused on human factors and the impact that this change has on safety and the human in the system,” she said.

“We know from research that what draws people into aviation is what I call the cool factor. The fun, the passion for the field, the excitement, the desire to be challenged,” said Lutte. Lutte observed that we are doing a good job at youth outreach, but she sees room for improvement. “I tend to think we lean in too much, or a little too STEM-forward in how we market and message what we’re doing in outreach. . . If we lean too heavily into STEM, we don’t want to send a message that if you’re not interested in STEM, aerospace, aviation, and AAM is not interested in you. So, we need to rethink the approach,” said Lutte.

“We can’t fill the workforce needs if we’re only targeting half the available workforce population. And, in aviation, women make up less than 20 percent of most of the workforce positions,” said Lutte, a member of the DOT’s Women in Aviation Advisory Board, established by Congress. “We also don’t do a great job of increasing representation in race and ethnicity. There is also work to do in terms of doing a better job at disaggregating gender data into race and ethnicity.”

Lutte touched on the education and training pathways that exist such as certificate programs, professional education, two-year, four-year, graduate programs, and training for jobs

that do not require a degree. “There are lots of ways to approach this and it is important to keep our options open, meet people where they are, and fill the needs for the workforce,” noted Lutte.

Shaping the Future Air Mobility Workforce

“It’s not only a topic of concern of how do we get the workforce of the future, but also a topic that is actually a great opportunity, because we can shape much of it,” said Robin Riedel. Many aviation experts agree the next several years will see exciting changes and new innovations across the industry. Robin Riedel highlighted several megatrends the aviation sector will experience in the next five to ten years.

- **Electrification** of aircraft, like eVTOL, using advanced battery and charging technologies; instead of hydraulics, electric is being used not just for propulsion, but for other systems.
- **Digitization** of aircraft operations and services to improve customer experience. “With the data that is available today we can run operations so differently. We can design aircraft differently. We can run simulations. It enables a whole different design space,” said Riedel.
- **New ways of learning** and training the next generation of aviation professionals.
- **Sustainability** and the shift away from traditional energy sources and toward net zero emissions for aviation.
- **Shared mobility**, which has the potential to reduce congestion and traffic wait times. Mobility options we’ve become familiar with, like ride hail, are coming to aviation.

“Future Air Mobility” is the term Riedel uses to expand the AAM discussion and include not only eVTOL and urban air mobility, the core of AAM, but sustainable aviation, unmanned AAM, and supersonic and hypersonic flight. We will need to train a new workforce for Future Air Mobility. According to Riedel, AAM will lead to an additional 340,000 in operational workforce demand by 2032, with design and manufacturing on top of that.

“Where are we moving from when we talk about this future of aviation?” asked Riedel. “I think across the areas of design, manufacturing, and operations, we’ll see real significant

change. The aircraft will get much more integrated,” said Riedel. “If you have an electric propulsion system for aerodynamic reasons, for structure reasons, for thermal management reasons, you’ll have to include that and integrate this propulsion system much more into the airframe, much more than we have historically done. And so that really changes the way we think about design, but also changes the skill set we’ll have to have,” Riedel said.

In discussing how to meet AAM workforce requirements, Riedel discussed the concept of simplified vehicle operations and the idea that if the aircraft are different, maybe we can train people differently. For example, if a pilot is focused on urban air mobility or electric vehicles only, traditional pilot



Laurence Wildgoose
Assistant Administrator for Policy,
International Affairs, and
Environment, FAA

“The AAM workforce must be diverse. It requires a diverse set of skills, a diverse set of viewpoints, and it will require a diverse set of people. Growing the AAM workforce of the future is going to require a collective approach and a combined effort. Government, industry, academia—everyone needs to be talking about the amazing possibilities that lie ahead in this field, and no person, no skill set, no viewpoint should be excluded from the opportunity to work in the aerospace field.”



Becky Lutte, PhD
Chair of Graduate Studies and
Associate Professor, Embry-Riddle
Aeronautical University College of
Aviation Worldwide

“What draws people to the field is what I call the cool factor. The fun, the passion for the field, the excitement, the desire to be challenged.”



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training would teach a lot of things they might not need. “If I’m going to fly any eVTOL between cities or within a city, I don’t really need to know high altitude aerodynamics, I don’t really need to know combustion jet engines. I don’t need to know global weather patterns,” said Riedel. “We have an opportunity to think about pilot curriculum and reduce the time it takes, as well as pilot training costs,” observed Riedel. “With these changes, the aviation field would be more accessible, and the workforce more diverse,” said Riedel.

According to Riedel and [data from McKinsey](#), the AAM industry in particular has experienced significant momentum and change in recent years. The AAM industry has experienced \$9 billion in investments in fiscal years 2022–2023. In addition, the current order backlog for new AAM aircraft, including eVTOL vehicles, and surveillance and delivery drones includes more than 21,300 aircraft worth an estimated \$118 billion.



Robin Riedel

Partner, Aerospace and Defense, Travel, Transportation and Logistics, and Sustainability, McKinsey Center for Future Mobility

“This is an industry that’s having actual traction. I always hear people asking, “Well, is this really real? Will we really have flying cars? Is this really something that’s on the horizon?” The reality is that yes, it is.”

“There are two big tailwinds that I’m really excited about as we think about aviation talent for the future. The first one is the improved access to aviation... When we think about pilots as an example, you would have to have exposure, usually early in life, to even build the excitement and even if you find that excitement early on, it’s a pretty steep pass to get a commercial rating, and really a role within that. And, if we can reduce the cost to doing that, and the time required to do that, we can open up this profession to a whole new group of people, whether it’s different socioeconomic backgrounds, family backgrounds, etc.

The second one is somewhat related. It’s the more attractive, local roles... AAM offers an opportunity to say there are more local jobs. Whether that’s in the airport context, you might have a vertiport in your neighborhood versus just an airport in one place in the city, or you might just have local flights. As we’re developing these roles in aviation, I think it will increase the attractiveness of aviation to people.”

Engagement and Outreach

The *Up, Up, and Away: Innovations in Advanced Air Mobility* thought leadership series was a successful conversation about the future air transportation system and the safe and efficient integration of this emerging and innovative technology. Twenty-three experts shared their visions, insights, and experiences with a diverse national and international audience. There were more than 2,700 unique registrants for the seven-part series from across the transportation enterprise, including nonprofit organizations, the private sector, international organizations, and many more.

Participants from 5 continents and 34 countries attended the webinars and more than 370 individuals from state, regional, local, and tribal government agencies from across all 50 states contributed to this important dialog about the future of our

air transportation system. As many as 49 U.S. and international colleges and universities were engaged in the series.

Each event in the series sparked thoughtful and engaging questions from participants, which led to insightful conversations and feedback from the expert panel of speakers. Participant questions covered a range of AAM-related topics, including community engagement and integration, supply chain needs, safety culture of eVTOL manufacturers, battery safety considerations, human factors research, airspace rights, environmental reviews, access-related equity concerns, public acceptance best practices, and more.

The full series with videos and highlights can be viewed here: <https://www.volpe.dot.gov/events/and-away-innovations-advanced-air-mobility>.

ENGAGEMENT IN THE UP, UP, AND AWAY SERIES

ORGANIZATION TYPE	REGISTRANTS
Federal government agency	1,315
Private sector	711
State government agency	211
Regional, county, or local government agency	153
Nonprofit	125
College or university	104
International agency or organization	88
Other	13
Tribal government or organization	5
Press	5

Over **2,700** unique registrants from across the transportation enterprise engaged in the seven-part series. More than **1,800 participants** joined the “live” events.

- Representatives from **5 continents** and **34 countries** linked in.
- **49 different colleges and universities**
- Over **370 participants** from state, regional, local, and tribal government agencies—from across all 50 states
- Federal officials representing **8 major cabinet agencies and other federal agencies and organizations**

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We must consider how to move quickly to embrace new technologies while ensuring that the aviation system of the future is safer, more efficient, equitable, and sustainable.



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