

FUTURE OF AVIATION

Advancing Aerial Mobility
through Technology, Sustainability,
and On-Demand Flight

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Summary of Conference Proceedings

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List of Common Terms and Acronyms

AAM - Advanced Air Mobility
AASHTO - American Association of State Highway and Transportation Officials
API - Application Programming Interface
ATM - Air Traffic Management System
BVLOS - Beyond the Visual Line of Sight
CALTRANS - California Department of Transportation
CEQA - California Environmental Quality Act
CFR - Code of Federal Regulations
DOT - Department of Transportation
EASA - European Union Aviation Safety Agency
ETOPS - Extended-range Twin-engine Operational Performance Standards
EVTOL - Electric Vertical Take-off and Land
ICAO - International Civil Aviation Organization
IFR - Instrument Flight Rules
FAA - Federal Aviation Administration
MAAS - Mobility as a Service
MDS - Mobility Data Specification
MOD - Mobility on Demand
MPO - Metropolitan Planning Organization
NARI - NASA Aeronautics Research Institute
NAS - National Airspace System
NASA - National Aeronautics and Space Administration
NEPA - National Environmental Policy Act
OMF - Open Mobility Foundation
RAM - Regional Air Mobility
SFAR - Special Federal Aviation Regulation
STOL - Short Take-off and Land
TNC - Transportation Network Company
TRB - Transportation Research Board
TSA - Transportation Security Administration
UAM - Urban Air Mobility
UAS - Uncrewed/Unmanned Aircraft Systems
UAV - Uncrewed/Unmanned Aerial Vehicle
USDOT - United States Department of Transportation
UTM - Uncrewed/Unmanned Aircraft System Traffic Management
VFR - Visual Flight Rules
VTOL - Vertical Take-off and Land

Executive Summary

Advanced air mobility (AAM) is a broad concept enabling consumers access to air mobility, cargo and package delivery, healthcare applications, and emergency services through an integrated and connected multimodal transportation network. AAM includes local use cases of about a 50-mile radius in rural or urban areas and intraregional use cases of up to approximately 500 miles that occur within or between urban and rural areas.

The Future of Aviation Conference: Advancing Aerial Mobility through Technology, Sustainability, and On-Demand Flight was held in person at the San Francisco International Airport from August 2 to 5, 2022. The conference commenced with an AAM 101 workshop hosted by the Community Air Mobility Initiative (CAMI) on August 2nd. The full conference program began on August 3rd. This event advanced key research and policy discussions around environmental impacts, safety, security, equity, multimodal integration, and the role of government.

The conference facilitated a lively dialogue among public-sector organizations, private companies, non-governmental organizations, and educational institutions. The conference fostered thoughtful discussions about the opportunities and challenges of planning, integrating, scaling, and governing advanced air mobility. The conference featured sessions and presentations around the core themes of:

- Current Practices, Innovations, and Emerging Futures
- Sustainable and Equitable Outcomes
- Public Sector Perspectives on Advanced Air Mobility
- Governing for On-Demand Air Mobility
- Workforce and Economic Development
- Stakeholder and Community Engagement
- Planning and Multimodal Integration
- Regional Air Mobility.

Key insights and discussion points from the workshop include the following:

- 1. AAM must be anchored in the public good.** The conference highlighted the importance of prioritizing humanitarian, aeromedical, and emergency response use cases to demonstrate broad societal benefit and build public acceptance of emerging AAM technologies.
- 2. Safety is existentially critical because many of the AAM use cases envision operations in low altitude airspace over urban areas.** A single crash could lead to widespread AAM disapproval. A number of safety issues that will still need to be addressed include: 1) airworthiness, operations, electric propulsion, pilot standards, and low-altitude air traffic control; 2) interaction between humans, machines, and highly complex software; and 3) maintenance training, among others.
- 3. A systems and multimodal approach are needed.** Technology often innovates faster than the regulatory environment can be updated. A number of speakers emphasized the importance of an aviation systems planning and multimodal

integration approach that deeply integrates AAM with existing transportation services (both ground and air).

- 4. Need to look at alternative fuels more holistically.** Numerous electrification challenges were identified, such as grid capacity, aircraft range, aircraft down-time due to charging, lifecycle impacts, and battery recycling, among others. Numerous speakers emphasized the importance of examining alternative fuels to help address these challenges and enable larger aircraft and longer-distance operations (e.g., regional air mobility).
- 5. Opportunities for new collar jobs.** AAM has the potential to support a variety of direct, indirect, and ancillary jobs to enable the emerging aviation ecosystem. Workforce development and training programs are needed to support new collar jobs, mostly technical occupations that require specialized skills in the areas of operations and operational support, engineering, vehicle design and manufacturing, business and financial operations, quality control and safety, medical and travel services, and hospitality.
- 6. Public acceptance is not the same as community engagement.** There is a difference between engaging communities and building public support for AAM. Speakers emphasized the importance of evolving community engagement from informing and consulting the public to collaboration and community empowerment where the public can influence decision-making and outcomes.
- 7. Different stakeholders have different definitions of equity.** There is not a single definition of 'equitable AAM.' For pilots, air carriers, and OEMs, equitable AAM can be viewed through the lens of equitable airspace access. For the public and community partners, equity is often viewed through the lens of public involvement and outcomes (e.g., who bears the benefits and impacts of AAM implementation).
- 8. Equity process (engagement) and outcomes are both important.** Both meaningful involvement in the AAM decision-making process and equitable protection from environmental and other impacts are key. Numerous speakers discussed the importance of integrating environmental justice principles (i.e., the fair treatment and meaningful involvement of all people) into AAM planning, decision-making, and implementation.
- 9. All levels of government must work together.** The planning and implementation of AAM will require a multi-governmental approach that includes federal, state, and local governments to implement safe, sustainable, and equitable outcomes.

This conference synopsis covers findings and discussions from the event and summarizes the key topics explored throughout the event. Key points made by each panel are summarized in this document. The summary concludes with key insights from the conference. The conference agenda also is provided in the appendix.

Conference Proceedings

Preconference Workshop: Advanced Air Mobility 101

The Community Air Mobility Initiative (CAMI) hosted its annual AAM 101 short course at the SFO Museum on the day before the conference. AAM 101 is a half day workshop designed to provide state and local decision-makers as well as urban and transportation planners with a solid introduction to advanced air mobility. Through a series of expert presentations, paired with ample time for questions and discussions, the 60 participants received key information to prepare them for the subsequent two days of conference as well as understanding of planning issues? Associated with the integration of AAM into their communities' transportation landscape.

AAM 101 began with an introduction to CAMI. After that, the first half of the workshop focused on AAM Fundamentals including AAM operations, infrastructure, markets, and legal framework. After a break, the second half of the workshop examined integrating AAM into communities, covering topics such as planning, community impacts, environmental impacts, and a discussion on the opportunities and challenges of integration. Speakers and participants ended the day with a reception.

Yolanka Wulff, Co-Founder and Executive Director of CAMI, welcomed all to the workshop and introduced the organization. Wulff explained that CAMI is an educational 501(c)(3) nonprofit whose mission is to support the responsible and sustainable integration of AAM into daily transportation needs through education, communication, and collaboration. Anna Dietrich of CAMI introduced key concepts including: 1) key terms and definitions; 2) an overview of AAM aircraft (e.g., electric vertical takeoff and landing (eVTOL), short takeoff and landing (eSTOL) and conventional takeoff and landing (eCTOL)); and 3) a discussion of the path to autonomy.

This was followed by a presentation from Darrell Swanson, co-founder of EAMaven, who discussed the importance of ensuring that commercially viable urban vertiports demonstrate broad social benefit and have limited environmental impacts on surrounding communities. Swanson emphasized the importance of co-locating AAM with public and active transportation, and ensuring that AAM complements existing public transit networks. Paul Stith of Black & Veatch gave a presentation on the electrification requirements for AAM infrastructure and described the steps necessary for electrification. Shahab Hasan with Crown Consulting discussed key findings from a number of AAM market studies and economic impact assessments. He also discussed findings from a recent economic impact analysis study completed for the State of Ohio.

This was followed by a presentation from Ben Merran from NEXA Capital Partners who discussed AAM predictive demand forecasting including key factors such as: airport origin/destination traffic, mobility substitutes, per capita gross domestic product, distances and congestion, population density, business aviation activity, and existing heliport infrastructure. Dawn Zoldi of P3 Tech Consulting LLC presented legal and regulatory considerations such as avigation (or aerial navigation) easements and federal pre-emption. Abby Smith of the FAA's Office of UAS Integration described the agency's strategic approach to supporting the certification and implementation of AAM near-term operations. Adam

Cohen with UC Berkeley's Transportation Sustainability Research Center discussed the importance of AAM integration into local and regional transportation planning. Maranda Thompson of Mead & Hunt explored airside and landside vertiport siting considerations at airports. Tim Middleton from HMMH discussed noise considerations as well as non-acoustic factors that could impact public acceptance of AAM (e.g., visual aesthetics, equity, etc.). Ryan Biziorek from Arup provided an in-depth explanation of the science of acoustics as well as aircraft noise regulations and policy.

The afternoon concluded with a panel focused on understanding AAM integration challenges. The panel included Todd Petersen of Lacuna, Adrienne Lindgren of Supernal, Clint Harper of Urban Movement Labs (UML), and Beth White of the FAA. Petersen discussed the work Lacuna is doing with Los Angeles to create a policy framework to inform vertiport siting. Lindgren discussed Supernal's approach to community integration and the importance of effectively engaging communities. Harper explored the need for collaboration among a broad group of stakeholders to achieve inclusive and equitable outcomes. Finally, White discussed the FAA's strategy on community engagement and how it has evolved over the past decade. Wulff concluded the session and welcomed attendees to an evening reception at SFO's Sky Terrace.

The video of the pre-conference workshop can be viewed [here](#) or at: <https://youtu.be/Neyd2EfNAIk>

Welcome and Opening Remarks from the Secretary of the California State Transportation Agency

The conference started with a welcome by Matthew Friedman of Caltrans' Division of Aeronautics and Adam Cohen of UC Berkeley. Cohen introduced the first day emcee, UC Berkeley Professor Susan Shaheen. Shaheen welcomed conference attendees and reviewed the conference agenda and logistics. Shaheen introduced Kevin Bumen, Chief Commercial Officer of San Francisco International Airport (SFO). Bumen said that SFO was proud to be a host of the conference as a gateway to the region of technological innovation. Bumen talked briefly about SFO's innovations in technology and sustainability, such as the tracking of transportation network companies (TNCs, also known as ridehailing) and the use of sustainable aviation fuel. Following introductory remarks from Bumen, Shaheen introduced the Secretary of the California State Transportation Agency, Toks Omishakin.

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Secretary Omishakin discussed the importance of information sharing to advance key research and policy discussions around environmental impacts, safety, security, social equity, multimodal integration, and the role of government with respect to the future of AAM. Omishakin said “if transportation is the tool that transforms lives in the U.S., the number one thing that has to be done is to make sure transportation is multimodal.” He said aviation, rail, highways, public transit, and active transportation must be integrated and connected. Omishakin said that there is an historic opportunity to upgrade transportation infrastructure due to momentous policy and funding alignment at the local, state, and federal levels of government. Omishakin discussed his vision for an aviation system that complements the surface transportation system. He asked how AAM could be leveraged to achieve environmental and safety goals, harness economic growth, and support social equity. He concluded his remarks stating that it was imperative to ensure that emerging aviation technologies do not become a luxury for a select few.



Figure 1. Secretary Omishakin Speaking

The video of the opening remarks can be viewed [here](#) or at: <https://youtu.be/n8RNKkCeDAk>

Plenary Session

The opening plenary session of the conference, moderated by Todd Petersen of Lacuna, focused on a discussion of how transformative and disruptive aviation technologies are creating new use cases, business models, aircrafts, and other opportunities for on-demand air mobility and goods delivery in urban, suburban, and rural communities. This panel included six expert panelists: Andrew Cummins, Archer Aviation; Edward Espiritu, United Airlines; Addison Ferrell, Skyports; Shivanjli Sharma, NASA; Ben Tigner, Overair; and Melissa Tomkiel, BLADE.

Cummins talked about how AAM is an umbrella term encompassing an array of aircraft, platforms, and use cases that can be built around these emerging aviation technologies (e.g., UAS, eVTOL, etc.). He asked what policies and technologies are needed to enable operations and use cases for different platforms. He explained that Archer is looking at what exists today that can be used as a foundation to get to market and what types of policies and technologies are needed to scale AAM. Sharma talked about how historically transportation innovation has been driven by advancements in propulsion technologies. She explained that production costs and infrastructure were driving factors why gas-powered automobiles became the predominant technology over electric vehicles in the early 1900s. She emphasized the importance of enabling infrastructure such as digital, airspace integration, and energy infrastructure to support new entrants in the aviation sector.

Tomkiel talked about the importance of local and state governments in preserving existing aviation infrastructure, such as airports and heliports. She explained that the first introduction of electric aircraft and rotorcraft will happen over time and within the existing regulatory framework that currently exists. She talked about how community airports and heliports are often targeted for closure due to noise concerns and explained that if this existing infrastructure is closed, it will be difficult to open new infrastructure in the future when quieter and more sustainable aircraft begin to mainstream. Tomkiel emphasized the importance of education and community outreach to explain that these innovations in aircraft technologies are under development and in the deployment pipeline.

Tigner talked about how the transition to electric aircraft and scaling AAM will be gradual due to the FAA's certification process and the ability to scale manufacturing. He said rational acoustic limitations are needed to encourage the adoption of new AAM aircraft. Cummins emphasized the importance of enabling policies to use and adapt existing infrastructure for AAM, such as incorporating aircraft electrification into building and fire codes. Ferrell discussed infrastructure business models (e.g., public vs. private vertiports), the role of public private partnerships, and emphasized the role of state governments in licensing and permitting new vertiport development particularly in advance of a published FAA Advisory Circular. He said it is important for states to lean in and to begin to understand technical concepts related to AAM take-off and landing infrastructure. Espiritu talked about their focus on safety first when investing in new technologies, followed by commercialization and public acceptance (e.g., noise and other community impacts). The panel discussed the role of noise and policies that could be implemented to help reduce noise and mitigate noise impacts (e.g., a noise budget for local communities that takes into account not only the volume of noise but the number of flights or overall operations tempo).

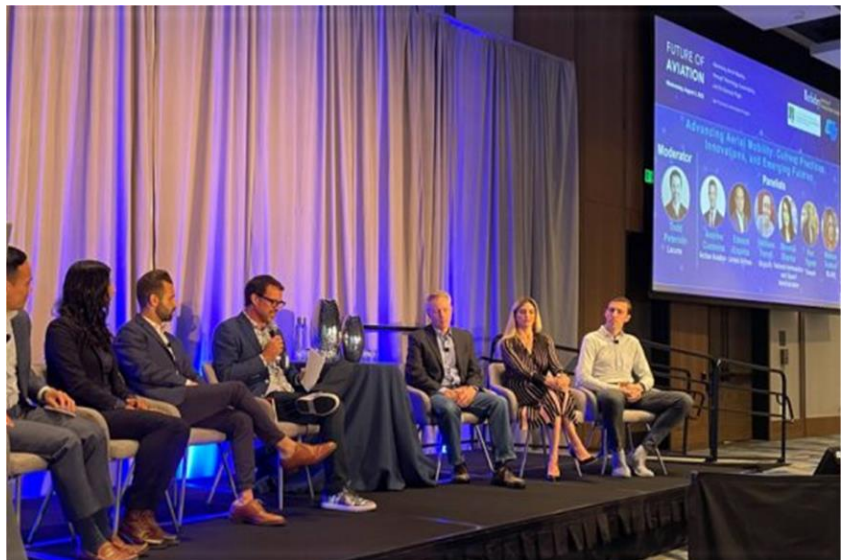


Figure 2. Plenary Session Panel

Further, the panel explored how to make AAM more affordable and accessible to a broader population. A few strategies discussed included cost savings from technological innovations such as electrification and autonomy; flying an aircraft more often; and the role of government support such as infrastructure funding and direct subsidies to reduce costs. The panel also discussed the role of equitable outcomes in AAM deployments. Sharma discussed the role of aeromedical, humanitarian, emergency response, and other use cases that serve the public good. Tomkiel discussed BLADE's medimobility program that offers organ transplant transport service. At the conclusion of the session, the audience asked about the

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need for standards development to streamline deployment (e.g., mobility data specification or MDS). In responding to this question, the panel emphasized the importance of research to help inform the development of industry standards for electrification, autonomy, take-off, airspace integration, and infrastructure to help advance emerging technologies in aviation.

The video of this session can be viewed [here](#) or at: <https://youtu.be/9vOlr4qvzx0>

Morning Breakout Sessions

Environmental Impacts: Weather, Noise, Visual Pollution, and Land Use Privacy

Paul Wheeler of WSP moderated a panel focused on the environmental impacts associated with AAM operations including: weather, noise, visual pollution, and land use privacy. This panel included four expert panelists: Ryan Biziosek, Arup; Timothy Middleton, HMMH; Brendan Reed, San Diego International Airport; and Chris Fernando and Colleen Reiche of EY Parthenon. The session addressed how AAM aircraft are smaller and more sensitive to weather with greater operational complexities associated with low-level flight over predominantly urban areas.

Middleton explained that it is important to consider the suitability of different aircraft and propulsion systems in a range of weather conditions. He discussed that electric aircraft currently have greater temperature limitations, which could impact aircraft range and payload capabilities. Reiche pointed out that insufficient weather observations and poor forecasts exist at the locations and altitudes AAM vehicles will operate in. Reiche talked about the data needs, infrastructure, and technologies that will be required to improve weather observations and forecasts for AAM. Additionally, the panel focused on the role of noise and potential mitigation measures. Biziosek shared a proposed noise classification system for AAM aircraft that would consider factors such as the: volume of noise an aircraft generates, aircraft weight, propulsion type, and frequency of noise. Middleton explained that there are two ways the FAA mitigates noise: 1) the source itself (e.g., making aircraft quieter) and 2) land use planning. He explained that if people live within areas that are deemed to be higher noise, there could be required mitigation measures to reduce noise.

The panel also discussed a paradigm shift in considering the sky as a natural resource and how low-level flight can raise a number of aesthetic and quality of life considerations. Fernando and Middleton explored the potential visual impacts of AAM. Middleton noted that the FAA includes visual impacts as part of its environmental review, such as the impacts of lighting from an aircraft or vertiport on the community. Reed also explained that many states, such as California, have state-level environmental reviews that could require the impacts of AAM infrastructure to be mitigated (e.g., California Environmental Quality Act (CEQA)). The session included a discussion of land use and privacy considerations, such as protecting the public from camera, sensor, and other surveillance activities. The panel concluded by discussing the role of community engagement in helping to identify, prevent, and mitigate AAM impacts.

The video of this session can be viewed [here](#) or at: <https://youtu.be/5M8RaIPgMcw>

Stakeholder and Community Engagement

Geoffrey Gosling of Aviation System Consulting LLC moderated a breakout session on stakeholder and community engagement. The session included five expert panelists: Gaël Le Bris, WSP; Liza Josias; Eve Air Mobility; Lisa Peterson, Airspace Link Inc.; Maranda Thompson, Mead & Hunt; and Beth White, FAA. This session discussed the role of stakeholder and community engagement, and emerging practices for the public and private sectors to engage stakeholders as part of the AAM planning process.

Le Bris talked about new and traditional stakeholders that will need to be engaged as part of AAM planning, including utility providers, hydrogen suppliers, ground transportation services, local governments, metropolitan planning organizations, and small businesses. Josias explained that Eve is developing both an aircraft and an air traffic management system which can provide additional data to communities. She also discussed the importance of integrating AAM into existing transportation systems, particularly public transportation and transit payment card systems, minimizing noise, developing workforce programs, and ensuring equitable access for underserved populations, including travelers with disabilities. She explained that stakeholder and community engagement is a key issue that can help advance all these goals. Peterson discussed Airspace Link's engagement efforts in Detroit to help integrate the use of small UAS into local communities. She discussed the importance of using geographic information systems to integrate ground and air risk data related to UAS operations into a format that can be understood and used by local communities. She explained that stakeholder engagement requires "show and tell" to demonstrate novel aircraft and aviation technologies to potential users and stakeholders.

Thompson discussed how existing airport land use compatibility planning efforts will need to be adapted to include AAM and strategies for engaging new stakeholders as part of the process of introducing vertiports into established communities. She explained that airport land use compatibility planning focuses on both providing for safe aircraft movement and protecting public health, safety, and welfare. She stated that most states have regulations addressing airspace protection around airports; however fewer states have regulations that encourage or require the adoption of airport land use compatibility zoning to address community concerns (e.g., noise). She discussed how this process could be adapted and applied to AAM vertiport planning in communities. She concluded with a discussion of a spectrum of stakeholder and community engagement ranging from informing the public (least level of involvement and influence over outcomes) to empowering the public (greatest influence over outcomes). White discussed the FAA's experience with community engagement, and explained the importance of distinguishing actual changes from community perceptions. She gave an example of air carriers replacing smaller regional aircraft with larger aircraft. These changes caused the FAA to receive community feedback claiming that planes were flying lower when in reality the larger aircraft were flying at the same altitude but because of their size they appeared lower. She also discussed how climate change has altered wind patterns, and affected aircraft take-off and landing direction and resulting community impacts.

White explained that these experiences caused the FAA to evolve their community engagement activities to make greater use of visual aids to explain technical airspace and aviation concepts in a way that can be more readily understood by the public. The FAA also started making greater use of virtual meetings and added a chat-bot to their website to help

users find information more easily. She described three key ingredients of successful community engagement: 1) collaborate early from the beginning; 2) set clear expectations; and 3) focus on looking forward rather than backward to past experiences.

During the discussion following the presentations, the panel discussed a range of strategies to support stakeholder and community engagement, including the importance of educating community members on the technical considerations involved in the issues being addressed and setting expectations prior to engaging stakeholders. The panel also discussed the importance of identifying local champions to spearhead outreach and engagement activities and involving community organizations and local public relations firms to engage with as broad a spectrum of the community as possible. It was stressed that outreach materials may need to be translated into multiple languages, depending on the composition of the community. Several panel members commented that the COVID-19 pandemic led to widespread use of virtual meetings, which have many advantages over in-person public meetings and are likely to remain an important element of future stakeholder and community engagement efforts.

The video of this session can be viewed [here](#) or at: <https://youtu.be/zTmblind9qU>

Integrating Advanced Air Mobility into a Multimodal System

Joseph Iacobucci of Sam Schwartz Engineering moderated a panel focused on integrating AAM with other modes of transportation, including digital and fare payment services such as mobility-as-a-service (MaaS). This panel included four expert panelists: Gabriela Juarez, City of Los Angeles; Adrienne Lindgren, Supernal; Caryn Moore Lund, Lilium; and Suzanne Murtha, AECOM. The session featured a discussion of the role of public private partnerships, infrastructure, multimodal connectivity, and the role of community acceptance.

Lindgren discussed the need to bring industry, traditional aviation stakeholders, and public agencies together to find common ground with respect to roles and responsibilities, funding, deployment timelines, regulation, and community impacts. She also discussed the importance of integrating AAM into existing urban and regional planning processes. Moore Lund talked about Lilium's long-range plans to stretch their aircraft and build a family of aircraft to help serve a greater array of use cases and help reduce costs and make AAM more affordable in the future. She further discussed how Lilium may consider short take-off and land (STOL) configurations as aircraft grow in size. She noted the importance of take-off and landing infrastructure as an enabler to help grow and scale AAM.

Juarez discussed limited public resources to address a variety of planning and policy challenges. She emphasized the importance of partnerships and use cases for AAM that help address key planning challenges and policy goals (e.g., firefighting, affordable housing access, etc.). Juarez noted the importance of partnerships with non-profits, community-based organizations, and academia that can collaborate on testing emerging modes. She mentioned the potential impacts of rooftop vertiports on land use, air rights, and urban densification. Murtha talked about the challenges associated with rooftop take-off and landing and charging infrastructure. She emphasized the importance of operational efficiency and moving people and goods quickly to help make AAM financially sustainable. Finally, the panel discussed opportunities to leverage municipal and general aviation

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airports, the potential for AAM to add an additional modal option and the importance of integrating AAM into regional transportation planning.



Figure 3. Integrating Advanced Air Mobility into a Multimodal System Session

The video of this session can be viewed [here](https://youtu.be/GKaqDXaq1Ys) or at: <https://youtu.be/GKaqDXaq1Ys>

Fireside Chat with NASA's Aeronautics Research Mission Directorate

During the lunch hour, Susan Shaheen of UC Berkeley moderated a fireside chat with John Cavolowsky director of the Transformative Aeronautics Concepts Program within NASA's Aeronautics Research Mission Directorate (ARMD). John provided an overview of NASA's aeronautics research including ultra-efficient transport, future airspace, high-speed commercial flight, and advanced air mobility. Cavolowsky emphasized the importance of an airspace system that enables legacy airspace users to work effectively and safely with new users of airspace (including crewed and uncrewed operations). Cavolowsky discussed NASA's AAM Ecosystem Working groups and their role in bringing the community together, identifying research needs, and understanding the policies and standards required to enable AAM. Cavolowsky emphasized the importance of cross-disciplinary and a systems approach to help address the diverse challenges confronting the AAM ecosystem.

Cavolowsky explained that AAM encompasses a variety of different ecosystem stakeholders such as UAS, UAM, and RAM. He emphasized that "AAM must be anchored in public good." He explained that AAM can include a variety of diverse use cases such as healthcare access, public safety, emergency response, goods movement, and passenger mobility. Shaheen and Cavolowsky discussed examples of humanitarian use cases such as organ transport, firefighting, and healthcare access in rural communities. Shaheen and Cavolowsky discussed how emerging transportation technologies can sometimes get ahead of public policy, risks from unintended consequences, and potential lessons learned from other forms of innovative mobility that could be applied to AAM. Cavolowsky also discussed the importance of expanding the conference's stakeholders and bringing them back together again through a variety of forums. He also said there are gaps and challenges that need to be addressed with respect to safety, human-machine integration, autonomy, and artificial intelligence to build existing capabilities and foster new skills. He highlighted the role of academia to aid in developing advanced capabilities, foster new skills, and help support an AAM workforce for the future.

The video of this session can be viewed [here](#) or at: <https://youtu.be/rmfPDWBFnro>

Afternoon Breakout Sessions

Ensuring Safety of Novel Aircraft Designs, Technologies, and Infrastructure

Chris Hart, former chairperson of the National Transportation Safety Board and founder of Hart Solutions LLC moderated a panel focused on the safety of novel aircraft designs, technologies, and infrastructure. This panel included three expert panelists: Ryan Naru, Joby Aviation; Abby Smith, FAA; and Richard Stocker, Australian Civil Aviation Safety Authority.

Hart explained that safety is existentially important because of AAM's planned operations at low altitudes and overpopulated areas. Smith explained that the FAA is taking a risk-based approach in certifying AAM aircraft. She explained that AAM is not a single technology, but a collection of new emerging technology, practically new aircraft types. She said in the short term the FAA plans to type certificate powered lift under its special class process pursuant to 14 CFR 21.17(b). She explained that this special class process is designed to address the many novel features of emerging aircraft such as small drones, eVTOL, electric propulsion, and advanced flight controls. She also explained that the FAA is developing a Special Federal Aviation Regulation (SFAR) Notice of Proposed Rulemaking to create a regulatory framework to permit the operation of powered lift aircraft and include alternate requirements to safely certificate initial groups of powered lift pilots. She concluded summarizing the FAA's commitment to safety, community engagement, and development of certification requirements for AAM integration with airspace, infrastructure, and operations.



Figure 4. Ensuring Safety of Novel Aircraft Designs, Technology, and Infrastructure Session

Stocker raised the issue of how nationally certified aircraft will be received and operated internationally (e.g., taking an aircraft certified by the FAA and operating it in a city outside of the U.S.). Stocker talked about the importance of promoting an internationally harmonized approach to industry for the regulatory approval of AAM aircraft. He said type certification rigor should be commensurate with the risk of the operations so that acceptable safety standards are met while also fostering industry innovation. He said achieving international alignment allows for an easier transfer of an aircraft design that has been type certified by one regulatory agency for use by another authority through a validation process. He also talked about the use of industry consensus standards to promote international alignment in type certification of AAM aircraft. He also discussed the role and importance of international

data sharing among civil aviation authorities to help support harmonization and minimize the duplication of certification processes.

Naru talked about the process an OEM goes through to have an aircraft certified with the FAA: 1) certification basis (e.g., determining which rules apply); 2) means of compliance (e.g., determining the tests and analysis to demonstrate safety under the rule(s)); 3) demonstration of compliance (e.g., conducting testing); and 4) verification of compliance (e.g., regulatory review of testing and reports). He explained that one of the ways OEMs can support safety is through levels of autonomy that reduce pilot workload and minimize task confusion (e.g., making an aircraft simpler and easier for a pilot to operate). During the discussion, the panel discussed the steps necessary to transition from visual flight rules (VFR) to instrument flight rules (IFR) operations. The panel also discussed airworthiness criteria for different aircraft configurations and phases of flight (e.g., vertical lift, horizontal flight, and the transition between vertical lift and horizontal flight).

The video of this session can be viewed [here](#) or at: <https://youtu.be/Df5af0AEJT8>

Workforce and Economic Development

Karen Philbrick of the Mineta Transportation Institute moderated a panel focused on workforce and economic development, including education and training requirements to support AAM and the potential for AAM to create high-road jobs. This panel included five expert panelists: Rubén Del Rosario, Crown Consulting; Ernest Huffman, North Central Texas Council of Governments (NCTCOG); Benjamin Merran, NEXA Capital Partners; Joshua Metz, Monterey Bay Drone, Automation, and Robotics Technology (DART) Initiative; and Paul Stith, Black & Veatch.

Del Rosario talked about how new training programs are needed to support five key areas: 1) electric propulsion systems; 2) advanced manufacturing; 3) pilot assistant systems; 4) digital information sharing and process; and 5) high-tech communication, navigation, and surveillance systems. He also discussed the need to create synergies with training programs in other industries that have similar skill requirements to AAM. Huffman talked about the North Texas Career Aviation Initiative, which launched in 2010, to create new pathways into the aviation career field. He noted other NCTCOG's initiatives including the development of standardized occupational classifications for AAM in partnership with the USDOT, the creation of workforce and training programs with the Dallas Fort Worth Aerospace Consortium, and ongoing work with NASA's National Campaign 1 (NC-1) and AAM Community Integration and Planning Partnership.

Then, Merran explored NEXA's AAM business valuation and economic research reports, including a study developed for the Ohio Department of Transportation in partnership with Crown Consulting. He shared NEXA's estimated market valuation of \$1.15 trillion US for five AAM use cases and four supply chains across 84 global cities over a 25-year period (2020-2045). He also discussed the diverse job categories that AAM could support such as: 1) operations and operational support, 2) engineering, 3) vehicle design and manufacturing, 4) business and financial operations, 5) quality control and safety, 6) medical and travel services, and 7) hospitality. He shared economic impact forecasts (e.g., full-time job equivalents, GDP,

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and tax revenue) for the States of Ohio and Arkansas and the Vancouver, BC metropolitan area.

Next, Metz talked about Monterey Bay Drone, Automation & Robotics Technology (DART) initiative, a regional economic development strategy that started with a partnership between the Fort Ord Reuse Authority the City of Marina, the University of California, California State University, Naval Post Graduate School, Airspace Integration, Joby Aviation, and other community stakeholders. He explored opportunities for high-road jobs and synergies between UAS, automation, and robotics with local economic clusters such as: agriculture, defense, marine research, and transportation. He also discussed regional efforts to create training opportunities to support aerospace and other high-tech manufacturing.

Finally, Stith explained that human capital is going to be needed to build the aircraft and the enabling energy infrastructure for AAM. He talked about the many skilled professionals needed to build, operate, and maintain charging infrastructure for AAM. He shared that personnel are needed for project conceptualization, budgeting, site selection, permitting, facility design, utility interconnections, site construction, operations, and maintenance. He concluded by discussing the need for reskilling and upskilling to support an AAM workforce. Reskilling involves training professionals for a different job and upskilling involves training professionals with additional skills to more effectively execute the same job. The session concluded with a video from the Choctaw Nation of Oklahoma featuring their UAS training, testing, and demonstration initiatives.



Figure 5. Workforce and Economic Development Session

The video of this session can be viewed [here](#) or at: <https://youtu.be/RqqPdtYLBwA>

The Role of Local and Regional Governments in Planning for Advanced Air Mobility

Yolanka Wulff of the Community Air Mobility Initiative (CAMI) moderated a session focusing on the role of cities, counties, metropolitan planning organizations (MPOs), tribal governments, and other jurisdictions play in integrating AAM into local and regional planning processes and transportation improvement programs. This session consisted of five expert panelists: Jacques Coulon, City of Orlando; Thea Ewing, Mid-Ohio Regional Planning Commission; Clint Harper, Urban Movement Labs; Shahab Hasan, Crown Consulting; and George Kivork, Joby Aviation.

Wulff explained that CAMI was founded to support the responsible and sustainable integration of AAM into the transportation network through education, communication, and collaboration. Wulff explained that AAM has been a technology push market and hasn't been developed in response to a specific market need. She said the public and private sectors need to consider how AAM can serve community needs. Kivork local officials often do not understand the realities of AAM. He said it's important for the AAM industry to explain to public agencies that the industry is beginning to mature into large corporations, hiring large numbers of employees, conducting daily test flights both in the U.S. and around the globe. He also explained that it's important for industry to understand the backdrop of how cities are approaching other forms of innovative mobility (e.g., managing disruption from transportation network companies/TNCs and scooters). He also talked about equity and how AAM has the potential to expand modal options and access to aviation services.

Hasan discussed a project by Crown Consulting and CAMI to develop an emerging practices playbook for NASA. He discussed a communities of practice interagency collaboration NASA organized to exchange ideas, concerns, and emerging practices among the City of Orlando, North Central Texas Council of Governments, and the Minnesota, Massachusetts, and Ohio departments of transportation. He explained that a key outcome of this communities of practice was the development of a playbook highlighting emerging practices in areas such as institutional readiness; equity and community engagement; planning and multimodal integration; data; funding; economic and workforce development. Ewing talked about how MPOs can be a planning resource to help bring public and private stakeholders together on transportation issues. She also explained that MPOs are involved in collecting and modeling transportation data to help guide transportation improvement programs that fund capital projects in a region. She explained that Ohio is releasing a framework to help guide expectations for AAM planning at the local and regional levels of government. Coulon discussed Orlando's Future-Ready City Master Plan which develops a plan to engage private sector eVTOL companies on strategies for connecting the city to activity centers in Central Florida and connecting Orlando to other cities in the Southeastern U.S. He discussed the importance of cities and counties being actively involved in AAM policy and planning, particularly related to land use and vertiport placement. Harper talked about the roles and responsibilities of various local government departments (e.g., planning, transportation, airport authority, etc.).

The video of this session can be viewed [here](#) or at: <https://youtu.be/Qz9nJeR74NY>

Plenary Session

Guiding Safe, Sustainable, and Equitable Outcomes

The first day closed with a plenary session moderated by Susan Shaheen of the University of California, Berkeley and focused on guiding safe, sustainable, and equitable deployments of scaled AAM operations. This panel included five expert panelists: Vince Bertoni, City of Los Angeles; John Cavolowsky, NASA; Christopher Hart, Hart Solutions LLC; Lori Pepper, California State Transportation Agency; and Yolanka Wulff, Community Air Mobility Initiative. The session featured a robust discussion about: 1) airworthiness and operational safety; 2) the role electrification, hydrogen, and alternative fuels to achieve carbon neutrality; and 3) considerations for including social equity into AAM planning and implementation.

After Shaheen introduced the panel, each of the panelists made brief introductory remarks. Hart explained that safety is existential because many of the AAM use cases envision operations in low altitude airspace over urban areas where one single crash could cause widespread AAM disapproval. He discussed an array of safety issues that will need to be addressed such as: 1) airworthiness, operations, electric propulsion, and pilot standards; 2) interaction between humans, machines, and highly complex software; and 3) maintenance training. He also discussed the need for the international harmonization of AAM standards as well as the development of standards for: 1) remotely piloted and autonomous aircraft, 2) propulsion redundancy, 3) moving beyond visual flight rules (VFR), and 4) collision avoidance.

Cavolowsky discussed environmental sustainability and the need to consider lifecycle emissions rather than just tailpipe emissions for electric aircraft and sustainable aviation fuels. He explained that the U.S. Aviation Climate Action Plan helps identify opportunities to achieve net-zero greenhouse gas (GHG) emissions by 2050 such as: new aircraft technologies, operations improvements, and sustainable aviation fuel. Wulff discussed the opportunity to view AAM from a local perspective and better understand how AAM can support communities and integrate with existing transportation systems. She also examined the importance of social equity and engaging communities. Pepper talked about the opportunity for state governments to support and facilitate connections among local governments, federal agencies, and industry. She also discussed the importance of integrating AAM with the existing transportation ecosystem, enhancing socially equitable outcomes, and supporting business models that reduce emissions and vehicle miles traveled. She explained that California has commissioned studies to understand the impact of vertiport placement on flight paths, create tools for local governments to use in their planning efforts, and participate in various AAM working groups.

Bertoni talked about the importance of regulating AAM from a land-use perspective beginning with where aircraft take-off and land. He also discussed the role of local government and the various municipal agencies that will be involved in aspects of AAM planning and implementation such as: planning, transportation, fire, and utility departments. Bertoni concluded by discussing the importance of learning from the past inequities in transportation and see if there is a way for AAM to be fairer and more equitable by expanding access and considering the impacts of AAM on the ground.

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During the discussion, Hart discussed the potential of applying the concept of Extended-range Twin-engine Operational Performance Standards (ETOPs) from commercial aviation and perhaps developing performance standards and routing requirements for AAM to minimize the likelihood and severity of AAM incidents. Cavolowsky also explained that research is needed to ensure the safety of electric and hydrogen powered aircraft. In addition, the panel discussed how to define social equity in the context of AAM. Pepper explained that one definition is that everyone has access to AAM. She said another definition is ensuring the movement of people and goods and making sure that everyone has mobility options. Pepper also emphasized the importance of equitable access to the electric grid and the role of hydrogen to reduce demand on the electric grid. Wulff talked about equity from an environmental justice lens and ensuring that AAM users are not creating adverse or disparate environmental impacts on non-users. Additionally, she cautioned that AAM could impact other transportation modes, such as shifting riders out of public transportation, which could reduce public transit service levels. Bertoni noted the importance of ensuring access for vulnerable and underserved populations and using an equity lens to assess the value of transportation investments such as AAM. In response to audience questions, the panel also explored the importance of physical and cyber security, scaling operations, and increasing aircraft occupancies to reduce user costs and support sustainability goals.

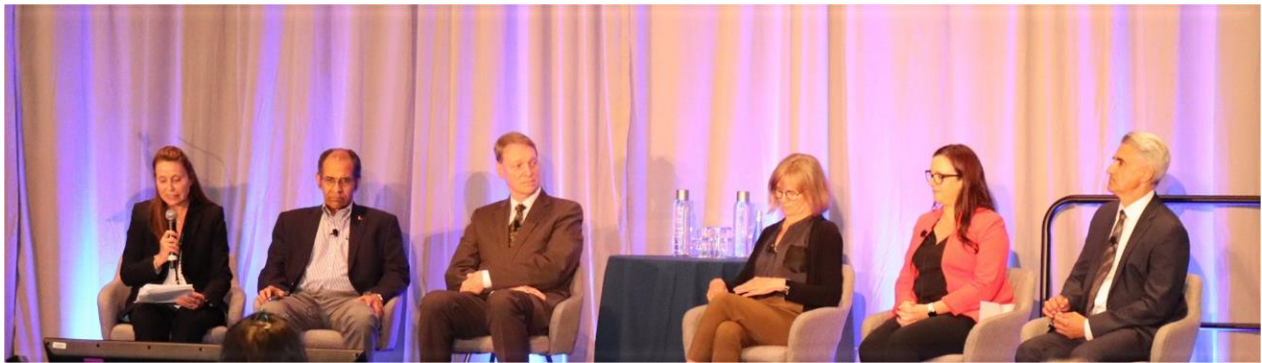


Figure 6. Guiding Safe, Sustainable, and Equitable Outcomes Panel

The video of this session can be viewed [here](#) or at: https://youtu.be/0xkhK5t_J0U

Keynote Remarks from The Secretary of Kansas Department of Transportation

The second day of the conference started with a welcome by emcee Alexandre Bayen, Associate Provost for Moffett Field Program Development at UC Berkeley. Professor Bayen introduced Secretary of the Kansas Department of Transportation, Julie Lorenz.

Secretary Lorenz explained that she was speaking on behalf of many different roles but primarily as Chair of the Aviation Council for the American Association of State Highway and Transportation Officials (AASHTO). Lorenz opened her remarks quoting Amelia Earhart who said: “some of us have great runways already built for us. If you have one, take off. But if you don’t have one, realize it is your responsibility to grab a shovel and build one for yourself and for those who will follow after you.” Lorenz explained that transportation is not just about roads and bridges, but a connection for people. She discussed the importance of scenario planning and understanding how long-term trends could lead to different types of futures. She explained the importance of transportation investments that are resilient and will work in a variety of future scenarios. She asked what the vision for what transportation can deliver for Americans is, what moonshot projects can be delivered by the end of the decade, and what strategies state DOTs can take to advance this agenda. She discussed AASHTO’s ongoing visioning process, which has included dozens of non-traditional partners such as academia, non-governmental organizations, and industry associations. She explained that as part of this visioning process, AASHTO considered trends and uncertainties such as the economy, environment, technology, and demographics (e.g., asset limited, income constrained, employed households – referred to as ALICE). She explained that AASHTO is headed in the direction of community centered transportation.

She explained that community can take a variety of scales such as an individual, a neighborhood, city, region, or megaregion. Lorenz asked: “what if we redesign how customers experience transportation and reinvent how transportation systems are operated and managed?” She discussed a range of actions that DOTs and other public agencies can take to help to achieve this vision such as: engagement, partnerships, planning, technology, human resources, and governance. She discussed the potential to repurpose existing infrastructure to enable AAM rather than building new infrastructure. She emphasized the importance of integrating AAM into a multimodal system and the importance of public agencies at all levels of government working in tandem to enable this multimodal vision. She explained the importance of public-private partnerships and collaboration, particularly at the state DOT level. She asked: “how often in our careers do we have a chance to pause and think this might be a Kitty Hawk moment?” She closed by



Figure 7. Secretary Lorenz Speaking

stating that we could be on the cusp of something big, and we all must build runways for future generations so we can all take-off.

The video of this session can be viewed [here](#) or at: <https://youtu.be/U1Q0LIAJLA8>

Plenary Session

Public Sector Perspectives on Advanced Air Mobility

The second day opened with a plenary session moderated by Professor Raja Sengupta exploring institutional readiness and public sector perspectives on planning and implementing AAM. This panel included four expert panelists: Carlos Cruz-Casas, Miami-Dade County; Jared Esselman, Utah Department of Transportation; Ramses Madou, City of San Jose; and Pricila Roldan, San Diego Association of Governments.

Sengupta opened the session stating: “technologists produce aircraft, but people consume mobility and, in the middle, sits the impact gap.” He shared several times technologies fail to mainstream because of cost, infrastructure, social equity, and other reasons. Cruz-Casas discussed the role of the public sector as mobility managers and stewards of the public rights of way. Madou discussed the challenges cities have keeping up with emerging transportation technologies, such as AAM given limited staff capacity. Both Madou and Cruz-Casas explained that they are trying to determine what resources to invest in AAM given that aviation historically has not been a part of their departmental functions. Roldan discussed the role of metropolitan planning organizations (MPOs) in regional planning and coordination, as well as providing technical support for smaller cities who may lack the staffing capability to support AAM.

Esselman shared key differences between urban transportation and aviation planning. He emphasized the importance of non-aviation stakeholders learning how to plan for AAM. A key difference is that urban planners are focused on two dimensions, and AAM policy is applied in three dimensions. He also shared visualizations of hypothetical AAM operations over Salt Lake City. Next, Cruz-Casas and Madou discussed digital infrastructure and the role of data sharing to enable policymaking through application programming interfaces (APIs). They explained efforts by the Open Mobility Foundation to integrate AAM as part of Mobility Data Specification (MDS). The Open Mobility Foundation (OMF) is an open-source foundation that creates a governance structure around open-source mobility tools including MDS. MDS is a digital tool that standardizes communication and data-sharing between cities and private mobility providers.

Madou discussed the opportunity for local governments to leverage tools, such as MDS, and share local land use and code information with AAM service providers (e.g., permissible areas where drone delivery can land in residential neighborhoods). Cruz-Casas explained that a network of cities working together can help AAM services more readily scale across multiple jurisdictions and markets. In addition, the panel discussed public sector roles and responsibilities such as: 1) local land use and permitting, 2) regional planning and modeling, and 3) the potential role of states in air traffic management (e.g., delegated authority from the FAA, providers of services of urban air mobility, etc.).

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The panel explored the potential implications of the diffusion of AAM impacts across regional population centers, which had often have been more confined to airports and their immediate vicinity. Finally, the panel discussed opportunities for early use cases such as: 1) regional air mobility, 2) goods delivery, 3) aeromedical, 4) emergency response, and 5) law enforcement. The panel concluded by emphasizing the importance of ensuring that AAM meets key public sector goals of safety, sustainability, connectivity, economic development, and social equity.

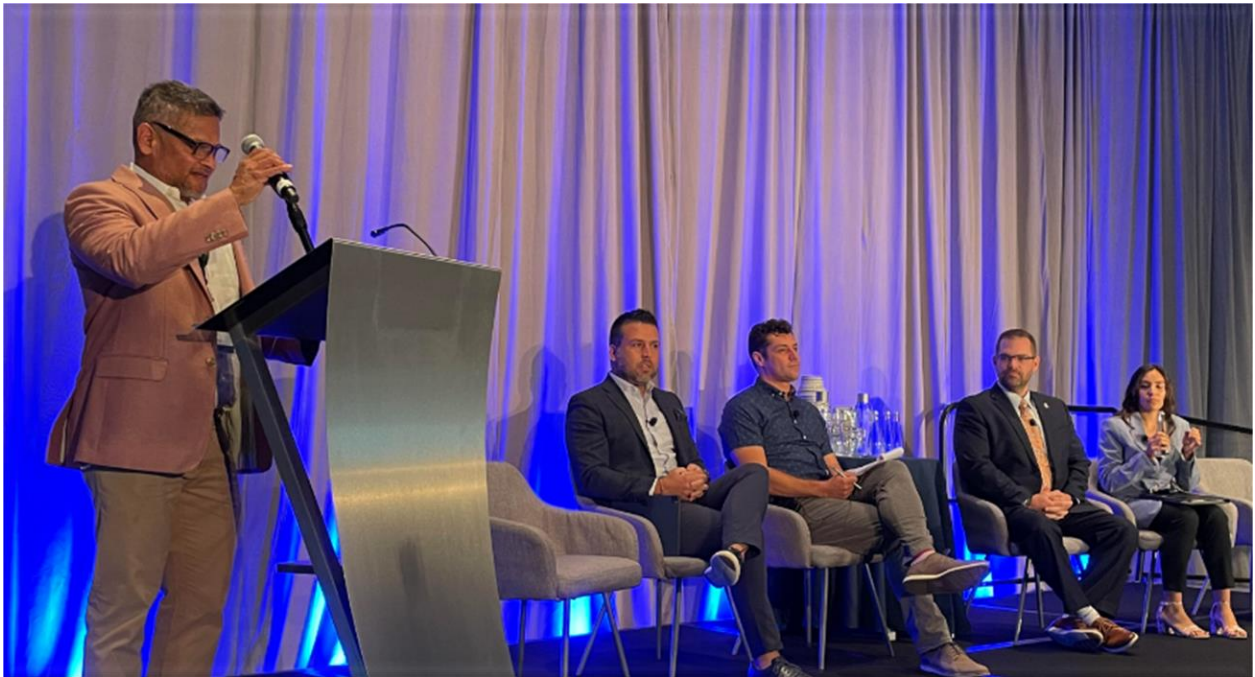


Figure 8. Public Sector Perspectives on Advanced Air Mobility Panel

This session can be viewed [here](https://youtu.be/ACfS3X3Zdyg) or at: <https://youtu.be/ACfS3X3Zdyg>

Morning Breakout Sessions

Safe and Equitable Airspace and Flight Operations

Toni Drummond of Global Aerial Management Group facilitated a discussion on the safety, social equity, and environmental impacts of AAM flight operations on airspace and surrounding communities. She was joined by five expert panelists: Antony Evans, Acubed; Curtis Ostrodka, Vanasse Hangen Brustlin, Inc. (VHB); Jasenka Rakas, UC Berkeley; Anuja Verma, MITRE Corporation; and Yu Zhang, University of South Florida.

Evans focused on the importance of equitable and fair access to airspace. He talked about opportunities for air traffic management (ATM) systems to provide digital services for UAS, AAM, high altitude, and traditional aviation operations. He also discussed the importance of data and simulations informing the development of standards, operational concepts, and regulations. Zhang shared research results of a paper modeling optimal vertiport locations and trip allocations in the Tampa Bay region. She also focused on automated flight planning for high-density UAM operations and procedures for integrating UAM at commercial airports. Verma explored the potential benefits of AAM corridors. She also discussed social equity and

whether AAM corridors are equitable if other airspace users do not have access to their own dedicated corridors.

Ostrodka spoke about Orlando's AAM Transportation Plan, which is intended to anticipate potential AAM impacts and potential locations for vertiports. In addition, he discussed the difference between social equity and equality. He emphasized the importance of considering negative externalities associated with vertiport siting and airspace use, including Orlando's online visioning activity. This visioning exercise employs online crowdsourcing to solicit community feedback on desired vertiport locations and routing between vertiports (e.g., preferred origins and destinations). Rakas explored the complexities of designing an airspace system for hundreds of different AAM aircraft. She shared that a more structured airspace system may enhance safety, but it also reduces capacity and path efficiency. She explained that when one accounts for obstacle avoidance, wind gusts, privacy, noise, and a clearance envelope, the resulting low-altitude airspace that can be flown is actually quite limited. She concluded by sharing groups of factors that influence airspace design such as: 1) safety (e.g., object avoidance, wind gusts, and weather); 2) social (noise, privacy, and visual pollution); 3) system (e.g., air traffic management, capacity, communication, navigation, and surveillance); and 4) vehicle (critical aircraft, autonomy, and energy efficiency). Finally, the panel discussed potential funding to support AAM infrastructure and the future role of visual and instrument flight rules (VFR/IFR).

The video of this session can be viewed [here](#) or at: https://youtu.be/JU6bRQj_1g4

Regional Air Mobility: Opportunities and Challenges for Rural Communities and Small Airports

Professor Mark Hansen of UC Berkeley moderated a session on the opportunities and challenges of regional air mobility (RAM) for rural communities and small airports. The session explored the use of AAM for intraregional use cases of up to a few hundred miles that occur within or between urban and rural areas. The panel included presentations by Arthur Dubois, Xwing; Nicholas Flom, Deloitte; Manal Habib, MightyFly; Will Heyburn, BLADE; Dave Merrill, Elroy Air; and Susan Ying, Ampaire.

Both Merrill and Habib talked about their companies' vision of offering same day shipping in a variety of built environments, including small and rural communities. Habib explained that autonomy can help reduce the cost of aerial logistics by up to 60 percent. Dubois also talked about the role of automation in helping reduce costs in the RAM market segment. Ying shared an example of American Airlines operating a bus service between two airports that are approximately 120 miles apart (about two and a half hours by bus depending on traffic). She explained that AAM has the potential to offer better regional service between airports currently being served by airline bus service. Heyburn explained that the lack of infrastructure is one of the largest challenges to scaling AAM. Flom discussed the importance of emerging infrastructure platforms, including intelligent transportation (e.g., AAM, AVs., remote sensing, etc.), advanced connectivity (i.e., 5G), and digital infrastructure (e.g., intelligent transportation systems). During the panel discussion, the panel discussed the importance of take-off and landing, energy, and digital infrastructure to enable RAM. Ying also shared a vision where airports are sustainable multimodal energy hubs for multiple modes of transportation (e.g., public transportation, vehicle charging, and aircraft).

The video of this session can be viewed [here](#) or at: <https://youtu.be/3jI5SJ59kfM>

Building Public Trust in Electric, Hydrogen, and Autonomous Aviation

Anna Dietrich of the Community Air Mobility Initiative moderated a session discussing issues of public trust and community acceptance of emerging aviation technologies. This panel included four expert panelists: Nicholas Matcheck, Supernal; Axel Radermacher, Odys Aviation; Anuj Totapudi, ZeroAvia; and Pavan Yedavalli, Wisk.

Matcheck emphasized the importance of safety in helping to build trust in emerging and new technologies. Radermacher talked about the differences in the passenger experience between AAM and commercial aviation, such as aircraft size and motion (i.e., turbulence), security and boarding processes, and shorter flight times. Both Radermacher and Yedavalli talked about the importance of education and outreach in helping build public trust in AAM as a mode of transportation. Yedavalli also discussed the role of actual and perceived control in transportation, and its influence on public trust. He explained that while automobiles are statistically less safe than commercial aviation, the public has a high level of trust in driving because they feel in greater control driving a private vehicle rather than flying with others in an airplane piloted by someone they do not know. Totapudi explored issues of trust related to hydrogen propulsion systems. He noted that there is a learning curve for the public to overcome regarding how hydrogen is being deployed through fuel cells in aviation. He said that the public generally does not understand that hydrogen fuel cells involve a chemical process to create electricity rather than the combustion of hydrogen. The panel also discussed the role of education, redundant systems, and human oversight of autonomy as an enabler to help build public and aircrew trust in novel aircraft and airspace management technologies.

The video of this session can be viewed [here](#) or at: <https://youtu.be/Kd2yPrhT4mM>

Fireside Chat with the FAA's Office of UAS Integration

During the lunch hour, Abby Smith gave a keynote address followed by a fireside chat moderated by Alexandre Bayen of UC Berkeley. Smith serves as Deputy Executive Director of the FAA's Office of UAS Integration. Smith opened her remarks stating that "safety is the FAA's north star." Discussing the FAA's record of experience and safety, Smith said the agency has been actively engaged in efforts to scale safe operations of new users of airspace including advanced air mobility (AAM). She explained that the FAA is continuing the process to implement the new regulation on remote identification for drones, and recently finalized the process for drone manufacturers to comply with the remote identification requirements¹. She also explained that the FAA is working to enable beyond visual line of sight (BVLOS) operations for drones by rule, rather than by a waiver. She said the FAA is also making progress in the area of aircraft certification for drones and AAM.

¹ This process for drone manufacturers is called a "means of compliance", which sets forth an acceptable manner by which an applicant can comply with specific FAA regulations.

Smith emphasized the importance of information exchange and breaking down silos. She discussed the FAA's "crawl, walk, fly" approach to integrating new entrants into the national airspace system. She said the FAA's research strategy begins with: 1) focusing on initial operations (crawl phase); 2) followed by research to support increased AAM operations and levels of automation (walk phase); and 3) later advanced operations, highly automated air traffic management, remote piloted and autonomous aircraft, and increased operational frequency (fly phase). She explained that the FAA's research planning efforts include analysis of the FAA's decisions needed to enable operational capabilities for AAM and identification of research needs to inform decision making.

She also shared that the FAA is modifying its regulatory approach, with respect to powered lift certification and the pilots who operate them. She explained that this highlights the FAA's commitment to safely integrate new types of aircraft into the nation's airspace system while providing a simpler pathway for applicants to obtain the necessary approvals. She noted that the FAA's previous approach would have required these aircraft to operate under existing aircraft rules rather than a framework that could be tailored to new technologies. She further delineated that the prior approach focused on certifying aircraft, while the new approach also includes operating the aircraft. In addition, she discussed how the Office of Airports released its draft Engineering Brief on Vertiport Design earlier in 2022. She noted the agency reviewed public comments and is preparing the final Engineering Brief for publication, which is anticipated for release in late-Summer 2022. She shared that the FAA expects this guidance to evolve as the FAA and industry learn more about AAM aircraft performance capabilities and the ground infrastructure required to support operations.

She noted that the Office of Airports plans to publish a new Advisory Circular by 2025. She also said in June 2020, the FAA's Office of NextGen published the first version of the AAM Concept of Operations. She explained that an updated version is currently being developed and will be broader and incorporate a variety of AAM use cases beyond urban air mobility. It is anticipated the updated concept of operations will be released in early-2023. Next, she shared that the Advanced Air Mobility Coordination and Leadership Act is in the final stages of the legislative process in the U.S. Congress. The legislation establishes a federal definition of AAM and directs the Office of the Secretary of Transportation to establish an interagency working group to plan and coordinate efforts related to the safety, infrastructure, physical security, cybersecurity, and federal investment necessary to support an AAM ecosystem.

Following the keynote remarks, Bayen of UC Berkeley moderated a fireside chat with Smith. During the discussion, Bayen asked Smith how she got interested in aviation. She shared that she started as an air traffic controller, after finishing her Bachelor's degree in Psychology. She had not planned to go into aviation, but it looked like an opportunity worth pursuing as she considered a range of jobs following her graduation. Smith and Bayen also discussed



Figure 9. Fireside Chat with Alexandre Bayen and Abby Smith

diversity in aviation careers and the importance of making AAM accessible to women and minorities. Smith explained that diversity of thought (e.g., professional background, gender, race/ethnicity, etc.) is integral to enhancing safety in aviation. Next, Bayen asked Smith about how the labor shortage is impacting the aviation sector and strategies to overcome this challenge. Smith explained that promoting interest in aviation careers must start as early as elementary school. She discussed a variety of high-paying jobs in the aviation sector (e.g., mechanics, dispatchers, air traffic controllers, pilots, data scientists, cybersecurity personnel, etc.) and explained that everyone has a responsibility to educate, excite, and recruit young professionals into the aviation field. She concluded by discussing the importance of inclusion and working together as a mobility ecosystem.

The video of this session can be viewed [here](#) or at: <https://youtu.be/FvUPCNQpHV8>

Afternoon Breakout Sessions

Securing Advanced Air Mobility

Ravi Singh of Crown Consulting moderated a panel focused on securing AAM, including physical, cyber, and personnel security issues, and policies and technologies, that could be employed to enhance security. This panel included four expert panelists: Kenneth Freeman, NASA; Torrie Meliska, Wisk; Christopher Kucera, OneSky; and Michael Rucinski, Transportation Security Administration (TSA). The panel discussed physical security of vertiports, aircraft, charging/refueling, other physical infrastructure.

Rucinski shared that the vast majority of aircraft coming online fall below threshold of what TSA currently regulates. He explained the threshold where TSA begins to regulate the security of passengers and cargo. This includes aircraft carrying passengers exceeding 12,500lbs maximum take-off weight and aircraft carrying cargo only exceeding 45,500lbs maximum take-off weight. He noted that the aviation industry has approached TSA requesting assistance to build voluntary security programs for passengers and cargo. The panel also discussed on-board passenger safety considerations in both piloted and autonomous aircraft. Rucinski also explored the vetting process for aircrew and other personnel. He shared that there is a new TSA AAM working group to help address a range of AAM security issues.

Meliska noted there is an uptick in people attempting to bring prohibited items onboard commercial aircraft, and TSA screening is not mandated for current helicopter operations. She emphasized that Wisk recognizes the need for some type of security screening process and is working to incorporate this into vertiport design. She also shared that Wisk is considering TSA security screening at some vertiports to enable passengers to connect to flights on the airside of the airport. Next, Freeman and Kucera explored digital risks and cybersecurity needs for enabling IT systems (e.g., ticketing/booking, air traffic management, communications, navigation, surveillance, and autonomous aircraft systems). Freeman discussed the zero-trust architecture approach (i.e., an architecture based on the principal that nothing can be trusted) and how it assumes IT systems are compromised (e.g., devices, systems, and users require authentication each time they interact with a secure system). He also shared the need to develop an ecosystem cybersecurity policy approach (i.e., systems to protect web applications or applications programming interfaces from attacks that

compromise overall security), which defines public and private sector roles with respect to AAM cybersecurity. Finally, Kucera noted the importance of moving from analog to digital communications to ensure more secure and efficient operations. The panel concluded by discussing potential mitigation measures that could be employed to prevent and respond to security concerns (e.g., passenger rating systems, passenger panic buttons, etc.).

The video of this session can be viewed [here](#) or at: <https://youtu.be/VbW3tppdqSE>

Potential Benefits of AAM and Aviation for Communities

Basil Yap of AeroX moderated a session discussing the potential benefits of AAM and aviation for communities with Marc Ausman, Electra.aero; Carl Dietrich, Jump Aero; Johnny Doo, International Vehicle Research Inc.; and Jeffrey Smith, Helicopter Association International. This session discussed the various impacts of airports on local communities, such as direct, indirect, induced and catalytic economic impacts; delivery of emergency humanitarian aid relief, medical supplies, and organs for transplantation; and promoting social inclusion in rural communities. The session also included a discussion of emerging use cases for AAM and UAS to serve emergency response and humanitarian use cases.

Yap opened the session introducing himself and providing background on AeroX and its work in UAS traffic management for package delivery, public safety, and infrastructure inspection use cases. Ausman explained that Electra is working to decarbonize aviation through hybrid electric, hydrogen fuel cell, and battery electric propulsion systems for the regional air mobility market. He discussed how new propulsion systems are enabling shorter take-off and land aircraft which in turn requires shorter runways (about the size of a soccer field) and reduce the spatial size, noise, and other community impacts of airports in the future. Dietrich explained that the average response time for medical emergencies in rural America is 14.5 minutes. Dietrich emphasized the opportunity for eVTOLs to reduce aeromedical response times in rural communities. Doo talked about NASA's Transformative Vertical Flight Working Groups and their work supporting public service use cases such as search and rescue, law enforcement, medical transport, and emergency/humanitarian response. He explained that the public services group is developing a roadmap to understand key enablers such as technology; certification and regulations; infrastructure; and community engagement. Smith talked about the importance of a mixed fleet with a variety of propulsion systems and capabilities to serve an array of first-response use cases. The panel discussed the importance of take-off and landing infrastructure to enable aeromedical and emergency response use cases. Additionally, the panel talked about the role of airports and heliports connecting rural communities to jobs and essential services (e.g., transporting patients to medical care and transporting specialists to patients). The panel also discussed the economic impact of airports and heliports such as jobs and generating tax revenues for local coffers.

The video of this session can be viewed [here](#) or at: <https://youtu.be/pkOGgOUKz0M>

Social Equity Impacts of Vertiports

Adam Cohen of UC Berkeley's Transportation Sustainability Research Center moderated a panel on the social equity impacts of vertiports with Chris Fernando, EY-Parthenon; Chris Musei-Sequeira, CJSC LLC; Kerry Rohrmeier, San Jose State University; Steven Spinello,

Skyports; and Amber Woodburn McNair, Ohio State University. The session included a discussion of: 1) the potential impacts of vertiports on nearby neighborhoods, 2) opportunities for vertiports to revitalize neighborhoods and serve as a catalyst for mixed-use development, 3) potential concerns associated with gentrification and displacement, and 4) strategies for engaging community stakeholders as part of vertiport planning and development processes.

Woodburn McNair talked about the importance of understanding historic and existing systemic inequities as part of infrastructure planning processes. Musei-Sequeira talked about the politics of planning. He shared that science and technology cannot answer the human questions of social equity and values. The panel also discussed the difference between procedural equity (i.e., full and fair participation) as part of the planning process and outcome equity (i.e., social and environmental impacts from deployments) when AAM is implemented. Spinello explained that some states, such as California, have state mandated environmental review and community engagement processes (e.g., California Environmental Quality Act known as CEQA). Spinello noted that although engagement will be required as part of the CEQA process, it is important to go beyond minimum requirements and conduct deep engagement with community stakeholders. Fernando discussed the importance of engaging with local community-based organizations (CBOs) that are knowledgeable of local planning, political, environmental, and social equity issues.

Rohrmeier explained that CEQA engagement starts when a potential vertiport site has been identified. She and other panelists emphasized the importance of engaging communities earlier in the planning process; this includes general planning and long-range visioning efforts. Cohen discussed diverse social equity issues associated with vertiport placement including direct impacts around take-off and landing facilities (e.g., noise, surface transportation congestion, gentrification, displacement, etc.) and impacts associated with flight paths to and from vertiport locations (e.g., noise, visual pollution, air congestion). Rohrmeier talked about her ongoing research with the Mineta Transportation Institute to develop tools and land use planning recommendations for vertiports that could be used by non-profits and local governments. During the discussion, the panel also explored the equity implications of public and private vertiports. Spinello noted that privately funded vertiports may have more authority to limit their own operations to mitigate community impacts (e.g., restricting overnight take-off and landings to reduce noise). The panel concluded with a discussion about the importance of demonstrations and case studies to enhance collective understanding of social equity in the context of AAM and guide future policy.

The video of this session can be viewed [here](#) or at: <https://youtu.be/AqCcVovLuhU>

Plenary Session

Governing for On-Demand Air Mobility

The closing plenary session of the conference was moderated by Justin Towles of Crown Consulting and included five panelists: Riley Beaman, North Carolina Department of Transportation; Doug Coleman, Reliable Robotics; John Eberhardt III, ATA LLC; Daniel Friedenzohn, Embry Riddle Aeronautical University; and Dawn Zoldi, P3 Tech Consulting LLC. This session closed the conference with a discussion of the roles and responsibilities of the

public sector, and the legal issues, policies, and emerging practices around governing and regulating advanced air mobility.

Friedenzohn discussed TRB's New Users of Shared Airspace Standing Committee (AV095) and the role of TRB as a convener of diverse stakeholders sharing information and supporting research. The panel also discussed how sometimes it can be difficult for the public sector to keep pace with technological changes occurring in transportation. Zoldi touched on regulatory roles and responsibilities, and the complexities of governing AAM at different levels and types of governments (e.g., federal, state, territory, tribal, etc.). She also said while there are lessons that can be learned from UAS, AAM is quite different. She said while stakeholders from UAS and AAM should collaborate with another, she asked the question if they should be regulated by different FAA offices.

Eberhardt said all too often industry believes that the FAA will implement magic regulation that will make everything easy. He emphasized the importance of including state and local governments and leveraging their networks to bring community stakeholders together. Riley discussed the importance of bringing together both state and federal stakeholders, as well as surface transportation and aviation stakeholders. Coleman talked about the need for regulatory support to enable beyond visual line of sight (BVLOS) operations, and the training and certification of ground pilots to supervise autonomous flight operations. The panel also discussed how they envision AAM evolving from the existing regulatory and governance structure to one that will be needed in the future when the technology automates and scales. One of the issues the panel identified is the need for industry and regulators to begin the discussion around privacy issues and interoperable infrastructure (e.g., take-off and landing, energy, weather monitoring, etc.). The panel also discussed the importance of keeping airports open and the role of programs such as essential air service to expand AAM access to more people. The panel emphasized the importance of engaging non-traditional aviation stakeholders and prioritizing early use cases, particularly for aeromedical, firefighting, and other emergencies.

The video of this session can be viewed [here](#) or at: <https://youtu.be/ryabvY4uUx8>

Closing Remarks

Bayen and Friedman closed the conference thanking Caltrans and the San Francisco International Airport, CAMI, sponsors, speakers, attendees, and others who made the inaugural event possible. Bayen explained that the Future of Aviation Conference will be an ongoing event and summarized key findings from the conference such as the need for diverse stakeholder engagement, research and policy for AAM, and use cases that support multimodal, sustainable, and equitable outcomes.

Key Insights

Key insights and discussion points from the conference include the following:

- 1. AAM must be anchored in the public good.** The conference highlighted the importance of prioritizing humanitarian, aeromedical, and emergency response use cases to demonstrate broad societal benefit and build public acceptance of emerging AAM technologies.
- 2. Safety is existentially critical because many of the AAM use cases envision operations in low altitude airspace over urban areas.** A single crash could lead to widespread AAM disapproval. A number of safety issues that must be addressed include: 1) airworthiness, operations, electric propulsion, and pilot standards; 2) interaction among humans, machines, and highly complex software; and 3) maintenance training, etc.
- 3. A system of systems and multimodal approach are needed.** Technology can often innovate faster than the regulatory environment. A number of speakers emphasized the importance of a system of systems planning and multimodal integration approach that deeply integrates AAM with existing transportation services (both ground and air).
- 4. There is a need to approach alternative fuels more holistically.** Numerous electrification challenges were identified, such as grid capacity, aircraft range, aircraft down-time due to charging, lifecycle impacts, and battery recycling, among others. Numerous speakers emphasized the importance of examining alternative fuels to help address these challenges and enable larger aircraft and longer-distance operations (e.g., regional air mobility).
- 5. There are many opportunities for 'new collar' jobs.** AAM has the potential to support a variety of direct, indirect, and ancillary jobs to enable the emerging aviation ecosystem. Workforce development and training programs are needed to foster new collar jobs in the areas of operations and operational support, engineering, vehicle design and manufacturing, business and financial operations, quality control and safety, medical and travel services, and hospitality.
- 6. Public acceptance is not the same as community engagement.** There is a difference between engaging communities and building public support for AAM. Speakers emphasized the importance of evolving community engagement from informing and consulting the public to collaboration and community empowerment where the public has the ability to influence decision-making and outcomes.
- 7. Different stakeholders have different definitions of equity.** There is not a single definition of 'equitable AAM.' For pilots, air carriers, and OEMs, equitable AAM can be viewed through the lens of equitable airspace access. For the public and community partners, equity is often viewed through the lens of public involvement and outcomes (e.g., who bears the benefits and impacts of AAM implementation).
- 8. Equity process (engagement) and outcomes are both important.** Both meaningful involvement in the AAM decision-making process and equitable protection from environmental and other impacts are key. Numerous speakers discussed the importance of integrating environmental justice principles into AAM planning, decision-making, and implementation.
- 9. All levels of government must work together.** The planning and implementation of AAM will require a multi-institutional approach that includes federal, state, and local governments to implement safe, sustainable, and equitable outcomes.



Future of Aviation

Advancing Aerial Mobility through Technology, Sustainability, and On-Demand Flight

Conference Agenda

Tuesday August 2nd, 2022

Pre-Conference Workshop: Advanced Air Mobility 101

1:00pm Welcome and Introduction to Community Air Mobility Initiative (CAMI)
Yolanka Wulff, CAMI

AAM Fundamentals

1:10pm Aircraft, Air Traffic Management, Use Cases, Operational Zones
Anna Dietrich, CAMI

1:30pm AAM Infrastructure
Paul Stith, Black & Veatch

2:00pm Markets and Opportunities
Shahab Hasan, Crown Consulting Inc.
Ben Merran, NEXA Capital Partners

2:30pm Legal and Regulatory Framework
Dawn Zoldi, P3 Tech Consulting LLC
Abigail Smith, FAA

Integrating AAM Into Communities

3:30pm Planning for Advanced Air Mobility
Adam Cohen, Transportation Sustainability Research Center, UC Berkeley
Maranda Thompson, Mead & Hunt

4:00pm Community and Environmental Impacts
Timothy Middleton, C.M., HMMH
Ryan Biziorek, Arup

4:30pm Understanding the Integration Challenge
Todd Petersen, Ellis & Associates
Adrienne Lindgren, Supernal
Clint Harper, Urban Movement Labs
Beth White, FAA

5:30pm Networking Reception - Sky Terrace

Wednesday August 3rd, 2022

Welcome and Opening Remarks

8:00am Welcome

Matt Friedman, Caltrans
Adam Cohen, UC Berkeley
Susan Shaheen, UC Berkeley

8:10am Opening Remarks

Toks Omishakin, California State Transportation Agency

Morning Plenary Session

8:30 am Advancing Aerial Mobility: Current Practices, Innovations, and Emerging Futures

Moderator: Todd Petersen, Lacuna

Speakers: Andrew Cummins, Archer Aviation
Edward Espiritu, United Airlines
Addison Ferrell, Skypoints
Shivanjli Sharma, NASA
Ben Tigner, Overair
Melissa Tomkiel, BLADE

Morning Breakout Sessions

10:30am Environmental Impacts: Weather, Noise, Visual Pollution, and Land Use Privacy

Moderator: Paul Wheeler, WSP

Speakers: Ryan Biziorek, Arup
Chris Fernando, EY-Parthenon
Timothy Middleton, HMMH
Brendan Reed, San Diego International Airport
Colleen Reiche, EY-Parthenon

10:30am Stakeholder and Community Engagement

Moderator: Geoffrey Gosling, Aviation System Consulting LLC

Speakers: Gaël Le Bris, WSP
Liza Josias, Eve Air Mobility
Lisa Peterson, Airspace Link Inc.
Maranda Thompson, Mead & Hunt
Beth White, FAA

10:30am Integrating AAM into a Multimodal System

Moderator: Joseph Iacobucci, Sam Schwartz Engineering

Speakers: Gabriela Juarez, City of Los Angeles
Adrienne Lindgren, Supernal
Caryn Moore Lund, Lilium
Suzanne Murtha, AECOM

Future of Aviation

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Fireside Chat

12:45pm NASA's Aeronautics Research Mission Directorate

Moderator: Susan Shaheen, UC Berkeley

Speaker: John Cavolowsky, NASA

Afternoon Breakout Sessions

1:30pm Ensuring Safety of Novel Aircraft Designs, Technologies, and Infrastructure

Moderator: Christopher Hart, Hart Solutions LLC

Speakers: Ryan Naru, Joby Aviation

Abby Smith, FAA

Richard Stocker, Australian Civil Aviation Safety Authority

1:30pm Workforce and Economic Development

Moderator: Karen Philbrick, Mineta Transportation Institute

Speakers: Rubén Del Rosario, Crown Consulting

Ernest Huffman, North Central Texas Council of Governments

Benjamin Merran, NEXA Capital Partners

Joshua Metz, Monterey Bay Drone, Automation, and Robotics

Technology (DART) Initiative

Paul Stith, Black & Veatch

1:30pm The Role of Local and Regional Governments in Planning for Advanced Air Mobility

Moderator: Yolanka Wulff, Community Air Mobility Initiative (CAMI)

Speakers: Jacques Coulon, City of Orlando

Thea Ewing, Mid-Ohio Regional Planning Commission

Clint Harper, Urban Movement Labs

Shahab Hasan, Crown Consulting

George Kivork, Joby Aviation

Afternoon Plenary

3:30pm Guiding Safe, Sustainable, and Equitable Outcomes - 3:30pm to 5:00pm

Moderator: Susan Shaheen, UC Berkeley

Speakers: Vince Bertoni, City of Los Angeles

John Cavolowsky, NASA

Christopher Hart, Hart Solutions LLC

Lori Pepper, California State Transportation Agency

Yolanka Wulff, Community Air Mobility Initiative

Evening Reception at the SFO Museum

Future of Aviation

Advancing Aerial Mobility through Technology, Sustainability, and On-Demand Flight

Thursday August 4th, 2022

Morning Remarks

8:00am Morning Keynote

Julie Lorenz, Kansas Department of Transportation

Morning Plenary

8:30am Public Sector Perspectives on Advanced Air Mobility

Moderator: Raja Sengupta, UC Berkeley

Speakers: Carlos Cruz-Casas, Miami-Dade County
Jared Esselman, Utah Department of Transportation
Ramses Madou, City of San Jose
Pricila Roldan, San Diego Association of Governments

Morning Breakout Sessions

10:30am Safe and Equitable Airspace and Flight Operations

Moderator: Toni Drummond, Global Aerial Management Group

Speakers: Antony Evans, Acubed
Curtis Ostrodka, VHB
Jasenka Rakas, UC Berkeley
Anuja Verma, The MITRE Corporation
Yu Zhang, University of South Florida

10:30am Regional Air Mobility: Opportunities and Challenges for Rural Communities and Small Airports

Moderator: Mark Hansen, UC Berkeley

Speakers: Arthur Dubois, Xwing
Nicholas Flom, Deloitte
Manal Habib, MightyFly
Will Heyburn, BLADE
Dave Merrill, Elroy Air
Susan Ying, Ampaire

10:30am Building Public Trust in Electric, Hydrogen, and Autonomous Aviation

Moderator: Anna Dietrich, Community Air Mobility Initiative

Speakers: Nicholas Matcheck, Supernal
Axel Radermacher, Odys Aviation
Anuj Totapudi, ZeroAvia
Pavan Yedavalli, Wisk

Fireside Chat

12:45pm FAA's Office of Unmanned Aircraft System Integration

Moderator: Alexandre Bayen, UC Berkeley

Speaker: Abby Smith, FAA

Afternoon Breakout Sessions

1:30pm Securing Advanced Air Mobility

Moderator: Ravi Singh, Crown Consulting

Future of Aviation

Advancing Aerial Mobility through Technology, Sustainability, and On-Demand Flight

Speakers: Kenneth Freeman, NASA Ames Research Center
Christopher Kucera, OneSky
Torrie Meliska, Wisk
Michael Rucinski, Transportation Security Administration

1:30pm Potential Benefits of AAM and Aviation for Communities

Moderator: Basil Yap, AeroX
Speakers: Marc Ausman, Electra.aero
Carl Dietrich, Jump Aero
Johnny Doo, International Vehicle Research, Inc.
Jeffrey Smith, Helicopter Association International

1:30pm Equity Impacts of Vertiports

Moderator: Adam Cohen, UC Berkeley
Speakers: Chris Fernando, EY-Parthenon
Chris Musei-Sequeira, CJSC LLC
Kerry Rohrmeier, San Jose State University
Steven Spinello, Skyoports
Amber Woodburn McNair, Ohio State University

Afternoon Plenary

3:30pm Governing for On-Demand Air Mobility - 3:30pm to 5:00pm

Moderator: Justin Towles, Crown Consulting
Speakers: Riley Beaman, North Carolina Department of Transportation
Doug Coleman, Reliable Robotics
John S. Eberhardt III, ATA LLC
Daniel Friedenzohn, Embry Riddle Aeronautical University
Dawn Zoldi, P3 Tech Consulting LLC

Happy Hour

5:00pm at the Grand Hyatt

Friday August 5th, 2022

Morning Tours

SFO Sustainability Walk
Aviation Museum and Library Tour
SFO Airfield Tour
Airport Land Use and Multimodal Integration Walking Tour
Behind the Scenes with United Airlines