Engaging Electric Aircraft

VFS holds an extremely insightful 16th Annual Electric Aircraft Symposium in Oshkosh

By Dan Gettinger, Managing Editor

The Vertical Flight Society hosted the 16th Annual Electric Aircraft Symposium (EAS) on July 23–24, 2022, the weekend before Experimental Aircraft Association's AirVenture, in Oshkosh, Wisconsin. The event was held at the University of Wisconsin Oshkosh and, after two years of virtual-only programming, featured a hybrid in-person/online format. More than 120 people registered for in-person attendance with another 85 attending online.

One of the benefits of the symposium is that engineers and others deeply immersed in the development of electric vertical takeoff and landing (eVTOL) aircraft get to hear and learn from experts across the electric aviation and advanced air mobility (AAM) community utilizing similar technologies and facing common challenges.

Originally established in 2007 by the Comparative Aircraft Flight Efficiency (CAFE) Foundation, EAS is the world's longest-running electric aviation technology meeting. VFS began co-sponsoring the event in 2018 and has now taken over full responsibility for the event. Jim Sherman, Yolanka Wulff and Ken Swartz were the key organizers of the event.

This year's EAS featured two days and more than a dozen sessions on AAM and electric aircraft. Attendees heard speakers from industry, government and academia address topics like aircraft autonomy and noise, vertiports, cargo delivery, certification processes, and much more. In all, more than 40 speakers and moderators — representing as many entities and institutions — participated in the wide-ranging event.

Money Matters

EAS 2022 underscored the transformative potential of AAM to reduce carbon emissions and contribute to economic development. In one case study of the potential advantages of introducing AAM in Ohio, Ruben Del Rosario of Crown Consulting forecasted that AAM could add $11.4B to the state's gross domestic product (GDP) over 25 years. In another study, Darrell Swanson of EAMaven argued that the introduction of 20 electric aircraft AAM routes in the UK could bring an additional GBP125M ($152M) per year in economic stimulation, all while saving the passengers on these routes 486 years in travel time.

Unlocking the potential of AAM will require significant investments in infrastructure. Michael Dyment of NEXA Advisors encouraged eVTOL developers to incorporate the cost of developing infrastructure to support AAM operations into their business plans. "There is very little market for AAM because most cities aren't ready for it," said Dyment. "Infrastructure is a huge and significant barrier to the success of this business." A study by NEXA Advisors found that for every dollar invested in the development of eVTOL aircraft, another will need to be spent on vertiports and other types of enabling infrastructure.

Dr. Susan Ying of Ampaire explained the company's hybrid-electric airplane flight demonstration accomplishments to date.

Johnny Doo of IVR reported on the NASA-VFS working group report on AAM for public service, including disaster relief.

Social Desirability

Productive investments in infrastructure will require both deep familiarity of the workings of municipal agencies and community buy-in. Clint Harper of Urban Movement Labs urged companies seeking to develop AAM vehicles and infrastructure to begin working with municipal regulators on land use policies, particularly with the department of city planning or an equivalent agency. "The pitch that you use to sell to your investors is not the pitch you need to use to talk to cities," said Harper. "It's a completely different ballgame."

Adam Cohen of the University of California, Berkeley described the intersection of airspace access and land use policy as the key to introducing AAM in communities. Maximizing the effectiveness and equity of AAM will require intermodal transportation hubs and interoperable infrastructure. Vertiport infrastructure, said Cohen, should be thought of less as traditional airports and more like rail stations that offer multiple modes of transportation. Facilitating buy-in from the public will require community engagement and empowerment. Some groups have transitioned from the word "public acceptance" to "social desirability" to indicate that communities must not only tolerate AAM but actively encourage its local adoption.

Creating the basis for that acceptance is part of the reasoning behind Volocopter's AAM demonstration flights and public exhibitions. Volocopter's Oliver Reinhardt said that when the public has the opportunity to see, feel and experience AAM aircraft, acceptance of these aircraft is likely to follow. Volocopter is currently hosting an exhibition of its eVTOL aircraft in Singapore, where the company is using the opportunity to both engage with the public and discover where eVTOL aircraft can add value to the existing transport services.

One possible barrier to public acceptance and integration — and, by extension, to the AAM market size — could be the noise emissions from the aircraft. AAM and eVTOL operations are most likely to occur in urban or suburban settings and, to keep prices low for the consumer, at a high rate of frequency. Ryan Biziorek of ARUP argued that creating events for stakeholders and for the public to experience how different noises sound in various contexts is key to integrating human responses into the design process for AAM aircraft. ARUP used this approach to inform the development of the Los Angeles Urban Air Mobility Policy Framework.

While electric aircraft may emit less noise than other types of aircraft, that doesn't mean they are quiet, said Devon Jedamski of Whisper Aero. The integration of propulsion systems on the aircraft can result in unintended noise emissions. "With the specific set of requirements we're working with for drone delivery and eVTOL, noise is a first-order driver in the economics of the vehicle," said Jedamski, describing noise as on-par with range and payload. Ultimately, even a modest reduction in noise level — as little as 3dB — could allow an operator to double its number of flights.

Automation

The combination of high-tempo AAM operations and complex environments has encouraged many AAM aircraft developers to embrace high-level automation and autonomy in their aircraft. An onboard pilot adds costs and takes away payload from paying customers. Autonomy simplifies both AAM and vehicle operations and allows scalability, said Del Christman of Autonodyne, who described six different enablers of autonomy such as detect and avoid and the ability of an aircraft to carry out missions without operator intervention.

Still, introducing autonomy in commercial operations in an emerging industry such as AAM carries various risks. Panelists at EAS appeared to agree that although technical solutions for high-level automation and autonomous behaviors exist, it will be some time before passenger-carrying aircraft are flown without aircrews. Crewmembers will probably remain involved, said Earl Lawrence of XWing, though their roles and responsibilities are likely to change. Safety is the key prerogative in eVTOL operations, said Mark Henning of AutoFlight. Regulators and the public must be allowed to understand how these technologies function.

Automation and autonomy may play a more immediate role in cargo delivery rather than passenger flights. Manal Habib of MightFly and Dave Merrill of Elroy Air, two companies developing cargo drones, both said that although current operations involve a remote pilot, the relationship between a pilot and aircraft will eventually evolve from one-to-one to one-to-many, allowing a single pilot to control multiple aircraft.

Virtual attendees were able to watch all of the presentations remotely through the VFS online broadcast. Here, Amanda Nelson of Bristow speaks on a panel on regional air mobility.

Marc Ausman of Electra Aero said that the firm is designing its electric short takeoff and landing (eSTOL) aircraft to be autonomous in the future pending regulatory approval.

Like Elroy Air, Electra Aero is designing cargo delivery aircraft that focus on the "middle mile" — transporting goods from large regional distribution centers to local centers. Currently, middle mile transportation is heavily reliant on trucks and involves multiple transfers of goods between different distribution centers. Electra envisions delivering goods directly to warehouses and even potentially to retail facilities. The company is examining the possibility of building short takeoff and landing runways on the roofs of large distribution centers.

Longer Ranges

Although passenger-carrying eVTOL operations in urban environments is the focus of many companies, EAS 2022 illustrated the extent to which AAM encompasses a wide spectrum of possible missions and aircraft. Amanda Nelson of Bristow Group described how an early adoption use case for regional AAM vehicles could be transporting the people and goods that support offshore oil and other energy operations. Similarly, Willi Tacke of Flying Pages suggested that Norway's state-supported air transportation system, which services remote coastal industries, could offer an early use case for electric aircraft. Johnny Doo of International Vehicle Research, Inc., identified a host of ways that AAM aircraft can support public service applications by complementing existing modes of transportation.

Dr. Anita Sengupta, CEO of Hydroplane, explained hydrogen fuel cell technology and the plans and progress of her company.

Col. Nathan Diller, US Air Force AFWERX Chief, highlighted the key role that VFS has had in supporting Agility Prime, and the agency's vision for the future.

Flying longer distances with larger aircraft will allow developers to look beyond a sole reliance on batteries and potentially at hybridized propulsion systems such as turbogenerators and fuel cells. "In terms of the technologies and propulsion system configurations, it's not one-size-fits-all," said Olaf Otto of Rolls-Royce. "There is an area for all-electric in the smaller applications and then consecutively as you go to bigger and bigger airframes, you do have to hybridize." The company is developing a hybrid-electric propulsion system involving a gas turbine, which it expects to test this year, and an electrical generator that it will begin testing at the end of 2023. Still, Otto observed that there are various battery technologies in development that could yield different outcomes in 2030 and beyond.

The rapidly changing technological landscape has already created a challenging environment for certifying electric aircraft. Jen Uchida of AeroTEC said that her company was able to fly the eCaravan demonstrator in 2020 — which now supports magniX and Surf Air plans to develop a supplemental type certificate (STC) to electrify Textron Grand Caravans — by successfully identifying the key safety aspects of existing regulations and striking a balance between full compliance and rapid prototyping. Kevin Bruce of Diamond Aircraft said that identifying requirements from the outset is an enormous factor in the success of the aircraft. When it comes to certification, said Bruce, around 80% of the process involves educating regulators on the technology. Battery density, supply chain barriers and design standards are also adding to the difficulties of certifying electric aircraft.

Look to the Future

Despite the challenges on the horizon, EAS 2022 highlighted the tremendous achievements of the many individuals, companies and institutions working to make sustainable electric aviation an integral part of future transportation systems. EAS 2023 next year should show even more progress.

VFS would like to express its gratitude to Lilium, AeroTEC, Elroy Air and Opener for their generous support of EAS 2022 and to thank all the panel moderators and speakers for their contributions to making this event a resounding success. The video recordings can be purchased as video-on-demand via the VFS Video Library at **www.vtol.org/videos**. Attendees can access the videos and presentations for free.