2025

Committee on Aviation Safety – Topic 1

Director – Vincent Correia[1]

[1] This paper reflects the author's personal views and cannot be considered as the views of ICAO.

Certification Issues related to Advanced Air Mobility

In recent years, a whole new set of projects have emerged that are now designated under the umbrella term "Advanced Air Mobility" (AAM). This concept constitutes an evolution of the preliminary thoughts devoted to the so-called "Urban Air Mobility" (UAM). The difference between these two concepts is not only semantic but also reflects a better understanding of the potential implications of new aerial vehicles, which could revolutionize how humankind transports goods and persons in a decarbonized world.

I. Advanced Air Mobility and the Future of Air Transport

Involving new and innovative aircraft, technologies, and infrastructure, AAM aims to enhance and expand air transportation capabilities to provide more efficient, sustainable, and accessible air mobility solutions for both urban and rural areas. The initial concept of "Urban Air Mobility" was centered on these new aircraft, most notably the electric vertical take-off and landing (eVTOL) ones. However, as the proofs of concepts became available, it became necessary to adopt a broader understanding of the usage of such vehicles, which are not meant to be confined to mere operations of "air taxis" but that can, on the contrary, profoundly change mobility and logistics in the years to come. By overcoming the "last mile/kilometer" challenge, AAM can indeed deliver the flexibility currently offered by trucks while guaranteeing zero emissions. As such, given its focus on electric propulsion, AAM aims to be more sustainable than traditional air travel. AAM can also offer new solutions to address the growing issues of traffic jams in overcrowded cities at limited costs in terms of infrastructure. The use of eVTOL aircraft for short-distance, on-demand flights can also provide a faster and more direct alternative to ground transportation in congested cities while facilitating certain complex operations in emergency situations or for the delivery of medical supplies. By integrating state-of-the-art automation systems, AAM also aims to enable safe and reliable aircraft operation with minimal human intervention, thus fostering technological innovation. Hence, AAM can represent a paradigm shift in air transportation, offering the potential for faster, more convenient, and environmentally friendly urban and regional air travel. All these reasons explain why it is an area of active development and research involving aerospace companies, technology firms, and regulatory bodies.

II. Regulatory Issues

The promising perspectives of AAM should, however, not overshadow the challenges that must be overcome in the short future: as these aircraft are by definition meant to operate in urban areas, the issue of the safety of people, both onboard and on the ground, is of paramount importance. An important factor is without a doubt the issue of scale: while helicopters are already cruising the cities' skies, for police or ambulance most notably, the advent of AAM would significantly increase the number of aircraft operating in urban areas. As such, it would require the development of proper Urban Air Traffic Management (UTM) and the use of automated technology to prevent collisions. These are not mere technicalities. They are, on the contrary, fundamental problems that need to be addressed from different angles, most notably the engineering, legal, sociological, and economic perspectives.

- From the engineering side, on the one hand, it is necessary to ensure that these aircraft are "safe by design" and that they cannot be affected by cyber-attacks or other malevolent actions in an unfortunately troubled world.
- From the legal perspective, on the other hand, issues such as authorizations of overflight of cities, liability in case of accident, certification, and insurance are among the first coming to mind.
- These elements are obviously of paramount importance from the economics perspective, as the promises of flourishing new business opportunities can only be fulfilled if the systems are safe and allowed to operate in their intended environment.
- At the same time, sociological elements must be taken into account, as this emerging technology could not be fully taken advantage of in case of low levels of social acceptability, raising fundamental questions about the willingness of potential passengers to use fully automated aircraft and the desirability of increasing the number of flying objects in urban areas.

All these different dimensions are intertwined. Social acceptability can only be guaranteed if the safety levels are high and the emissions, including noise, are low. The legal regime must set the necessary safeguards to guarantee that these objectives are met, but we can anticipate that the regulators would devote their efforts to this difficult task only in the presence of real economic activity.

III. The Certification Conundrum

The certification of advanced air mobility (AAM) projects, including eVTOL aircraft and supporting systems, involves numerous challenges across various dimensions. For the aircraft themselves, regulatory agencies like the FAA and EASA must establish clear and comprehensive safety standards for novel designs, propulsion systems, and operational profiles that differ significantly from traditional aviation. Indeed, in June 2024, both Agencies issued either updated technical standards or proposed some changes to the existing legal framework through, respectively, EASA's Special Condition for small-category VTOL-capable aircraft and FAA's Draft Advisory

Circular for the Type Certification of Powered-Lift. However, these rules are certainly not final, as AAM aircraft have a wide range and diversity. Furthermore, these aircraft introduce significant differences compared to traditional airplanes and helicopters, requiring a reevaluation of existing standards. Additionally, recent field issues related to products and programs have prompted adjustments to the Type Certification process to address emerging challenges effectively. Most importantly, these rules are not global, since they originate from selected jurisdictions.

Ensuring the reliability and redundancy of electric propulsion, battery systems, and autonomous or semi-autonomous flight control software is critical, particularly given the limited historical data available for these technologies. Noise emissions and environmental impacts also present unique certification challenges, as AAM aircraft are often designed to operate in urban and suburban environments with stringent community expectations. Beyond the aircraft, the broader AAM ecosystem must address certification for integrated traffic management systems

Hence, from both legal and regulatory perspectives, several questions must be considered:

- **How to ensure that the certification process addresses all the potential safety risks?**
- **How can ICAO ensure uniformity of the rules governing AAM, while not discouraging national or regional agencies to develop sound and relevant technical standards?**
- **How can ICAO facilitate the transition from an aircraft-centered certification approach towards a more holistic approach, including urban air traffic management and automation?**
- **Is there room, or need, for international rules given the local dimension of AAM projects, taking place in urban (national) environments?**
- **Given the increased use of Artificial Intelligence in AAM-related projects, what could be the lessons learned for traditional aviation?**

Suggested readings :

Jason Lorenzon, “Drone Dynamics: Unraveling the Legal Tapestry”, Federal Lawyer, Vol. 71, Issue 2 (Spring 2024), pp. 22-27.

Kevin Collareno, “The Flight Path to Transportation Equity: How Legislators Can Ensure That Urban Air Mobility Delivers Inclusive Transportation Services”, University of Illinois Law Review, Vol. 2023, Issue 2 (2023), pp. 639-672.

Benjamyn I. Scott, Bart Custers, Henning Lahmann, “Drone Regulation and AI Law: Assessing the Intersection of the EU Legal Frameworks for Unmanned Aircraft and Artificial Intelligence”, Air and Space Law, Vol. 49, Issue 6 (2024), pp. 565 – 584.