Enhancing Innovation in Aviation

The aviation industry stands at an inflection point, urgently needing to embrace transformative innovations that will propel it towards unparalleled safety, sustainability, and connectivity.[1]

On December 8, 2024, the International Aviation Forum (IAF), representing 43 organizations and businesses across the aviation sector, endorsed a shared vision for the future of aviation by signing the document, Aviation4All. After first recognizing the significant contributions of aviation to economic development, trade, and global tourism, the IAF outlined several challenges facing aviation. These included the following:

- Delivering on environmental commitments to provide a "net zero" industry
- Enhancing the workplace to establish an inclusive and diverse working environment, regardless of age, religion, gender, academic or physical ability or national origin
- Increasing connectivity to enhance global accessibility
- Working with governments to enhance safety and security to protect passengers, customers, and the workforce
- Integrating throughout the value chain to provide an improved customer and shipper experience, adopting seamless technology-based solutions
- Providing a customer centric culture
- Dedicated focus on improving operational performance to minimize service disruptions enhancing the joy of flying
- Delivering financial efficiencies to lower the barrier of access, so that a greater percentage of the global population can reap the benefits of domestic and international air travel
- Enhancing the overall positive impact that commercial aviation has on global society through increased opportunities for prosperity and cultural integration

It is evident that the aviation industry needs to embrace innovative approaches to business operations and strategies to accomplish these key goals. To develop a shared vision of the innovations required by the industry, the Hermes Air Transport Organization solicited input from associations representing a cross-section of the aviation industry. The inputs from these associations form the basis of the five recommendations to enhance innovation in aviation described below:

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[1] Interview with Juan Carlos Salazar, ICAO Secretary General, for Hermes Magazine.

Recommendation 1: Adopt a collaborative and systemic approach to innovations in the aviation industry.

The brief from the European Regions Airline Association (ERA) states: "Collaboration is essential if we are to unleash the potential of these new innovative technologies…" The Civil Air Navigation Services Organization (CANSO) notes: "It is crucial to collaborate with key global bodies like ICAO to establish a unified framework that can be adapted to regional contexts." The International Federation of Air Traffic Safety Electronics Associations (IFATSEA) asserts: "… [T]he challenges and barriers that hinder innovation, such as regulatory constraints, lack of resources and resistance to change, require concerted efforts to foster collaboration and provide strategies and best practices to foster innovation and creativity such as cross-disciplinary collaboration." The International Transport Workers' Federation (ITF) recommends: "[T]he establishment of national tripartite aviation bodies, including employers, regulators and union representatives from across the aviation service chain … to develop and implement aviation policies and review existing policies to ensure adaptability." The Joint Aviation Authorities Training Organization (JAA TO) states, "By emphasizing cross-disciplinary training, aviation professionals can develop a broader understanding of interconnected systems, promoting a holistic approach to safety and innovation." Finally, the ICAO Secretary General writes: "We work closely with all interested parties to share information, identify synergies, coordinate efforts and facilitate the implementation of innovation activities to achieve our objectives."

CANSO provides key examples of how collaboration is needed for the implementation of innovative technologies. For example, CANSO describes the implementation of Advanced Air Mobility (AAM):

Advanced Air Mobility (AAM) represents a groundbreaking approach to transportation, offering the potential to reshape urban mobility, reduce congestion, and create new economic opportunities by integrating new types of airspace users, such as electric Vertical Take-OB and Landing (eVTOL) aircraft, into the existing airspace. The vision for AAM is ambitious, aiming to revolutionize how people and goods move through urban environments, connecting previously underserved areas and providing sustainable alternatives to traditional transportation methods.

CANSO notes the many stakeholders need to collaborate to implement AAM, including:

- Regulators to establish safety standards, certification processes for new aircraft, and guidelines for operations within controlled airspace.
- Infrastructure providers to develop vertiports, charging stations, and other necessary infrastructure to support the deployment of AAM.
- Technology companies to ensure that eVTOL aircraft can communicate effectively with existing ATM systems and are equipped with the necessary technology for safe operation, including advanced sensors and navigation systems.

- The public and its representatives to develop trust and acceptance of this new technology through transparent communication, community engagement, and by showcasing the benefits of AAM through controlled demonstrations.

Recommendation 2: Adopt a phased approach to innovations, with short, medium and longer-term objectives.

The ICAO Secretary General states:

In the short term, we need innovation that will allow aviation to evolve into something that is more safe, more secure, and more sustainable. That includes new materials, more fuel-efficient operations, and enhanced diagnostics for preventative maintenance.

In the long term we need revolutionary innovation that will get us to zero fatalities and zero net CO2 emissions while continuing to expand connectivity and affordability.

The ERA notes that regional airlines will be the first to employ new propulsion technologies, such as electric, hybrid and hydrogen-powered aircraft, since these technologies can be more easily adapted to smaller aircraft flying short-range routes, typically employed by regional operators. It is only after these technologies have been successfully employed by the regional carriers will they be adopted by the mainline operators.

CANSO discusses how air traffic management will be transformed in phases. For example: “A key short-term innovation is the initial integration of TBO [trajectory-based operations] principles into ATM operations. TBO focuses on managing aircraft trajectories in a more strategic manner, allowing for optimized flight paths, reduced fuel consumption, and enhanced airspace efficiency.” In the medium term: “Dynamically configuring airspace in response to real-time data and operational needs will optimize airspace usage and reduce congestion.” Finally, in the long run: “Further increasing the level of automation in air systems will enhance efficiency, reduce workload, and improve safety in a fully integrated airspace environment.”

Recommendation 3: Incorporate the human element into technology innovations.

ITF asserts: “Responsible deployment of technology can significantly enhance operational efficiency. However, its development and deployment must include social dialogue at every stage. Workers who engage in the work processes daily are crucial to identifying the needs, risks and potential consequences of technological innovation.”

JAA TO notes the importance of training humans in the implementation of new technologies. In outlining requirements for the successful implementation of uncrewed aircraft (i.e., drone) technology, JAA TO states: “Continuous training and skill development are essential equipping the workforce to implement these innovative solutions effectively. Regular training programs, workshops, and certification courses can ensure that aviation professionals stay abreast of the latest technological advancements and regulatory changes.”

The ICAO Secretary General states: “The key driver to innovation is quite basic. It relies on a simple premise that the more people there are who are trying to solve a problem, the sooner and better it will be solved. Accordingly, a key element is to try to engage as many creative minds as we can to focus on the evolution and the revolution that we need.”

Recommendation 4: Implement risk management, safety, and security measures as key components of technology adoptions.

IFATSEA notes: “[T]he aviation industry must also address the challenges of legacy systems integration and cybersecurity risks to fully leverage the benefits of digital transformation. By investing in robust security measures and ensuring the smooth integration of new technologies, air navigation service providers and civil aviation authorities can create a secure and efficient digital ecosystem.”

JAA TO states that when implementing new technologies: “[M]inimizing the risk of security breaches remains paramount, as security incidents may soon result in an aviation safety occurrence.”

ERA adds: “With innovation brings new and additional risks that must be managed and mitigated, and the aviation sector is no different. The sector faces a constant barrage of cyberattacks on a regular basis, with all actors increasingly becoming targets for threats like Distributed Denial of Service (DDoS) attacks and ransomware. These attacks not only put pressure on organizations but also pose risks to safety.”

Finally, ITF notes: “Digitalization and other technologies bring forth a spectrum of opportunities for increased efficiency and sustainability. However, it also presents challenges, such as the risk of job displacement, the deskilling of the workforce, embedding inequalities into algorithmic processes and at worst, compromising safety track records.”

Recommendation 5: Carefully consider the funding sources for the implementation of innovative technologies – transparent governance is of essence

Although innovations will often reduce costs for companies and organizations, many of these reductions will take place well into the future, after considerable expenditures need to be made. Moreover, the costs of implementing technologies may be spread over multiple stakeholders and may not be aligned with the benefits from the innovations. Thus, financing innovative technologies is often a complex undertaking.

The ICAO Secretary General notes that, “Funding an innovation is contextual. It depends on a variety of factors ranging from the organizational mandates to prioritization of needs, resources and the dynamics of an ever-changing future world.”

ERA emphasizes the role of public-private partnerships (PPPs) in the funding of innovative technologies. It notes that PPPs can encourage innovation, and governments can facilitate PPPs by providing them with grants and tax incentives.

CANSO notes that some of the technological innovations, such as TBO, may be self-funded through the savings that are generated. CANSO states: “TBO will deliver material fuel savings and increased predictability, flexibility and scalability for airspace users. Transition costs are supported by those benefits, as investments will be recoverable from savings.”

On the other hand, JAA TO states that public funding is often required for the initial development of technologies, and it is only after the initial technological innovation that market-based funding takes over from the public funding initiatives. JAA TO further cautions that the handover from the public to the private sector may take place too quickly, before regulations and procedures are developed. If this occurs, the progress of the technological development may be stunted.

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