HERMES
AIR TRANSPORT ORGANISATION

2024_RECOMMENDATIONS

ENHANCING INNOVATION IN AVIATION

HERMES
AIR TRANSPORT ORGANISATION

2024_RECOMMENDATIONS

ENHANCING INNOVATION IN AVIATION

According to ChatGPT, innovation in aviation can be enhanced, "**by fostering creativity, adopting advanced technologies, and promoting collaboration**."

Strategies to enhance innovation should include:

- Investing in research and development that focuses on cutting-edge technologies, including aircraft design, propulsion systems and fuel efficiency.
- Collaborating with industry partners to bring diverse expertise together, accelerating the pace of innovation.
- Promoting STEM Education to train the next generation of aviation professionals and innovators.
- Establishing or supporting innovation hubs, incubators, and accelerators dedicated to aviation to bring innovative ideas to fruition.
- Working closely with regulatory bodies to create an environment that supports innovation, including streamlining regulatory processes to facilitate the integration of new technologies and ideas.
- Providing incentives to encourage the development of environmentally friendly aviation solutions, such as electric propulsion, biofuels, and more fuel-efficient aircraft.
- Openly sharing data to facilitate collaborative research and development efforts.
- Providing continuous training and skill development to ensure that the workforce is equipped to implement innovative solutions.
- Organizing challenges and competitions to spur innovation.
- Enhancing government support by establishing national strategies and roadmaps for aviation development.

It is clear (from ChatGPT) that there are many initiatives that can be undertaken to enhance innovation in aviation. With these broad areas of innovation in mind, the Hermes Air Transport Organization asks your organization to consider the following questions:

1. **What are the key short term and longer-term innovations that need to take place in the aviation industry?**
2. **How can these innovations be developed? Specifically, what projects, programs and initiatives should be undertaken to develop these key initiatives?**
3. **How can these key innovations be funded? How can the capital be generated to fund the development of the innovations?**
4. **How can these innovations best be implemented? What is the role that your organization can take in enhancing the implementation of these innovations?**

HERMES
AIR TRANSPORT ORGANISATION

R24

Enhancing Innovation in Aviation

According to ChatGPT, innovation in aviation can be enhanced, "by fostering creativity, adopting advanced technologies, and promoting collaboration." Strategies to enhance innovation should include:

- Investing in research and development that focuses on cutting-edge technologies, including aircraft design, propulsion systems and fuel efficiency.
- Expanding aircraft capacity through innovations in passenger facilitation and security procedures.
- Collaborating with industry partners to bring diverse expertise together, accelerating the pace of innovation.
- Promoting STEM Education to train the next generation of aviation professionals and innovators.
- Establishing or supporting innovation hubs, incubators, and accelerators dedicated to aviation to bring innovative ideas to fruition.
- Working closely with regulatory bodies to create an environment that supports innovation, including streamlining regulatory processes to facilitate the integration of new technologies and ideas.
- Providing incentives to encourage the development of environmentally friendly aviation solutions, such as electric propulsion, biofuels, and more fuel-efficient aircraft.
- Openly sharing data to facilitate collaborative research and development efforts.
- Providing continuous training and skill development to ensure that the workforce is equipped to implement innovative solutions.
- Organizing challenges and competitions to spur innovation.
- Enhancing government support by establishing national strategies and roadmaps for aviation development.

It is clear (from ChatGPT) that there are many initiatives that can be undertaken to enhance innovation in aviation. With these broad areas of innovation in mind, the Hermes Air Transport Organization asks your organization to consider the following questions:

1. What are the key short term and longer-term innovations that need to take place in the aviation industry?
2. How can these innovations be developed? Specifically, what projects, programs and initiatives should be undertaken to develop these key initiatives?
3. How can these key innovations be funded? How can the capital be generated to fund the development of the innovations?
4. How can these innovations best be implemented? What is the role that your organization can take in enhancing the implementation of these innovations?

HERMES
AIR TRANSPORT ORGANISATION

R24

Your organisation is cordially invited to prepare a position paper on **Enhancing Innovation in Aviation** taking into consideration the foregoing background information.

The position paper should not exceed 3,000 words. Your organisation is requested to email it to

secretariat@hermes.aero by 17:00 CET, **Friday 31st of May 2024**.

All position papers will be thoroughly studied by the members of the 2024 Hermes Report Committee consisting of:

Chairperson
Professor Martin Dresner, Chair, Air Transport Research Society (ATRS)

Members
-Dr Olumuyiwa Benard Aliu. Honorary Member, Hermes - Air Transport Organisation & founder and President of iPADIS
-Angela Gittens, President, Hermes - Air Transport Organisation
-Mario Nemeth, ex Director General of Civil Aviation, Slovakia
-Professor Dr Andreas Papatheodorou, President, Hellenic Aviation Society & Editor-in-Chief, Journal of Air Transport Studies

The Committee will then convene in June 2024 to synthesise the opinions expressed in the various position papers and the conclusions of the 2024 Hermes AGM and produce a unified report, which will be made public.

- END -

HERMES
AIR TRANSPORT ORGANIZATION

INTERVIEW

R24-I/01
30/05/24

ENHANCING INNOVATION IN AVIATION

(Interview with Juan Carlos Salazar, Secretary General, ICAO)

1. What are the key short term and longer-term innovations that need to take place in the aviation industry?

   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.

   When I refer to revolutionary innovation, that may include blended-wing body aircraft, hydrogen powered engines, and new processes that leverage high levels of automation to assist humans in aviation operations.

   However, the paths to near-term and long-term innovations are parallel, using some of the same underlying enablers.

   For example, Artificial Intelligence is a disruptive technology that may help improve the design of a wing in the near term, but in the long term, AI can help develop an entirely new aircraft design.

   Moreover, innovation is key to the international aviation sector's ability to attain its two emissions reductions goals: the long-term global aspirational goal (LTAG) of net-zero carbon emissions by 2050 and the goal of reducing CO2 emissions in international aviation by 5 percent by 2030 through the use of Sustainable Aviation Fuels (SAF), Lower Carbon Aviation Fuels (LCAF) and other aviation cleaner energies, compared to zero cleaner energy use. That second goal was recently adopted at the Third ICAO Conference on Aviation and Alternative Fuels (CAAF/3).

   The series of ICAO Stocktaking events unlocked and showcased many novel technologies and solutions supporting these goals. ICAO is closely working with our aviation industry partners on this innovation and its safe and effective implementation, steadily working to ensure that the new Standards and Recommended Practices are embracing these new technologies so that no country is left behind.

   Please allow me to focus on the particularly pressing need to scale up the development and deployment of SAF.

   As a drop-in fuel option, SAF enables the sector to realise significant life cycle emissions reductions, without changes to existing infrastructure. Crucial innovation includes increasing the existing blend limits, approving new SAF conversion processes, and lowering SAF production costs. The development and commercialization of synthetic SAF, produced using renewable energy, is widely regarded as an important longer-term innovation as we move ahead in the global energy transition.

As far as aircraft technology is concerned, the fleet development of advanced tube and wing and other aircraft concept designs can bring about progressive improvements in carbon intensity.

In the long run, the option of non-drop-in fuels (hydrogen and battery electric) come into play, but they will require major infrastructural changes.

In the area of operations, we are considering both ground and airborne systems and technologies. Measures such as horizontal/vertical flight efficiencies and ground operations efficiencies need to be adopted in the short-term. Others, like formation flying, are largely regarded as longer-term innovations.

Having given some concrete examples here, I would nonetheless like to affirm that the aviation community's focus at this time needs to be on fostering and developing an innovation ecosystem rather than trying to predict the single winning ticket!

2. How can these innovations be developed? Specifically, what projects, programs and initiatives should be undertaken to develop these key initiatives?

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.

The innovation revolution has taken care of much of the “enabling” part. With more and more people having access to computing power, they are able to develop affordable prototypes and access innovation in financial investments mechanisms to crowdfund their ideas.

That is why ICAO has initiatives that are focused on the “engagement” aspect. We have delivered events in multiple formats, from gathering hundreds of people at our innovation fairs to holding dozens of online webinars.

These fora go beyond the traditional attendance at ICAO and reach out to the youth (including through competitions), the non aviation sectors, and they touch on social acceptance and governance issues that are key to making sure we innovate in a responsible manner.

ICAO continuously consults with industry stakeholders, monitoring and promoting their latest developments and innovations. For example, an ASTM task force has been convened to facilitate the evaluation and approvals needed for 100% drop-in SAF. Boeing’s ecoDemonstrator program applies promising technologies in an operational environment, involving projects such as the use of sustainable wall panels in the cargo hold, as well as fuel quality sensors compatible with 100% SAF. Airbus’ ZEROe project aims to bring to market the world’s first hydrogen commercial aircraft by 2035, together with the ecosystem required to support it.

On the topic of specific innovations, I would like to highlight that ICAO has also adopted new methodologies to ensure that regulations do not lag behind and delay their use. This includes the

recent process approved by the Air Navigation Commission on "Direct Submission," which allows for more efficient development of global Standards in some specific instances.

Finally, let me stress that the future of the air transport sector will rely, more than ever, on data-driven policy and decision-making.

In fact, direct access to reliable, accurate and comprehensive data is one of the key components for authorities worldwide to design flexible, scalable and forward-looking national and regional aviation strategies.

ICAO has been embracing data innovations through various projects and collaborations and has also developed advanced dashboards leveraging big data to monitor the evolution of aviation data in the post-COVID-19 pandemic era.

3. How can these key innovations be funded? How can the capital be generated to fund the development of the innovations?

Funding in innovation is contextual. It depends on a variety of factors ranging from the organisational mandates to prioritization of needs, resources and the dynamics of an ever-changing future world.

Funding mechanisms for innovation are diverse and the taxonomy of funding for innovation draws on a variety of motivating factors. These motivating factors range from the intrinsic satisfaction of innovation to the pursuit of economic development.

Thus, one needs to undertake a thorough analysis of the need, the feasibility, the future utility to identify projects that are deemed sustainable and beneficial to stakeholders.

In this regard, ICAO plays an important role in advocacy and outreach.

Following the adoption of LTAG, several ICAO Council high-level dialogues on the challenges and opportunities of aviation decarbonization were held. These dialogues involved financial institutions, banks and investors, and energy companies and aimed to highlight the sector's net-zero ambitions and the role of financing critical to its decarbonization efforts.

Plans are also underway to operationalize the 'ICAO Finvest Hub', which intends to match aviation decarbonization projects with public funding and private investors, including for the scale-up in development and deployment of SAF, LCAF and other aviation cleaner energies.

This can be supported by the ongoing ICAO Assistance, Capacity-Building, and Training for SAF (ACT-SAF) programme, where the implementation of SAF feasibility studies and business implementation reports can lead to the development of SAF project proposals, facilitating financing and investment decisions. As the work in ACT-SAF extends to an ACT-LTAG programme, we also expect implementation support across technological and operational measures.

These are just some of the judicious ways of generating and sustaining interest in the continuous supply of supporting funds for innovation.

4. How can these innovations best be implemented? What is the role that your organization can take in enhancing the implementation of these innovations?

The implementation of innovation is a fully-fledged discipline. The optimum means of innovation implementation is specific to typical requirements.

ICAO is deeply invested in programs that enhance the implementation of innovation in the aviation ecosystem.

As a result of our mandate, ICAO's role covers a wide range of responsibilities as enablers, practitioners and enhancers of innovation implementation in aviation. To fulfil these multiple roles, we undertake a systematic and scientific approach that draws on foresight analysis, an ICAO Secretariat strategy on innovation, and an implementation mechanism.

It should be emphasized that our implementation is open, participative and collaborative. 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.

The aviation industry stands at an inflection point, urgently needing to embrace transformative innovations that will propel it towards unparalleled safety, sustainability, and connectivity. By cultivating an ecosystem that engages diverse minds, harnesses disruptive technologies like AI and sustainable aviation fuels, and aligns stakeholders through investment and supportive regulations, we can catalyze a renaissance - redefining boundaries with revolutionary designs, decarbonizing operations, and embodying a bold vision of environmental stewardship and operational excellence. We must be audacious and turn these concepts into reality, crafting a legacy that will echo through generations.

- - END -

HERMES
AIR TRANSPORT ORGANIZATION

POSITION PAPER

R24-PP/01
30/05/24

Training for the Digital Aviation Ecosystem

(Presented by JAA TO)

HERMES
AIR TRANSPORT ORGANIZATION

INTERVIEW

R24-I/01
30/05/24

1. What are the key short term and longer-term innovations that need to take place in the aviation industry?

   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.

   When I refer to revolutionary innovation, that may include blended-wing body aircraft, hydrogen powered engines, and new processes that leverage high levels of automation to assist humans in aviation operations.

   However, the paths to near-term and long-term innovations are parallel, using some of the same underlying enablers.

   For example, Artificial Intelligence is a disruptive technology that may help improve the design of a wing in the near term, but in the long term, AI can help develop an entirely new aircraft design.

   Moreover, innovation is key to the international aviation sector's ability to attain its two emissions reductions goals: the long-term global aspirational goal (LTAG) of net-zero carbon emissions by 2050 and the goal of reducing CO2 emissions in international aviation by 5 percent by 2030 through the use of Sustainable Aviation Fuels (SAF), Lower Carbon Aviation Fuels (LCAF) and other aviation cleaner energies, compared to zero cleaner energy use. That second goal was recently adopted at the Third ICAO Conference on Aviation and Alternative Fuels (CAAF/3).

   The series of ICAO Stocktaking events unlocked and showcased many novel technologies and solutions supporting these goals. ICAO is closely working with our aviation industry partners on this innovation and its safe and effective implementation, steadily working to ensure that the new Standards and Recommended Practices are embracing these new technologies so that no country is left behind.

   Please allow me to focus on the particularly pressing need to scale up the development and deployment of SAF.

   As a drop-in fuel option, SAF enables the sector to realise significant life cycle emissions reductions, without changes to existing infrastructure. Crucial innovation includes increasing the existing blend limits, approving new SAF conversion processes, and lowering SAF production costs. The development and commercialization of synthetic SAF, produced using renewable energy, is widely regarded as an important longer-term innovation as we move ahead in the global energy transition.

ecosystem, namely at the pharmacy for logistics and accountancy purposes. Flying Forward 20204, a project funded by the European Union (EU), was amongst the first to experiment the connected digital ecosystem in relation to (unmanned) medical transport.

But of course, while these developments may benefit society and generate jobs for young aviation professionals; nevertheless, aviation's top priority remains safety, without which societal acceptance would be jeopardised.

Consequently, innovators need to find solutions to the following issue: how can the community govern such innovation without detriment to safety?

Firstly, minimising the risk of security breaches remains paramount, as security incidents may soon result in an aviation safety occurrence. Taking the appropriate measures is clearly stated by Articles 4 and 88 of the EU Regulation 2018/1139 establishing the European Union Aviation Safety Agency (EASA). These 'safety evolutions' are clearly depicted in a graph from the 4th edition of the ICAO Safety Management Manual5 (Doc 9859), reproduced in Figure 1.

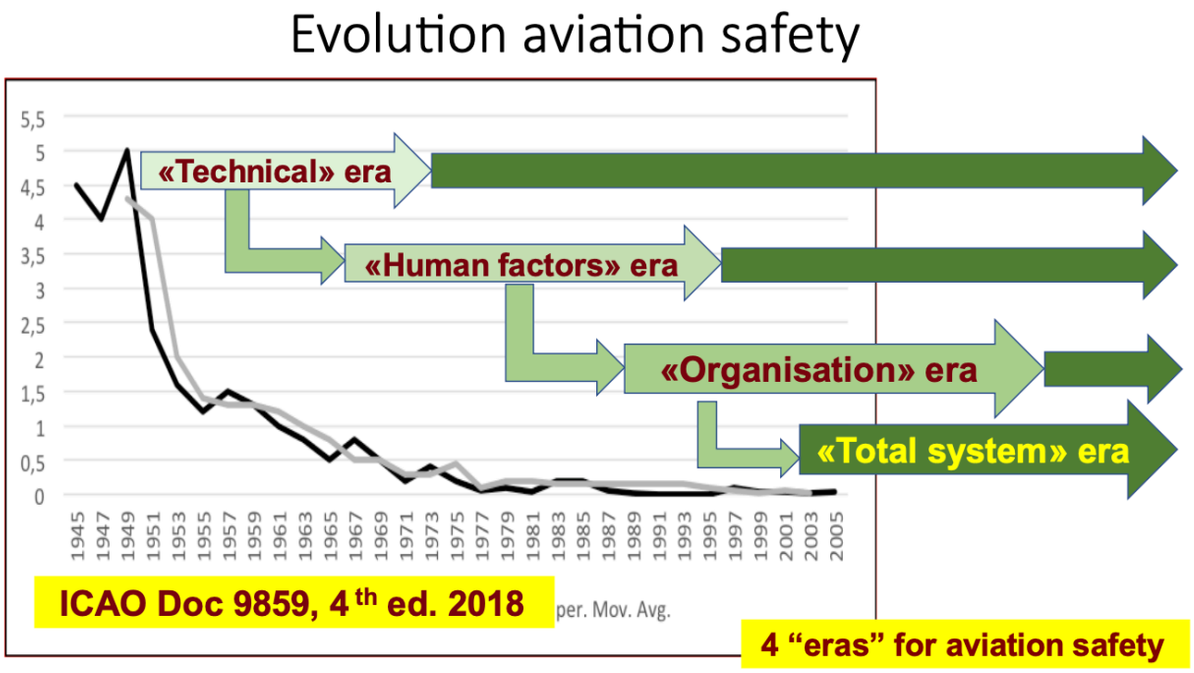

Figure 1. Source: Filippo Tomasello/private

In Doc 9859, ICAO expresses that building safety (and security) requires safe design, production and maintainance of equipment, from the drone's airworthiness to its Command Unit (CU; the station from which the Remote Pilot controls the flight), including any other training and necessary equipment (e.g. the vertiport, the command and control (C2) data link, etc.)5 Secondly, next to the 'technical safety', the aviation sector needs to minimise the probability of human errors stressing the importance of paying attention to training and qualification for UAS

Pilot Licences (UPL) and related UAS Flight Instructors (UFI), Examiners (UFE) and UAS Training
Organisations (UTO). Needless to say, that training and qualification should cover also other personnel involved in UAS operations, such as Observers, Fleet Managers and so on. As part of the qualification process, medical and mental fitness of the crews should also be tested and ensured. Finally, the Human Machine Interface (HMI) shall be appropriately designed and validated to minimise the probability of inadvertent human error.

While the above considerations feature both, the human and the system, but in independence from other humans, it is equally important to consider the organisational perspective. Through the tragic 1977 Tenerife airport disaster, aviation has learned that modern humans work in teams whose communication, culture, climate and procedures may also influence safety and human factor parameters when studying it from an inside-out organisational perspective. As result, ICAO expands beyond the system and human factor era to highlight the new frontier of safety oversight which includes also “organisations” (see Figure 1). For the purpose of this argument, safety measures on organisational level, meaning the UAS ‘Operator’ (i.e. the entity or commercial company employing the RPs and other personnel), is paramount.

Would this be sufficient to ensure safety and security of the digital ecosystem?

Definitely not. In fact, in the digital ecosystem, organisations continuously exchange real-time, digital data/communication (also in-flight), so the timeliness, integrity and availability of such data shall be ensured as well. ICAO concludes this as the ‘total system’ of aviation safety, already mentioned in Figure 1. To ensure sufficient Quality of Service (QoS) for the digital exchanges of data, three different sets of rules and related voluntary industry standards are required:
• Minimum Operational Performance Standards for each service (e.g. quality of data for UAS Geoawareness in EUROCAE ED-318) and related aircraft functions (e.g. EN 4709-003).
• Interoperability standards to reliably exchange data in a format comprehensible to both piers (e.g. emerging EUROCAE standard on Network Information Service, NIS); and
• Organisation of the service provider (e.g. ISO 23629-12 on UTM service providers).
In conclusion, ensuring safety and security of UAS operations requires much more than technical specifications to design the system.

3. Implementing Innovation

To develop, deploy and apply non-military drones for applications beneficial to society, we need four key enablers:
a) Developed, mature and available technologies on the market for UAS, UTM and Advanced (alias Innovative) Air Mobility (A/IAM) including but not limited to the aircraft;
b) A comprehensive set of rules protecting society on one side, giving certainty to investors on the regulatory processes, the achievable approvals and associated privileges and accountabilities on the other side;
c) Related voluntary industry standards supporting the rules as Means of Compliance (MoC); and
d) Capacity-building including training and certification of aviation professional and therefore related instructors and examiners, but also inspectors in the Civil Aviation Authorities (CAAs) able to identify, understand, consult and apply the relevant rules and industry standards.6

For initial development of technology innovations public funding is indeed an asset. That is why, the European Commission (EC) has funded almost 800 research projects7 in the mobility sector, several of which dealing with digital technologies for various modes of transportation and several specifically aiming at development of technologies and services for non-military drone applications.

After initial spin-off, which public funding significantly contributes to, the market should take over promoting clear rules for end-users to fly drones without disproportionate administrative burden. Market- and product-driven competition among manufacturers should open up the widest possible level playing field to further promote innovation implementation.

For small UA, typically encompassing airframes with a total maximum take-off mass (MTOM) not above 25 kg, the EU has opened the way for a global market entry. Consequently, the market autonomously produces ever-frequent innovations because the customer base is now sufficiently wide for industry to invest part of its income in new developments. A good illustration on the successful implementation on EU level is the purchase and operation of a very small drone of less than 250 grams. In this case in fact, by lowering the administrative barriers the involved person may only need to register and, without any mandatory training and without any additional approval, s/he may start flying, based on the limitations and conditions in European Commission Regulation (EU) 2019/947.

Furthermore, manufacturers from all over the world, complying with the rules in EU Regulation 2019/945 can put their products on the EU market, accompanied by a Declaration of Conformity, CE mark and class label based on series 4709 of European Norms (EN) developed by CEN. Several of such Declarations are already available8.

However, to fly drones Beyond Visual Line-of-Sight (BVLOS) we still need to develop vertiports9 and UTM services10. Additional EC funding initiatives should hence be undertaken to continue developing these key aspects aiming at creating the proper digital ecosystem around the operation of a drone.

In addition to technology, mentioned EU Regulations 945 and 947 of 2019 provide a comprehensive regulatory framework, still absent in several other States outside the EU, offering certainty to investors who are deciding to develop a technology or to establish a company that commercially operates drones – which will offer even more societal benefits and could generate sustainable job growth. To this argument, comprehensive regulatory frameworks provide a societal and economic anchor to innovation and technology implementation on State level. These rules are already backed by several industry standards developed e.g. by ISO, by ASTM, by CEN, by EUROCAE and by other Standard Development Organisations (SDOs). This work is however far from being completed and therefore, EU calls for tenders for newly funded projects should include the requirements to link research, demonstrations and development with inputs for the SDOs.

Finally, capacity-building for aviation professionals, including but not limited to Remote Pilots and inspectors in the CAAs, should accompany all developments highlighted in this paragraph. For this purpose, EC/EASA are committed through several Aviation Partnership Projects (APP)11 In its comprehensive approach to UAS training activities, JAA TO has contributed to several of such Projects in relation to UAS/UTM/IAM e.g. in Central and Southern America, Zambia and

South Asia.

4. Avoiding Pitfalls in the Financial Business Plan

A big limit of European funded projects is that historically, EU financial support was capped at the Technology Readiness Level (TRL) 7 which encompasses demonstrations in an operational environment through systems at, or near scale of the operational system with most functions available. However, at TRL 7 limited documentation is available. For instance, necessary industry standards may not be mature, manuals may not be ready, and personnel may not have been trained appropriately to use the new system. In fact, these aspects are completed at subsequent step TRL 8, which completes validation and verification providing most user, training and maintenance documentation as necessary for actual implementation. Finally, TRL 9 implements the innovation in the operational environment, and leads to accruing concrete experience on the operational use gaining confidence in the market implementation/launch. However, in the EU, TRL 8 and 9 are left to individual EU Member States or to private investors. This may often result in gaps between achieved TRL 7 objectives (or limits) and actual implementation. This evident funding mechanism disconnect oftentimes turns the results of EU funded projects into a series of mere reports doomed to dust on the shelf, without any investor actually committing to implementation.

Some projects, to which EuroUSC Italia12 has contributed, strove to turn results into standards, such as ICARUS13 which initially developed the Vertical Conversion Service (VCS), and is now included in ISO 23629-12; CERTIFLIGHT14 which developed the Authenticated Tracking services is now mentioned in ISO 23629-9; and Flying Forward 202015 further defines the role of the Fleet Manager. Such new job profile is already necessary to prepare the UAS mission of today but it will remain essential for all UAS missions in the future when fully autonomous operations would no longer require a RP. The ideas developed by this latter project are now being embedded in subsequent editions of ISO 21384-3 on UAS operations and ISO 23665 on training of UAS personnel.

In addition to the abovementioned TRL discrepancy, one common investment pitfall yet still remains and addresses the defiance of not including costs and efforts for regulatory compliance in respective business plans. This early negligence may later result in costly corrective actions or unfeasibility due to poor documentation in a product launching process that is compliance dependent. Therefore, it is strongly recommended to include such costs and activities in new projects from the beginning, pathing the smoothest way towards the shortest possible time-to-market.

5. Training for the Digital Aviation Ecosystem

EuroUSC Italia supports the aviation industry for participation to EU-funded projects, in relation to safety evaluations and regulatory compliance. In addition it supports the industry in preparing the documentation and obtaining any approval in the aviation sector and in particular for non-military applications of drones. These Subject-Matter-Expert environments facilitate the knowledge transfer and implementation process of innovations to the objective of a safe and sustainable digital ecosystem. Further, regulatory compliance, education, hands-on experience and know-how is mediated through proper UAS training, capacity-building and the correct reference materials and standards ensuring that regulatory frameworks and training activity evolve in tandem with technological advancements. 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. For instance, specialised training in drone technology, AI-driven air traffic management, and more can prepare the workforce to handle new developments confidently. Engaging in continuous dialogue and feedback loops between innovators and regulators, along with robust training initiatives, ensures that innovation is implemented safely and efficiently, ultimately leading to a more dynamic and forward-thinking aviation industry.

6. Conclusion

To summarise the transformative potential of digital technologies in aviation, particularly focusing on the integration of drones and the associated challenges of cybersecurity and system resilience, the concept of a digital ecosystem, where various actors continuously exchange data, is central to this transformation. Today, drones spearhead the third industrial revolution in aviation by primarily handling digital information rather than physical goods. EU funding has been crucial in developing these technologies, but further efforts are needed to promote market-driven competition and lower administrative barriers for drone operations. Safety remains a top priority, necessitating robust solutions to security risks and human error. ICAO's Safety Management Manual emphasizes the importance of safe design, production, and maintenance of equipment, as well as comprehensive training and qualification for UAS operators and related personnel/organisations manifesting the ‘total system’ era of today’s aviation safety culture and operationalisation.

To support innovation, remind us of the four key enablers: mature technologies, comprehensive regulations, voluntary industry standards, and capacity-building through training and certification which can significantly enhance the mastery of the digital aviation world by fostering a culture of continuous learning and adaptability. Implementing modular and scenario-based training programs can simulate real-world challenges, equipping professionals with practical skills to handle emerging technologies. Additionally, integrating AI and virtual reality into training modules can provide immersive and interactive learning experiences, making complex concepts more accessible and engaging.

By emphasising cross-disciplinary training, aviation professionals can develop a broader understanding of interconnected systems, promoting a holistic approach to safety and innovation. Ultimately, a robust and dynamic training framework can ensure that the workforce remains agile and proficient, ready to navigate the complexities of the digital aviation ecosystem.

- END -

1 Faculty Manager at JAA TO and CEO EuroUSC Italia ltd
2 Faculty Manager at JAA TO and Senior Partner at EuroUSC Italia ltd
3 The term vertiport is defined in ISO 21384-4:2020 https://www.iso.org/standard/76785.html?browse=tc
4 https://www.ff2020.eu/
5 https://www.icao.int/SAM/Documents/2017-SSP-GUY/Doc%209859%20SMM%20Third%20edition%20en.pdf
6 https://jaato.com/uas-diploma/
7 https://cordis.europa.eu/search?q=(%2Farticle%2Frelations%2Fcategories%2Fcollection%2Fcode%3D%27resultsPack%27%2C%27projectsInfoPack%27%2C%27brief%27%2C%27news%27%2C%27video%27)%20AND%20(%2Farticle%2Frelations%2Fcategories%2FapplicationDomain%2Fcode%3D%27trans%27)%20AND%20language%3D%27en%27&p=1&num=10&srt=/article/contentUpdateDate:decreasing

8 https://www.easa.europa.eu/en/domains/civil-drones-rpas/open-category-civil-drones
9 https://www.iso.org/standard/80606.html?browse=tc
10 https://www.iso.org/standard/78962.html?browse=tc
11 https://www.easa.europa.eu/en/domains/international-cooperation/technical-cooperation-projects
12 https://www.eurousc-italia.it/en/
13 https://cordis.europa.eu/article/id/429191-helping-aviation-embrace-data-driven-innovation
14 https://certiflight.info/
15 https://cordis.europa.eu/project/id/101006828

HERMES
AIR TRANSPORT ORGANIZATION

POSITION PAPER

R24-PP/02
01/06/24

Enhancing innovation in aviation

(Presented by ERA)

HERMES AIR TRANSPORT ORGANIZATION

POSITION PAPER

R24-PP/02
01/06/24

Introduction

The European Regions Airline Association (ERA) is a trade body that represents over 55 airlines, and over 170 associate members, including manufacturers, airports, suppliers and aviation service providers across the entire spectrum of the aviation industry.

Our members' commitment to providing essential connectivity, bridging gaps between regions and providing air services to destinations that might otherwise be underserved or inaccessible, ensures that European citizens and goods can travel efficiently, safely and sustainably. They contribute significantly to local economies by facilitating tourism, business travel and trade, stimulating growth and creating jobs and are a key enabler to fostering regional economic development.

Our sector's commitment to sustainability will see it be the first to adopt new propulsion technologies which are expected to provide up to one third of the decarbonisation required to reach net zero as laid out by the industry's Destination 2050 roadmap.

Alongside these new propulsion technologies, we are entering a new technological age, with the deployment of disruptive digital technologies and services, underpinned by the likes of Artificial Intelligence (AI) and Large Language Models (LLM), which will become more prevalent and will soon touch on all areas of the industry whether that be operational, commercial or from a safety perspective.

Against that backdrop, ERA is delighted to be given the opportunity to provide the Hermes Air Transport Organisation with our views on enhancing innovation in aviation. This short paper will address the following areas:
- new propulsion technologies;
- AI and LLM;
- cybersecurity;
- Urban and Regional Air Mobility (UAM/RAM);
- development strategies;
- funding mechanisms; and
- pathways to implementation.

New propulsion technologies

As noted above, the regional sector will be the first to deploy electric, hybrid and hydrogen-powered aircraft, with commercial roadmaps and studies clearly demonstrating that zero-emission technologies will be implemented first in smaller regional aircraft.

Reflecting this, ERA's manufacturer members have grown substantially over the last two years, with ten 'new entrant' OEMs now among our membership. AURA AERO, Heart Aerospace and ZeroAvia were elected to the ERA board, helping to shape the strategic direction of the association.

These new entrants into the OEM arena will complement the legacy of regional manufacturers by delivering new aircraft that will substantially reduce emissions, deliver lower operating costs and quieter operations, and play a vital part in delivering ERA's commitment to net zero as laid out in the Destination 2050 initiative.

Improvements in aircraft and engine technology will reduce CO2 emissions by 37 per cent in 2050, and as traffic fully recovers from the impact of COVID-19, the share of upcoming aircraft is expected to increase.

The different propulsion technologies can be summarised as follows:
- Hybrid–electric turboprop aircraft combining kerosene or Sustainable Aviation Fuel (SAF) with energy storage in batteries, for example the ATR EVO, are expected to enter service in 2035 and aim to reduce CO2 emissions by 50 per cent compared to 2020 (without SAF benefits).
- Hybrid–electric aircraft using electric propulsion, such as those designed by Heart Aerospace, AURA AERO and Maeve Aerospace, estimate reducing CO2 emissions by 99 per cent compared to upcoming aircraft and will enter into service from 2030.
- Hydrogen fuel cell powerplants for regional aircraft, for example as produced by ZeroAvia and Universal Hydrogen, will see CO2 emissions reduced by 100 per cent with an energy efficiency improvement of 30 per cent compared to the average fleet in the regional class in 2030, with initial entry into service expected from 2026.

Over the next decade, these innovative technologies will enter service, providing regional aviation with a platform to become the first market sector to meet net zero emission targets, however significant investment in infrastructure will be required, particularly at airports where clean energy demands and hydrogen liquefication facilities are needed.

AI and LLM

AI's influence on regional aviation is evolving quickly. Digital tools and platforms can significantly enhance operational efficiency and customer experience. Implementing AI-driven analytics, cloud computing and Internet of Things (IoT) technologies can optimise flight operations, maintenance schedules and passenger services with digital transformation facilitating data-driven decision making and real-time monitoring.
- AI and LLM algorithms analyse vast amounts of data, including weather patterns, air traffic and historical flight data and can recommend the most efficient routes both for the airspace user, but also for Air Navigation Service Providers (ANSP). This can deliver fuel management and environmental benefits for the airline and capacity improvements for the ANSP.
- AI-driven predictive maintenance systems can monitor aircraft health in real time. By analysing data from sensors embedded in various aircraft components, AI can predict potential failures before they occur. This proactive approach reduces downtime, enhances safety and lowers maintenance costs.
- AI-powered chatbots and virtual assistants improve customer service by providing instant responses to enquiries, managing bookings and offering personalised travel recommendations. AI can also analyse customer feedback and preferences to tailor services and improve satisfaction.

The sheer speed of AI development means that regulation has had to catch up quickly. The EU AI Act, passed in March this year, has adopted a risk-based approach, one that is generally supported by ERA. However, with regional aviation reliant on a global supply chain which will also be impacted by the deployment of AI, there are already concerns that potential different regulatory approaches by states outside the EU will lead to significant complexity in the management of information security risks.

Cybersecurity

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 organisations but also pose risks to safety.

As the European regulator for aviation safety, the European Union Aviation Safety Agency (EASA) has developed the Part IS regulation to address information management security threats and vulnerabilities faced by aviation organisations. It requires aviation organisations in Europe to identify and manage information security risks and the data used for civil aviation purposes. It requires affected stakeholders to detect information security events, classify them accordingly, and respond to, and recover from, incidents based on their impact on aviation safety.

Developing effective regulation is of course challenging due to this constantly changing landscape, therefore it essential to create rules that can adapt to different types of organisations and emerging threats and that are flexible and adaptable to meet the diverse needs of aviation, allowing organisations to tailor their approaches.

Whilst the Part IS provides a proactive and flexible approach, allowing organisations to manage information security risks effectively while maintaining aviation safety, ERA along with other aviation associations has highlighted to the European Commission (EC) that harmonisation of different cybersecurity workstreams in the EU is required to avoid duplication and creating additional complexity in an already complex environment.

We therefore support the subsequent work being carried out by an EC-led aviation security expert subgroup tasked with mitigating any duplication, conflict of requirements and ensuring alignment of requirements.

EUROCONTROL, through the work of the European Air Traffic Management Computer Emergency Response Team (EATM-CERT), helps stakeholders protect against cyber threats, and their efforts are also supported by ERA.

ERA considers cybersecurity a priority safety topic, with the subject being a standing agenda item for our Operations and Air Safety Groups. ERA will hold a separate workshop on cybersecurity and AI at our upcoming General Assembly in Seville in October.

Urban and Regional Air Mobility

When we consider innovative technologies, Urban (UAM) and Regional Air Mobility (RAM) have been at the forefront of recent research and development activities.

Electric vertical take-off and landing (eVTOL) aircraft, represent a significant leap in aviation design and propulsion systems. These technologies can reduce local noise pollution and emissions and provide greater flexibility in terms of landing and take-off sites.

Like the deployment of new propulsion technology, implementing UAM and RAM requires new

infrastructure, as well as integration into the current airspace including the development of vertiports and deployment of new and advanced air traffic management systems.

The rise of UAM and RAM has significant implications for regional airlines. With companies exploring on- demand air taxi services, which can potentially offer faster, more efficient travel options in congested urban areas, these new models create opportunities for investment and partnerships, further stimulating economic activity and innovation within the aviation sector.

Regional airlines are likely to face increased competition from UAM services, particularly for ultra short-haul routes. As air taxis and eVTOL aircraft become more prevalent, they could capture a share of the market traditionally served by regional airlines. It is therefore likely that this competition will compel some regional airlines to innovate and enhance their service offerings, raising the possibility of strategic partnerships with UAM and RAM operators.

It is foreseen that UAM and RAM could serve as feeders to regional airline hubs, improving connectivity and reducing travel times for passengers. Therefore, through integrating UAM services, regional airlines could offer seamless, multimodal travel experiences, enhancing overall passenger 'door to door' experience and potentially increasing demand for regional services.

Development strategies

Collaboration is essential if we are to unleash the potential of these new innovative technologies with further government support, closer industry collaboration and additional investment in research, development and deployment.

Governments should create favourable policies and provide funding for research and development in aviation. Grants, tax incentives and public–private partnerships (PPP) can all encourage innovation development.

The SESAR Joint Undertaking is a good example of a PPP that plays a pivotal role in modernising European air traffic management through technological innovation and a collaborative approach. With several projects addressing AI, UAM, trajectory-based operations, non-CO2 effects and mitigations, to name a few, the innovations driven by SESAR can help regional airlines better navigate the complexities of European airspace, improve their service offerings and contribute to a more efficient and sustainable aviation industry.

In the context of new propulsion technologies, stronger strategic governance at EU level is needed to support key industry roadmaps to achieve net zero. The EU has currently two alliances dealing with aviation sustainability, led by two different EC Director Generals. The first covers Net Zero Emission Aircraft (AZEA) and the second, known as the Renewable and Low-Carbon Fuels Value Chain Industrial Alliance (RLCF), covers SAF. Both state the need for a pipeline of projects and matchmaking between actors and investors. However, they are not equal in their achievements, do not benefit from the same level of resources, nor do they share their best practices.

However, the scope of these alliances is important to bring together all sides of sustainability. The current Commissioner for Climate Action has called for an aviation pact, involving services of the EC and industry representatives, to enable the necessary policies to fulfil industry commitments. ERA supports this call and would urge for the next mandate to set up such a governance framework.

Regulatory safety bodies need to adapt quickly to the evolving technological landscape to ensure safety standards are maintained. It is important that both industry and regulators are in close collaboration with each other. Innovation development means that the sharing of knowledge and resources will be vital with industry supporting the regulators to help establish standards and best practices.

Innovation also requires a platform for investing in education and training programs. With a skills shortage existing in the aviation sector today and to prepare the workforce for the aviation world of tomorrow, universities and training institutes will need to offer specialised programmes in these disruptive technologies.

By supporting innovation development through funding, collaboration and education, the aviation industry will be able to harness the full potential of these technologies ensuring a safer, more efficient, sustainable and customer-centric future for regional aviation.

Funding mechanisms

At a holistic level, the European Union offers several funding programmes aimed at fostering innovation in the aviation sector. Programmes like Horizon Europe, the EU's key funding programme for research and innovation, provide substantial grants to projects that advance sustainable and competitive aviation technologies. Additionally, the European Green Deal, which aims to make Europe climate neutral by 2050, offers funding opportunities for green innovations in aviation.

As previously noted, PPP, venture capital and private equity all have a role to play, especially in startups and companies developing disruptive technologies demonstrating the potential for significant returns on investment through innovative business models, technologies or services.

Traditional bank loans and financial instruments, such as bonds, remain viable options for funding innovation. Financial institutions may offer favourable terms to airlines with robust business plans focused on innovation and sustainability. Additionally, the European Investment Bank (EIB) should engage more closely with the aviation sector and provide loans and guarantees for projects that align with EU aviation sustainability policy objectives.\

National governments across Europe should provide subsidies and tax incentives to encourage innovation in the aviation sector. This financial support should reduce the risk associated with investing in new technologies and promote sustainable practices.

Looking more closely at new propulsion technology, innovation in electric and hybrid aircraft presents a significant opportunity for regional airlines to reduce operating costs and emissions with various EU funds currently available for new aircraft manufacturers or SAF producers to scale up, like the EIC Accelerator or the Innovation Fund. However, there is concern that they do not always have the right scope and the application process is very complex. More importantly, they do not always combine strategically with national funding opportunities to create the maximum effect for beneficiaries. In the private sector, investing in aviation technology today is unclear and many actors are reluctant to invest in the right place. For example, investments in eVTOLs are approximately seven times higher than in SAFs, yet still not a single eVTOL has been fully certified. More involvement of actors like the EIB is needed and ERA would support setting up an

order-backing system and an investor guide to give more certainty and confidence to private investors.

Pathways to implementation

With regards to new aircraft technologies, we must provide a way of preparing the ecosystem for regional aircraft, including new technologies and best-in-class aircraft. The Public Service Obligation (PSO) scheme is a very strong incentive towards new aircraft and needs to be strengthened as well as being continuously improved by the industry, Member States and the EC working together.

Associated with such a scheme, a revision of the Alternative Fuels Infrastructure Regulation (AFIR), dating from 2017, is needed to cover infrastructure deployment for electric charging stations adapted to high-voltage aircraft, such as hybrids or battery–electric propulsion.

Airport and en-route charges must be adapted to support potentially heavier but cleaner aircraft, where cleaner aircraft will always be more economically viable than current aircraft.

At the same time, SAFs need to fit within regional airlines' transition plans together with fleet renewal, therefore adequate supporting systems such as a Book and Claim are required.

More generally, we believe that collaboration with technology providers, research institutions and other airlines is crucial for successful innovation. Partnerships can provide access to technologies, shared expertise and funding opportunities. Participating in consortiums like the SESAR Joint Undertaking can help regional airlines stay at the forefront of air traffic management innovations.

Implementing pilot programmes allows stakeholders to test new technologies and processes on a smaller scale before full deployment. Prototyping helps identify potential issues and refine innovations to better meet operational needs. Successful pilots can provide proof of concept and justify further investments.

Once pilot programmes demonstrate viability, upscaling and integrating these innovations into operations is the final step to implementation. Once again, access to funding is vital through grants, venture capital, PPP and government subsidies.

Adopting sustainable practices not only addresses regulatory and environmental pressures but also attracts environmentally conscious passengers. Investments in SAFs, electric and hybrid aircraft and carbon offset programmes are key levers for enhancing sustainability. This can also open potential new funding opportunities from green investment funds.

Conclusion

Enhancing innovation in European regional aviation requires a holistic approach. By embracing short and long-term innovations, fostering collaboration, securing funding and implementing strategies effectively, Europe can lead the way toward cleaner, more efficient and connected skies.

It requires a strategic and well-co-ordinated approach that involves setting clear goals, fostering

collaborations and testing new ideas through pilot programmes. By leveraging funding instruments, investing in R&D, engaging with regulators and developing talent, the regional sector can take advantage of these emerging technologies.

Utilising digital transformation, customer-centric innovations and advanced air traffic management will further drive efficiency, competitiveness and sustainability, helping regional airlines adapt to the new operating landscape and thrive in the future.

- END -

HERMES
AIR TRANSPORT ORGANIZATION

POSITION PAPER

R24-PP/03
05/06/24

Enhancing Innovation in Aviation

(Presented by IFATSEA)

HERMES AIR TRANSPORT ORGANIZATION

POSITION PAPER

R24-PP/03
05/06/24

Innovation in the aviation industry

The aviation industry is undergoing a rapid transformation, driven by technological advances, environmental concerns, and changing customer expectations. Throughout this digital transition, innovation and creativity are essential for engineering professionals such as Air Traffic Safety Electronics Personnel (ATSEP) to adapt to these transitions and seize new opportunities. Be it the emergence of newer technologies, changing the sector from being a closed to a more open network, necessitated by the emergence of the fourth industrial revolution and related technological evolutions, or the erosion of the legacy systems' useful lifespan. The transition and navigating through this complex and dynamic ecosystem require a unique approach to ensure the relevance and sustainability of the industry. To navigate all these turbulences, innovation remains integral to any sector or organisation's existence, relevance and competitiveness in a dynamic market accelerated predominantly by efficient and agile human-centred innovative ideas, responsive processes and evolving technology.

The aviation industry is not immune to the competitive world; therefore, innovation remains a catalyst for aviation's contribution **towards better safety performance and ensuring safety**, **efficiency, and passenger experience**. Enhancing safety, through the development and implementation of innovative solutions in aviation has led and will continue to derive significant advancements in safety performance.

From the perspective of ATSEP, who are involved in the installation, operation and maintenance of communication, navigation and surveillance /air traffic management (CNS/ATM) systems, are shared understanding of their role and contribution, through the provision of innovative solutions and enhancing system performance to support globally interoperable systems and achieve the optimum capacity within acceptable safety limits.

The continued research, developing technology specifications and implementation of advanced and evolving Communication, Navigation and Surveillance (CNS) systems, only represent the ATSEP's commitment to ensuring safety for the flying public. For instance, the introduction of automation, blockchain, artificial intelligence and other evolving technologies has a great potential to reduce the risk of human error, ensuring safer flights for passengers and crew.

Innovation has revolutionized the efficiency of aviation operations. Air Navigation Service Providers (ANSP) or Airport Authorities and Civil Aviation Authorities (CAA), who are the dominant employers of engineering professionals, continue to seek efficient ways to optimise the system's corrective and preventative maintenance philosophies, reducing inefficiencies in system support, and streamline maintenance processes. For example, through the emergence of newer technologies, the use of data analytics and predictive maintenance allows ANSPs or CAAs, with ATSEP contribution, to proactively identify and address potential common system failure points and address potential issues, minimising the prolonged system outages and improve the overall operational efficiency.

Key initiatives earmarked for projects and programme development through innovation

The aviation industry, like any other industry, should be ceased with the realities of environmental impacts, social realities, governance safety, security, digital transformation, and finding innovative approaches to deliver and implement projects and programme development by infusing innovation and sustainability..

Training institutions, which remain the knowledge hubs, should continue to aid this sector in achieving its goals and developing innovative solutions. For example, the aviation industry

contributes to about 2% of global CO2 emissions and is expected to grow significantly in the future. From the environmental impact point of view, this data presents a serious threat to the environment and the climate and requires the industry to adopt more sustainable practices and technologies.

Some of the solutions that are being explored include using biofuels, electric aircraft, hydrogen-powered aircraft, and carbon offsetting schemes. However, these solutions also face technical, economic, and regulatory barriers that need to be overcome. ATSEPs often travel longer distances to respond to system failures and make use of cars that are burning fuel and contributing to air pollution. The new technologies should be embraced as they contribute to less travelling and enable predictive maintenance and remote maintenance capabilities. Alternative sources of energy are also some of the evolving technologies that should be incorporated into project and programme development to reduce environmental impact and promote cleaner energy.

Innovative implementation plans within the ATSEP fraternity.

Technology is a powerful driver of innovation and creativity in any field, and aviation is no exception. Leveraging technology for innovation in **aviation training** means using the latest tools and methods to enhance the learning experience, improve the skills and competencies of aviation professionals, and foster a culture of innovation and collaboration in the industry. Like any other industry or sector, the 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.

By promoting a culture of collaboration, aviation professionals can come together to share their expertise, insights, and experiences, leading to the development of groundbreaking ideas and solutions. Moreover, the ATSEP are requested to service the current legacy or state-of-the-art CNS/ATM technologies and at the same time train and prepare for the deployment of new innovative technologies globally.

More specifically one of the key challenges in the aviation industry is to keep up with the rapid changes and innovations that are constantly emerging. To ensure that ATSEP professionals are equipped with the skills and knowledge to adapt to these changes, it is essential to implement effective training programs focused on equipping aviation professionals, particularly ATSEPs, as certifiers of air safety, with necessary interventions to foster innovation and creativity.

For example, Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR) to simulate realistic scenarios and environments for innovation are some of the implementable actions to find effective and efficient solutions to preventative and corrective maintenance philosophies. Simulation and VR are widely used in aviation training to provide realistic and immersive scenarios that mimic the real-world conditions and challenges that aviation professionals face. Simulation and even VR help engineering professionals such as ATSEPs to develop their technical, operational, and decision-making skills and their situational awareness, teamwork, and communication abilities.

Another implementable plan within the ATSEPs fraternity is embracing Artificial intelligence (AI) and Machine Learning (ML). AI and ML are technologies that enable machines to perform tasks that normally require human intelligence, such as learning, reasoning, and problem-solving. AI and ML can be used to enhance the quality and efficiency of aviation training, by providing personalised and adaptive learning paths, intelligent tutoring systems, and data-driven insights. They can also aid educators and trainees to access and analyse large amounts of information and generate new knowledge and solutions. For example, AI and ML can help pilots learn from their own and others'

flight data, air traffic controllers optimise their workload and routing strategies, and ATSEPs diagnose and repair complex systems, all with the help of smart algorithms and models.

However, the 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. ATSEP are the first responders in this challenge and can benefit from innovative solutions like the ATSEP Working Position with Cybersecurity tools to tactically address cyberattacks.

Conclusion

Digital transformation creates new opportunities and challenges for the industry and requires the industry to adapt and innovate accordingly. The industry needs to leverage the potential of digital technologies, such as cloud computing, the Internet of Things (IoT), augmented reality, and 5G and integrate them into its processes and operations. Some of the benefits of digital transformation include increased efficiency, productivity, profitability, and innovation.

ATSEPs are expected to keep evolving and innovative to keep pace with the changing environment and service provision demands. The industry needs to foster a culture of innovation and creativity. It further needs to encourage and support ATSEPs and other aviation professionals to contribute innovative solutions to remain competitive and responsive to emerging safety and security concerns, particularly in cyber threats and security. IFATSEA being the voice of ATSEP is committed to providing ideas to international organizations such as ICAO, SESAR, NextGen, HERMES and CANSO.

In the future of aviation, digital transformation will revolutionize the industry through advanced technological advancements. As we have already stepped into this new era, the industry should expect a myriad of opportunities and possibilities. With the integration of artificial intelligence, IoT connectivity, and big data analytics, the aviation industry will continue to witness improved efficiency, personalized services, and enhanced safety measures. These advancements will continue to reshape the way we fly, and maintain our technologies, making air travel more seamless, secure, and enjoyable. Get ready to soar to new heights with the prospects of digital transformation in aviation.

- END -

References

https://aerospace.honeywell.com/us/en/about-us/blogs/five-aviation-technologies-making-flight-safer-than-everE

https://www.icao.int/Meetings/a41/Documents/WP/wp_481_en.pdf

https://www.linkedin.com/pulse/how-embrace-innovation-technology-advancements-aviation-itsali-/

https://fastercapital.com/content/Aviation-Innovation-Training-Services--How-to-Foster-Innovation-and-Creativity-in-Aviation.html#The-Importance-of-Innovation-in-Aviation

https://medium.com/@JacobsEdo/transforming-aviation-the-impact-of-digital-innovation-a76363dcb71b

HERMES
AIR TRANSPORT ORGANIZATION

POSITION PAPER

R24-PP/04
26/06/24

ENHANCING INNOVATION IN AVIATION: A LABOUR PERSPECTIVE

(Presented by ITF)

HERMES
AIR TRANSPORT ORGANIZATION

POSITION PAPER

R24-PP/04
26/06/24

INTRODUCTION

In the aviation industry, innovation needs extend beyond mere technological advancements; they encompass a holistic transformation of the industry. The International Transport Workers' Federation (ITF) emphasizes the importance of redefining innovation to include systemic reforms that prioritise economic, social and environmental sustainability. The current industry model is heavily fragmented with a complex web of independent service companies, contractors and sub-contractors engaging in discrete services that together form the aviation service chain. While discrete, these heavily interdependent services are necessary for the safe operation of air services. Unfortunately, this heavy fragmentation with little regulation (especially on the ground) and intense competition between airlines, airports and aviation service providers has created an industry characterised by economic fragility, contract flipping, demand/ supply challenges and low incentivisation for long- term innovation, especially in aviation services.

The "A New Deal for Aviation," proposed by the ITF, serves as a comprehensive framework that identifies the core issues within the industry and offers a framework to create a socially, economically and environmentally sustainable industry.
At its core the ITF recommends social dialogue, with collective bargaining at its heart, to be embedded into the processes of innovation- from systemic innovation to technological innovation. This human- centred approach facilitates the continuity, stability and overall sustainability of the industry.1

SYSTEM INNOVATION

Structural changes in aviation in terms of ownership, operation and business models, characterized by extensive deregulation, have demonstrably weakened the industry's resilience. Privatisation has fragmented the service chain, leading to inconsistencies in service quality and safety standards. Additionally, it has contributed to a decline in wages and working conditions, resulting in poor labour standards and consequent staffing shortages across various sectors within the industry.

The ITF recommends the establishment of national tripartite aviation bodies, including employers, regulators and union representatives from across the aviation service chain. Similar bodies should also be established or strengthened at global and regional bodies. These bodies must be empowered to develop and implement aviation policies and review existing policies to ensure adaptability. Such coordination and cooperation will be a significant innovation in the industry and facilitate the ability to avoid, mitigate and respond to crises.

Empowering airport authorities and resourcing labour inspectorates is crucial to ensuring coordination and robust operating standards at local level. Airport authorities must have the ability to set minimum entry requirements, operating standards, coordinate healthy and safety regimes and convene tripartite forums at local level to facilitate forward planning and responsive operations.

INNOVATIONS IN SAFETY

Operational safety and a safe and healthy working environment are interrelated. **2** Given the safety critical nature of aviation, the development and application of preventative and remedial measures to ensure a safe and healthy working environment are therefore crucial.

At its heart, health and safety regimes must be rooted in a 'just culture', which allows workers to access appropriate, effective and timely legal recourse, remedy and complaints mechanisms. Non- punitive, confidential reporting systems will support system-wide safety innovations by encouraging the workers that operate the aviation system to report risks, hazards and incidents without fear of punishment, thereby allowing early identification and remedy/recourse.

Airport-wide health and safety bodies are another innovation that will increase occupational health and safety and therefore operational safety by convening operators and trade union representatives from across operations and concessions at the airport to ensure cohesion, cooperation, prevention and innovation.

The promotion of a 'just culture', and airport wide health and safety bodies will support ensuring safe staffing levels, mitigating fatigue, developing robust operating procedure, safety management systems and other practices that can enhance constant innovations to improve safety.

INNOVATION FOR ENVIRONMENTAL SUSTAINABILITY

Technological innovation will be significant in the industry's initiatives to address climate change and achieve net zero by 2050. Workers can play a significant role in identifying and supporting measures towards environmental sustainability.

In Argentina, the airport operator AA2000, together with trade unions that represent workers at the airport, have established national and local committees to identify and develop initiatives that reduce their airports' carbon footprint. The forum has ensured a continuous and consistent drive towards environmental sustainability, based on social dialogue. The move also ensures that as sustainability initiatives are deployed workers at the front line of their deployment are already supportive and able to highlight their needs, such as training or reskilling, in deploying them.

TECHNOLOGICAL INNOVATIONS

Technological innovation, particularly within the aviation industry, is a multifaceted issue that requires a delicate balance between progress and the protection of workers' rights and safety. The "New Deal for Aviation" underscores the necessity of integrating worker input in the technological transformation process, ensuring that advancements serve to augment rather than diminish the quality of their work environment. This participatory approach not only fosters a sense of ownership among workers but also acts as a safeguard against the misuse of data they produce.

Digitalisation 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.

The focus of technological innovations must primarily be improvements in safety -both operational safety and occupational health and safety-. Transparent, measurable research and development, including labour impact assessments, should be the starting point for any technological innovation initiatives.

Technology can aid decision making, minimise mundanity and improve health and safety outcomes for workers. Where innovation does this, it has the potential to enhance aviation operations and the attractiveness of the industry for employment and retention. The deployment of technological innovations currently, without consultation or negotiation and with minimal forums for non-punitive feedback from the workers who deploy them, is in many cases having negative consequences on the workforce. The integration of productivity algorithms in various sectors of the industry, including baggage handling and onboard sales, is a testament to the relentless pursuit of efficiency in the aviation industry. These algorithms, designed to optimize operations, have indeed revolutionized the way tasks are managed and executed. However, the increasing reliance on such technology brings with it a significant concern: the intensification of work pressures on employees. As these systems demand faster and more consistent performance, workers may find themselves under relentless scrutiny, leading to heightened stress levels and potential burnout.

The discourse of technological innovation in aviation must be considered. Current discourse, for example, that advertises ‘contactless airports’, ‘automation’ etc, also have negative consequences on the attractiveness of the industry for employment. Especially for jobs with high levels of initial investment, the possibility of being automated out of a job can be a disincentive for entering the industry.

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. It is also often workers’ labour that produces the data to support decision- making. The uses and limits of such data must be negotiated with trade union representatives to ensure privacy is protected, and misuse avoided.

The ITF’s remote towers policy3, for example, outlines workers’ recommendations and consideration for the deployment of remote towers in aviation systems.

CONCLUSION

The aviation industry stands at a pivotal crossroads, where the trajectory of its growth and evolution is influenced not only by technological advancements but also by a growing consciousness of the human elements that sustain it. The ITF has been instrumental in highlighting the need for a holistic approach to innovation, one that integrates the rights of workers and the imperatives of environmental sustainability into the core of aviation's progress.

As the ITF continues to champion the cause of workers, its advocacy is not a solitary endeavour. It requires the collective effort of stakeholders across the spectrum, including airlines, other types of aviation companies, governments-regulators, and civil society at large. The path to innovation in aviation is thus a shared journey, one that necessitates meaningful social dialogue, partnership, and a shared commitment to a set of values that transcends individual interests.

The emphasis on social dialogue is particularly significant, as it fosters an environment where diverse voices can contribute to shaping the industry's future. It is through such collaborative platforms that consensus can be built around the need for reforms that are both progressive and inclusive. The ITF's approach underscores the belief that innovation should not be an end but a means to achieve a more just and equitable world.

The ITF, as the global voice for aviation workers, can support social dialogue at global level around innovation and engage to support social dialogue at local and national level. The aviation industry's response to the ITF's call to action will be a testament to its readiness to work towards a holistic recognition of sustainability- across economic, social and environmental paradigms. As we look towards the horizon, it is the collective will to innovate responsibly that will determine the legacy of this generation and shape the experiences of those to come. The journey ahead is not without challenges, but with a clear vision and a steadfast commitment to principles, the aviation industry can soar to new heights -ones where the sky is not the limit, but the starting point for a journey towards a more sustainable and humane world.

- END -

1 Conclusions and recommendations on the promotion of decent work to shape a green, sustainable and inclusive economic recovery for the civil aviation sector, International Labour Organisation, April 2023.

2 Conclusions and recommendations on the promotion of decent work to shape a green, sustainable and inclusive economic recovery for the civil aviation sector, International Labour Organisation, April 2023.

3 https://www.itfglobal.org/en/resources/safe-skies-itf-approach-remote-tower-operations

HERMES
AIR TRANSPORT ORGANIZATION

POSITION PAPER

R24-PP/05
07/09/24

Enhancing Innovation in Aviation Through Fundamental Transformations in Air Traffic Management

(Presented by CANSO)

1 Introduction

Aviation stands at a pivotal moment, facing unprecedented challenges alongside unparalleled opportunities. The industry is tasked with constructing a scalable, sustainable, and resilient airspace system while efficiently and safely managing growing volumes of traffic and integrating a diverse array of airspace users. As transformative technologies emerge, the need for innovation, adaptability, and collaboration has never been more critical. In response to these demands, CANSO established the Complete Air Traffic System (CATS) Global Council—a think tank designed to unite organizations across the aviation sector to shape the future of airspace.

As the industry embarks on this transformative era, driven by the rapid evolution of technologies and the increasing complexity of global operations, embracing key innovations in Air Traffic Management (ATM) and Advanced Air Mobility (AAM) is imperative. However, these advancements cannot be pursued in isolation. A unified vision for the future is essential. The integration and sequencing of cutting-edge improvements in ATM are crucial not only for enhancing current operations but also for unlocking the full potential of AAM. To realize this vision, the industry must evolve current capabilities in light of future needs, ensuring that each innovation builds upon the last to create a cohesive and future-proof aviation ecosystem.

2 Fundamental Transformations in Air Traffic Management

The role of ATM is to ensure the safe and efficient movement of aircraft. However, traditional ATM systems and manual ways of tactically managing flows are increasingly challenged by rising traffic volumes. The emergence of new types of aircraft, and new intended uses for the skies will further increase the demand for more efficient operations. To address these challenges, ATM must undergo significant transformations that incorporate digitalization, automation, and advanced data-sharing capabilities.

2.1 Short-Term Innovations in ATM

In the short term, the focus should be on integrating foundational technologies that enhance real time information sharing and lay the groundwork for Trajectory-Based Operations (TBO). These innovations are critical for creating a robust and interconnected ATM system with enhanced capacity and efficiency. Additionally, evolving current ATM system architecture will be critical to improving the flexibility of the system to further innovation.

- **In-Time Information Sharing:** Real-time data exchange between operational stakeholders is essential for maintaining situational awareness and enabling more effective decision-making processes. This transformation supports better trajectory management and is crucial for the initial stages of TBO implementation.
- **Service-Oriented/Open Architecture:** A service-oriented architecture allows for the rapid deployment of new features and facilitates seamless interaction between different systems and stakeholders. This architecture is a key enabler for integrating new technologies and airspace users into the ATM ecosystem.
- **Virtualization:** Virtualization optimizes resource allocation and enhances the scalability and resilience of ATM systems, supporting the dynamic reconfiguration of airspace to accommodate diverse operations.

• **Integrated/Adaptive CNS:** Enhancing Communication, Navigation, and Surveillance (CNS) systems is crucial for improving connectivity and ensuring that ATM can safely and efficiently manage new types of aircraft, such as drones and Urban Air Mobility (UAM) vehicles.
• **True North:** Transitioning from a magnetic to a True North reference for heading and track in air operations, provides short-term improvements in navigational consistency, which is essential for integrating new entrants and ensuring safe operations.
• **Trajectory-Based Operations (TBO):** A key short-term innovation is the initial integration of TBO 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 short term, implementing foundational elements of TBO will involve aligning real-time information sharing and CNS enhancements with trajectory management capabilities, setting the stage for more advanced TBO applications in the future.

2.2 Medium-Term Innovations in ATM

Building on the short-term advancements, the medium-term focus should be on implementing advanced automation and real-time performance management systems. These innovations will optimize traffic flow, enhance safety, and prepare the ATM system for higher levels of automation. Modernizing regulatory frameworks, improving safety management, and dynamically managing airspace are key components of this scenario.

• **Higher Levels of Automation in ATM:** Increasing automation levels will enable the efficient management of higher traffic volumes and increasing diversity of traffic. This will require a shift in the role of humans in tactical ATM.
• **Disruptions Management:** Advanced automation will enable more effective management of disruptions, ensuring that the ATM system remains resilient and adaptive in the face of unexpected events.
• **Dynamic/Flexible Configuration and Management of Airspace:** Dynamically configuring airspace in response to real-time data and operational needs will optimize airspace usage and reduce congestion.

2.3 Long-Term Innovations in ATM

In the long term, the goal is to achieve full integration of all airspace users, creating a unified and adaptive airspace environment that can accommodate the evolving needs of the aviation industry.
• **Adaptive Flight Rules and Airspace Structures:** Evolving flight rules and airspace structures to be more adaptive will ensure that the ATM system can accommodate a wide range of aircraft types and operational scenarios.
• **Common/Adaptive Altitude Reference System:** Establishing a common altitude reference system is critical for ensuring consistent and safe operations across different airspace classes and types of operations.
• **Increasing Automation in Air Systems:** Further increasing the level of automation in air systems will enhance efficiency, reduce workload, and improve safety in a fully integrated airspace environment.
• **Enhanced Separation Management and Collision Avoidance Systems:** Advanced separation management and collision avoidance systems will be necessary to ensure safety in an increasingly automated and congested airspace.

3 Trajectory-Based Operations (TBO): A Transformative Scenario

Based on Advanced Digital Information Sharing TBO represents a fundamental shift in how air traffic is managed, moving from reactive and tactical management to strategic and proactive control of aircraft trajectories. TBO optimizes flight paths from departure to arrival, based on real-time data, collaborative decision-making for negotiated trajectory, and advanced automation. In the envisioned TBO environment, aircraft are strategically managed throughout their entire trajectory, from pre-flight planning to landing, to optimize outcomes that best match the needs of airspace users and the overall aviation system.

Flight Planning:
• Flight planning begins up to a year in advance, with airlines generating initial trajectories based on proposed schedules, aircraft types, and seasonal weather forecasts. This information is shared with relevant stakeholders, including Air Navigation Service Providers (ANSPs) and airports, through System-Wide Information Management (SWIM).

System Capacity and Optimization:
• ANSPs and airports use this data to define system capacity and throughput, identifying potential limitations early. As these constraints become known, airspace flow and other system parameters are adjusted to optimize operations.

Departure and Enroute Operations:
• Before departure, final trajectory plans are submitted and assessed for potential conflicts. Once airborne, aircraft follow their optimal cruising profiles, with ATM systems proactively oBering clearances in line with the pre-agreed trajectory. Real-time adjustments are made as necessary to maintain efficiency and safety.

Arrival Management:
• Arrival sequences are planned well in advance and iteratively refined throughout the flight. Dynamic routing and final clearances are provided to ensure smooth transitions from air to ground operations.
Technological and Infrastructure Requirements:
To fully implement TBO, significant upgrades to both technical systems and physical infrastructure are required. Key areas include:
1. System-Wide Information Management (SWIM):
o SWIM facilitates real-time data exchange, ensuring all stakeholders have access to the same information. This system requires standardization of data formats, real-time processing capabilities, and robust cybersecurity measures.
2. Flight and Flow Information for a Collaborative Environment (FF-ICE):
o FF-ICE supports collaborative decision-making by allowing for dynamic modifications to flight trajectories. Integration with existing ATM systems and real-time data exchange interfaces are critical for its success.
3. Advanced Communication Technologies:
o New communication technologies, including enhanced SATCOM and VHF data links, are essential for maintaining secure and reliable data exchange between aircraft and ground systems.
4. Virtualization and Service-Oriented Architecture (SOA):
o Virtualization enables scalable resource management, while SOA facilitates the integration of modular services across different systems and stakeholders, supporting the dynamic needs of TBO.

Expected Benefits:

1. Improved Safety:

o Enhanced situational awareness and real-time data sharing contribute to higher safety standards and more effective conflict resolution.

2. Flight Efficiency:

o TBO allows for optimized flight paths, reducing fuel consumption, operational costs, and environmental impact.

3. Increased Capacity and Throughput:

o By optimizing airspace utilization, TBO increases overall capacity, helping to manage peak traffic periods more effectively.

4. Enhanced Collaboration:

o TBO fosters a collaborative environment where all stakeholders work together to optimize flight operations, ensuring decisions are made based on comprehensive data and shared objectives.

The implementation of TBO, supported by foundational transformations in information sharing, architecture, and technology, promises significant benefits. However, achieving TBO requires substantial investments in infrastructure, technology, and regulatory frameworks to ensure a smooth and successful transition.

4 Advanced Air Mobility (AAM): A Revolutionary Vision

Advanced Air Mobility (AAM) represents a groundbreaking approach to transportation, oBering 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.

4.1 Short-Term Developments in AAM

In the short term, AAM will focus on initial trials and demonstrations, aiming to build public confidence and lay the groundwork for broader adoption. These early efforts will involve the use of specialized airspace corridors and the integration of AAM into existing Air Traffic Management (ATM) systems. The initial phase of AAM development is crucial for demonstrating the safety, reliability, and efficiency of eVTOL aircraft in real-world.

Key enablers in this phase include:

1. **Regulatory Frameworks:** Developing clear and supportive regulations is essential to ensure the safe and efficient operation of AAM. This includes the establishment of safety standards, certification processes for new aircraft types, and guidelines for their operation within controlled airspace.
2. **Public Engagement:** Building public trust and acceptance through transparent communication, community engagement, and showcasing the benefits of AAM through controlled demonstrations.
3. **Supporting Infrastructure:** The development of vertiports, charging stations, and other necessary infrastructure will support the initial deployment of AAM operations. This infrastructure must be integrated with existing urban transport systems to facilitate seamless multimodal transportation.

4. **Technological Integration:** Ensuring 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.

4.2 Medium-Term Expansion of AAM

As AAM technologies mature, their applications will expand into niche markets, such as urban air taxis and cargo delivery services. This expansion may require changes to existing airspace classifications and the refinement of regulatory frameworks to accommodate these new operations. The medium-term phase focuses on scaling AAM operations from trials and demonstrations to broader, more commercial applications.

1. **Refinement of Airspace Management:** As AAM operations increase in volume and complexity, airspace management systems will need to evolve to accommodate these new entrants. This includes the development of specialized airspace corridors, dynamic airspace management systems, and advanced traffic management solutions tailored to AAM vehicles.
2. **Continued Infrastructure Development:** Expansion of vertiports, enhanced charging infrastructure, and the integration of AAM operations into urban planning will be critical to supporting the growth of AAM services.

4.3 Long-Term Integration of AAM

In the long term, AAM is expected to be fully integrated into the broader aviation ecosystem, operating alongside traditional manned aircraft and other new entrants, such as Unmanned Aerial Systems (UAS). This will require a unified approach to flight rules, enhanced traffic management services, and the development of new operational concepts to ensure safe and efficient coexistence in increasingly crowded airspace.

Key considerations for long-term integration include:
1. **Unified Flight Rules:** The development of a single set of flight rules that can accommodate the diverse range of AAM operations, from low-altitude urban flights to higher-altitude intercity travel. This will ensure consistency and safety across all operations.
2. **Advanced Traffic Management Systems:** The implementation of sophisticated traffic management systems that can dynamically manage the flow of AAM vehicles in real-time, ensuring safe separation from other airspace users and optimizing the efficiency of airspace use.
3. **Full Airspace Integration:** The seamless integration of AAM into existing airspace frameworks, allowing for the coexistence of manned and unmanned aircraft. This will require collaboration between various stakeholders, including regulatory bodies, ATM providers, and AAM operators.
4. **Sustainability and Environmental Impact:** As AAM becomes a more prominent mode of transportation, its environmental impact will need to be carefully managed. This includes the adoption of sustainable energy sources, noise reduction technologies, and the minimization of the overall carbon footprint of AAM operations.

4.4 Conclusion

The journey towards realizing the full potential of Advanced Air Mobility is a complex and multi-phased process that will fundamentally reshape the landscape of urban transportation. From initial trials and regulatory developments to the widespread adoption of urban air taxis and cargo services,

4. **Technological Integration:** Ensuring 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.

4.2 Medium-Term Expansion of AAM

As AAM technologies mature, their applications will expand into niche markets, such as urban air taxis and cargo delivery services. This expansion may require changes to existing airspace classifications and the refinement of regulatory frameworks to accommodate these new operations. The medium-term phase focuses on scaling AAM operations from trials and demonstrations to broader, more commercial applications.

1. **Refinement of Airspace Management:** As AAM operations increase in volume and complexity, airspace management systems will need to evolve to accommodate these new entrants. This includes the development of specialized airspace corridors, dynamic airspace management systems, and advanced traffic management solutions tailored to AAM vehicles.
2. **Continued Infrastructure Development:** Expansion of vertiports, enhanced charging infrastructure, and the integration of AAM operations into urban planning will be critical to supporting the growth of AAM services.

4.3 Long-Term Integration of AAM

In the long term, AAM is expected to be fully integrated into the broader aviation ecosystem, operating alongside traditional manned aircraft and other new entrants, such as Unmanned Aerial Systems (UAS). This will require a unified approach to flight rules, enhanced traffic management services, and the development of new operational concepts to ensure safe and efficient coexistence in increasingly crowded airspace.

Key considerations for long-term integration include:
1. **Unified Flight Rules:** The development of a single set of flight rules that can accommodate the diverse range of AAM operations, from low-altitude urban flights to higher-altitude intercity travel. This will ensure consistency and safety across all operations.
2. **Advanced Traffic Management Systems:** The implementation of sophisticated traffic management systems that can dynamically manage the flow of AAM vehicles in real-time, ensuring safe separation from other airspace users and optimizing the efficiency of airspace use.
3. **Full Airspace Integration:** The seamless integration of AAM into existing airspace frameworks, allowing for the coexistence of manned and unmanned aircraft. This will require collaboration between various stakeholders, including regulatory bodies, ATM providers, and AAM operators.
4. **Sustainability and Environmental Impact:** As AAM becomes a more prominent mode of transportation, its environmental impact will need to be carefully managed. This includes the adoption of sustainable energy sources, noise reduction technologies, and the minimization of the overall carbon footprint of AAM operations.

4.4 Conclusion

The journey towards realizing the full potential of Advanced Air Mobility is a complex and multi-phased process that will fundamentally reshape the landscape of urban transportation. From initial trials and regulatory developments to the widespread adoption of urban air taxis and cargo services,

AAM has the potential to revolutionize the way we think about mobility, oBering faster, safer, and more sustainable solutions to the challenges of modern transportation. The long-term vision for AAM is not just about introducing new types of vehicles but about creating a fully integrated, efficient, and environmentally responsible transportation system that meets the needs of a growing urban population. The successful implementation of this vision will depend on continued innovation, collaboration, and a commitment to safety and sustainability at every stage of development.

5 Funding of ATM Innovations

The development of ATM innovations are guided in part by global planning documents such as the Global Air Navigation Plan and the Aviation System Block Upgrades which lay out the incremental and evolutionary steps for new future capabilities required by the ATM system. This gives research and development actors certainty as to market demand for innovations.

Implementation should be supported by both business cases based on achievable benefits and the necessary lifecycle update of existing technologies. However issues of regional harmonization warrant consideration and may argue in favour of coordinated innovation adoption, outside of normal lifecycle considerations.

Innovations such as 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. Higher levels of automation will enable improvements to dynamic airspace management and the deployment and alignment of resources in line with traffic.

The funding of innovations to support the AAM community will initially be complicated by a smaller user base to support investments. However the phasing of investments in line with traffic growth should be achievable in some areas.

6 Implementation and Role of Organizations

The successful implementation of these innovations hinges on a strategic, phased approach, starting with pilot programs and gradually expanding to full deployment. It is crucial to collaborate with key global bodies like ICAO to establish a unified framework that can be adapted to regional contexts. This ensures that while strategies are agreed upon at a global level, they are tailored to address the specific needs and challenges of each region.

CANSO and the CATS Global Council are at the forefront of these efforts. The CATS Global Council is currently developing a Concept of Operations (CONOPS) which will serve as a guiding document designed to revolutionize the aviation ecosystem. This CONOPS will serve as a blueprint for the future of airspace management, outlining the pathways to integrate advanced technologies and new airspace users while maintaining safety, efficiency, and sustainability.

In parallel, the CATS Global Council is actively supporting ICAO in developing a comprehensive vision and pathway for AAM, updating the Global Air Navigation Plan and the Global ATM Operational Concept to reflect innovations in aviation. By working closely with ICAO and other international organizations, CANSO and the CATS Global Council are ensuring that the global strategies being developed are robust, realistic, and adaptable to different regional contexts.

By uniting stakeholders, fostering collaboration, and accelerating the pace of innovation, CANSO and the CATS Global Council will play pivotal roles in the successful implementation of these advancements. Their efforts will help ensure that the aviation industry is well-prepared to meet future challenges, achieving a globally integrated and regionally tailored aviation system that is safe, efficient, and sustainable.

- END -

HERMES
AIR TRANSPORT ORGANISATION

REPORT

R24-R

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:

[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.

2024 Hermes Recommendations Committee

Chairperson
Professor Martin Dresner, Chair, Air Transport Research Society (ATRS)
Members
-Dr Olumuyiwa Benard Aliu. Honorary Member, Hermes - Air Transport Organisation & founder and President of the International Partners for Aviation Development, Innovation and Sustainability (iPADIS)
-Angela Gittens, President, Hermes - Air Transport Organisation
-Mario Nemeth, ex Director General, Civil Aviation, Slovakia
-Professor Dr Andreas Papatheodorou, President, Hellenic Aviation Society & Editor-in-Chief, Journal of Air Transport Studies

- END -