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Agenda Item 4: Review the process of Phase 2 of the Transition from AIS to AIM and preparation for SWIM

The impact of digitalisation on the AIM implementation process and SWIM readiness

(Presented by Brazil)

SUMMARY

This working paper shows the impact of digitalisation on aeronautical information management, taking into account the main characteristics of the SWIM environment and how it is possible to contribute to its implementation by offering an implementation case study.

References:

- Doc 9750 - Global Air Navigation Plan
- Doc 10066 - Aeronautical Information Management
- Doc 8126 - Aeronautical Information Services Manual
- Annex 15 - Aeronautical Information Services

ICAO strategic objectives:	*A - Safety* *B - Air navigation capacity and efficiency* *C - Economic development of air transport* *D - Environmental protection*

1. BACKGROUND

1.1 We start contextualising this topic with a brief reference to ICAO strategic objectives, in order to acknowledge the importance of implementing a SWIM (system-wide information management) environment in an AIM (aeronautical information management) context and how the scenario interconnects with digitalisation in the processes.

1.2 The aforementioned ICAO strategic objectives were established to promote the harmonisation and interoperability of aeronautical information systems. In this way, ICAO seeks to ensure that AIM and SWIM systems are harmonised at the international level, enabling member States and their air navigation institutions to share information in an efficient, accurate and standardised manner, using common standards and procedures for the exchange of aeronautical information.

1.3 SAFETY

1.3.1 AIM is primarily related to aviation safety, as its main objective is to provide accurate, up-to-date and reliable information to support aircraft operations and ensure the safety of the air transport system,

supported by an efficient and standardised management of essential aeronautical information, such as navigation charts, flight procedures, hazard advisories, restricted area warnings, *inter alia*.

1.3.2 Although AIM is more closely related to safety, it also plays a complementary role in aviation security, as the availability of accurate and secure aeronautical information is critical to prevent security-related risks such as airspace intrusions, cybersecurity events, and other potential intentional acts against aviation.

1.3.3 In turn, SWIM is an integrated information management environment aimed at improving data exchange among the various systems and players involved in air transport, which has a significant impact on both safety and security.

1.3.4 In Safety, it facilitates the secure, rapid and standardised exchange of safety-related aeronautical information among different aviation stakeholders such as airlines, air traffic controllers, airport operators and aviation authorities.

1.3.5 In Security, it allows you to ensure the secure and encrypted exchange of security-related information among authorised parties, including data on security threats, security measures implemented, security intelligence and more.

1.4 AIR NAVIGATION CAPACITY AND EFFICIENCY

1.4.1 SWIM and AIM play a key role in improving air navigation capacity and efficiency by enabling the rapid, standardised and secure exchange of information among all industry participants. SWIM optimises the flow of data, enabling more agile and better-informed decision-making, while AIM optimises the availability of accurate and up-to-date information to support aircraft operations, leading to more efficient routes, reduced delays and fuel savings.

1.4.2 These technological solutions enable better coordination, integration and exchange of information among the various actors in the aviation industry, such as traffic controllers, pilots, airlines, aviation authorities and other stakeholders, resulting in a safer, more agile and sustainable air navigation system, ensuring more efficient and reliable air transport for the industry and the passengers.

1.5 ECONOMIC DEVELOPMENT OF AIR TRANSPORT

1.5.1 SWIM and AIM have a significant impact on the economic development of air transport. With SWIM, information is shared more quickly and efficiently among stakeholders, resulting in better coordination of flights and reduced holding times on the ground and in the air. Likewise, AIM provides a sound foundation of accurate and up-to-date data, enabling airlines to optimise their operations, plan more efficient routes and reduce fuel consumption, resulting in cost savings and increased market competitiveness.

1.5.2 To mitigate negative impacts and maximise benefits, solutions are offered that include public-private partnerships, international cooperation, continued investment in technology, and staff training.

Collaboration among governments, aviation authorities, airlines and other industry players is also crucial to ensure that changes are implemented in a harmonised and coordinated manner. In addition, the adoption of global standards and the development of appropriate policies and regulations are essential to foster the interoperability and security of aeronautical information systems.

1.6 ENVIRONMENTAL PROTECTION

1.6.1 SWIM and AIM have a significant influence on the search for solutions to problems related to environmental protection in aviation, as the efficient exchange of information provided by SWIM allows for better coordination among industry players, resulting in more efficient flight routes and reduced fuel consumption, contributing to the reduction of greenhouse gas emissions and environmental impact.

1.6.2 Furthermore, AIM provides accurate data on weather conditions and other factors that may affect the environmental performance of airline operations, enabling airlines and air navigation service providers to make better-informed decisions to minimise environmental impact.

2. DISCUSSION

2.1 THE IMPACT OF DIGITALISATION

2.1.1 Digitalisation has been a decisive factor in improving implementation processes in several areas. With the advancement of technology, it is possible to automate tasks that were previously done manually, reducing costs and increasing the efficiency of processes. In addition, digitalisation has enabled greater accuracy in data collection and analysis, allowing for problem identification and more assertive decision-making.

2.1.2 It has also had a significant impact on the AIM implementation process and the preparation of SWIM, as these initiatives seek to improve the exchange and management of aeronautical information among the various players in the aviation market. Examples of impacts include:

2.1.3 **Simplified data management**, as digitalisation enables the collection, storage and dissemination of aeronautical information in electronic format, reducing reliance on paper-based processes, which can facilitate the creation of more efficient data management systems, allowing faster and more accurate information updates.

2.1.4 **Improved data accessibility** makes aeronautical information, now digitalised, easily accessible to stakeholders in the process. Pilots, air traffic controllers, airport managers and other aviation stakeholders can access the necessary information through digital platforms, improving situational awareness and operational efficiency.

2.1.5 **Real-time information exchange** gives stakeholders access to the most up-to-date aeronautical information, which is particularly crucial for operational decision-making, as it allows immediate knowledge of essential data such as weather updates, runway conditions and airspace restrictions. It also helps to minimise delays, enhance passenger experience and reduce operational costs.

2.1.6 With **automation** and **standardisation**, digitalisation has paved the way for data validation and quality control, reducing human error and ensuring consistency among different systems and platforms. By facilitating processes that support data analysis, better decisions can be made. Through data analysis, aviation authorities and stakeholders can identify trends, predict future demands and optimise operational processes.

2.1.7 **Integration** and **interoperability** enable seamless data sharing among different stakeholders, such as airlines, air navigation service providers, and airports, leading to better collaboration and efficiency in the management of aviation as a whole.

2.1.8 Despite all these positive effects, digitalisation has also introduced new **cybersecurity** challenges, since, in order to protect aviation information against potential threats, it has been necessary to adopt robust measures, including cryptography, access controls and intrusion detection systems, to ensure data integrity and reliability.

2.1.9 Finally, it is important to emphasise that digitalisation should not be seen as a panacea for all problems. Therefore, the need for **training** cannot go unmentioned, as the need for proper planning and adaptation of the teams involved is a given in order for implementation to succeed. Furthermore, it is necessary to be aware of other possible negative impacts, such as the **digital exclusion** of people who do not have access to, or the necessary skills to cope with, these new technologies.

2.2 CASE STUDY

2.2.1 The world is undergoing a swift digital transformation and aviation cannot lag behind. To the extent we embrace digitalisation, we will pave the way for countless advantages that will benefit everyone, from pilots and flight crews to engineers and air traffic managers.

2.2.2 The points made so far are just a few of the many benefits that digitalisation can provide. However, for this transition to be successful, it is essential that everyone is involved in this process and works together to address the challenges that may arise.

2.2.3 Thus, ICAO adopted the ASBU initiative that seeks to promote the modernisation and harmonisation of global aviation by identifying standard operational solutions to meet future challenges and improve the capacity, efficiency and safety of air navigation.

2.2.4 One possible way to implement ASBU in a given scenario would be to implement one of its specific "building blocks", such as DAIM B1/1 "Provision of quality-assured aeronautical data and information". The selected content can be found in the GANP portal by clicking on the following link (https://www4.icao.int/ganpportal/ASBU?Threads=9,7). If you want to know more, click on (https://www4.icao.int/ganpportal/GanpDocument/ES#/).

2.2.5 As a suggestion, its implementation could involve the following steps:

a) Analysis and mapping of the current environment:

i) Conduct a comprehensive analysis of the current environment for the management, processing, verification, use and exchange of aeronautical data and information;

ii) Identify the critical points where human intervention is most susceptible to errors and inconsistencies;

iii) Interview stakeholders and experts from different areas to better understand their needs and expectations regarding data digitalisation;

iv) Identify the importance of data digitalisation and the expected benefits for stakeholders and experts from different areas;

v) Define, together with your partners, the specific objectives of the roadmap to be implemented, such as standardisation of systems, increased interoperability and cybersecurity, among others.

b) Training: Training of professionals responsible for the management and dissemination of aeronautical information, with the contents identified in the analysis and mapping of the environment, ensuring that they have the necessary skills and knowledge to use the systems effectively.

i) Train professionals involved in the use of new digital systems in an efficient and secure manner, with knowledge of the data chain and the use of a new working environment with data quality;

ii) Promote awareness of cybersecurity risks and the importance of protective measures.

c) Data quality assurance: Implement rigorous quality control processes, based on the analysis and mapping of the environment, to ensure that aeronautical data is correct, complete and reliable before it is distributed to AIS customers.

d) Establishment of detailed requirements for an automated and data-centric environment, in accordance with Doc 10066, item 5.3 "Digital data" and considering:

i) The standardisation of aeronautical data and information formats;

ii) Automated collection, verification and validation processes;

iii) The interconnection and interoperability of systems;

iv) Integration with authorised aeronautical data sources.

e) Development and implementation of an automation platform, that is, investing in improved data collection systems and implementing platforms for real-time dissemination of up-to-date information:

i) Hire or develop a technology platform that meets the requirements for digital data exchange;

ii) Integrate this platform with existing systems, ensuring a smooth transition and coexistence between existing and automated environments during the defined transition period;

iii) Define a standard for communicating the decisions and strategies to be applied by all those involved in the process;

iv) Conduct tests and validate digitalised systems in controlled environments prior to large-scale implementation.

f) Data chain control, based on quality assurance:

i) Implement a control system that tracks and records all stages of the data chain, from collection to distribution;

ii) Ensure the authenticity and origin of data through digital certificates and electronic signatures;

iii) Conduct periodic audits throughout the data chain to verify compliance with established standards and ensure that all processes are following the right procedures;

iv) Identify possible deviations or non-conformities and take the necessary corrective actions to ensure data integrity and quality;

v) Establish a certification and accreditation programme for aeronautical data sources and systems involved in the data chain; and

vi) Certify and accredit entities that meet established quality, security and compliance requirements, ensuring that only data from authorised sources are deemed reliable and used in the data chain.

g) Integration with SWIM: Integrate the AIM system with the SWIM environment, enabling more efficient and secure exchange of information among different regions and countries, in order to contribute to increased global interoperability.

h) Monitoring and continuous improvement: Establish performance indicators to assess the effectiveness of the new AIM system and conduct periodic evaluations to identify areas for improvement and make the necessary adjustments.

2.2.6 Successful implementation of the DAIM B1/1 block would significantly improve the capacity, efficiency and safety of air operations. Reliable data, when updated, would enable better decision-making, reducing the likelihood of traffic conflicts, delays and aircraft incidents. In addition, interoperability with the SWIM environment would facilitate international coordination and real-time exchange of information, benefitting air transport on a global scale.

2.2.7 The script presented here can be adapted to specific needs, taking into account the operational reality and the human and technical resources available, not forgetting that collaboration among the different actors in the process is fundamental to the success of data digitalisation.

3. CONCLUSION

3.1 In summary, digitalisation has the power to drive the AIM implementation process and SWIM readiness by improving data management, accessibility, real-time information sharing, automation, standardisation, integration, decision-making support and sustainability. However, it has also shown that a strong focus on cybersecurity is needed to ensure the reliability of digital systems and of the information they handle. As a result, there is a need for training in several new areas, requiring a struggle against digital exclusion and ensuring that the necessary skills and knowledge are maintained.