



INTERNATIONAL CIVIL AVIATION ORGANIZATION

Seventh Meeting of the APIRG Infrastructure and Information Management Sub-Group (IIM/SG7)

Dakar, Senegal, 5 - 8 August 2024

Agenda Item 5 : Other Air Navigation initiatives

WP3.5A Transformative blockchain approach to enhance security, efficiency and transparency

(Presented by South Africa)

<b>SUMMARY</b>
<p>This paper articulates the possible aviation industry approach within the context of transformative blockchain technology and identifies possible applications. The focus will be on the Air Traffic Management (ATM) ecosystem. To assist in identifying various transformative blockchain approaches to enhance security, efficiency, and transparency.</p> <p>Action by the meeting in paragraph 3</p>
<p><b>REFERENCE(S):</b></p> <ul style="list-style-type: none"> <li>▪ Aviation Cybersecurity Strategy</li> <li>▪ ICAO Cybersecurity Action Plan (CyAP)</li> <li>▪ ICAO Assembly Resolution 40-10 – Addressing Cybersecurity in Civil Aviation</li> </ul>
<p>This working document relates to ICAO Strategic Objectives: Safety and Air Navigation Capacity and Efficiency</p>

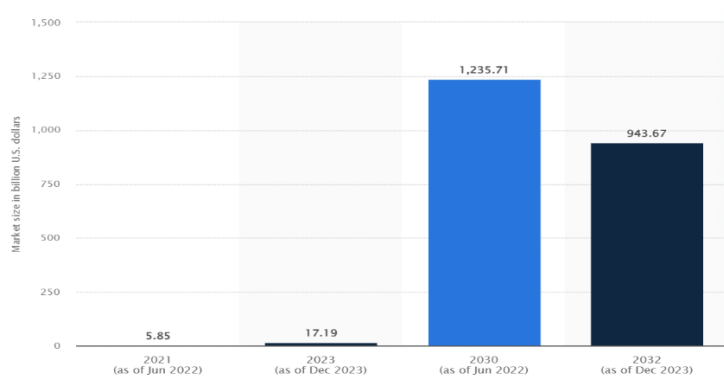
1. INTRODUCTION

- 1.1 Industries are seeking transformative approaches to generate revenues after the pandemic’s impact. This has necessitated a need to re-evaluate how the organisation conducts business and provides services that drive economic development in the face of the fifth Industrial Revolution (5IR).
- 1.2 The aviation industry is expected not to be left behind and define transformative approaches that are required to enhance security, efficiency, and transparency. The rate of exponential change and the need to remain globally competitive is a driving force behind these expectations.
- 1.3 The aviation ecosystem in a landscape where transformative approaches are unknown, leverage the use of transformative technology like blockchain to enhance security, efficiency, and transparency to align the incongruity between what they need to survive and the transformative technologies.
- 1.4 This paper articulates the possible aviation industry approach within the context of transformative technology blockchain and identifies possible applications. The focus will be on the Air Traffic

Management (ATM) ecosystem. To identify approaches to enhance security, efficiency, and transparency.

## 2. DISCUSSIONS

- 2.1 The transformative technologies industry like cloud computing, the Internet of Things (IoT), machine learning, blockchain, and big data are game changers and require different collaborative approaches. This can cause the inability of air service providers to meet the growing customer demand. The air traffic management components are a critical element in supporting the air service provision, however the systems are not quickly adapting to the changing environments.
- 2.2 Transformative innovation is defined as “innovations that contribute to those transformations that are desirable and feasible in a specific conjuncture. Desirable enables a good life for all, and feasible are those that can be implemented within the short to long term. Creates and strengthens sustainable and inclusive systems”.
- 2.3 There is a requirement for real-time information, a distributed database that is reliable, accurate, secure, and transparent in the aviation value chain to ensure that the shared data can be trusted. Blockchain technology is a possible solution to address and improve the identified requirements.
- 2.4 According to the research and consulting service provider Gartner, blockchain will increase to \$360 billion by 2026. Transparency, open source, decentralisation, and coordination are blockchain technology principles.
- 2.5 According to Statista the blockchain technology worldwide market size is projected to reach over a trillion dollars by 2030.



**Figure 1 - Blockchain Market Size (Statista, 2024)**

- 2.6 Blockchain technology is a distributed database where transactions are managed across various nodes connected to the blockchain network, instead of using a central server. It uses an algorithm to bind multiple blocks together in a chain. All entities connected to the network manage encrypted transactions using a hash function, promoting the concept of decentralised information sharing. This technology enables information recording, verification, storage, and distribution, ensuring trust and transparency. Transactions are recorded through a consensus process, meaning each time a transaction occurs, data is stored in the ledger of each node and verified by all participants. This decentralized approach significantly enhances security and the reliability of shared data.

- 2.7 Blockchain applications can be divided into various types such as private, public, and alliance chains. The public chain is open and can be joined by any user in the node group system and participate in the calculation. Download and obtain the complete blockchain data. The advantage of the public chain is that it is decentralised and secure. The private chain is open to authorised nodes, who can write and view the data. The advantages are being customisable, and fast due to a controlled environment. The disadvantage is the lack of decentralisation. Alliance is managed by different institutions and organisations, with each participating institute running one or more nodes. Authorised institutions can read, send transactions, and record transaction data.
- 2.8 The ATM ecosystem needs to decide which blockchain application direction is going to be used depending on the requirements of the platform.
- 2.9 The air service provision is heavily reliant on data management. There is an opportunity within blockchain transformative technology as an emergent of secure and transparent data management that will positively contribute to a sector that contributes towards economic growth. The approach is fraught with uncertainty about regulations, skills shortages, and high production costs (IATA, 2018). With the anticipated changes, and the need to relook future workforce to adopt a transformative technology approach, blockchain becomes a necessary tool.
- 2.10 The transformative blockchain technology should be applicable for any airspace or airport; and be able to calculate charges for landing, parking, housing, rental retail space, terminal, and route navigation. The need for automated, efficient, and transparent data management. This talks to skills that are not equally inherent in all employees within the organisations.
- 2.11 Blockchain technology aims to revolutionise existing business processes and systems and reduce operating costs. The skilled shortage in the blockchain market can be addressed by collaboration and partnerships.
- 2.12 Possible blockchain technology applications include:
- 2.12.1 Smart contracts  
Automatic contracts are completed when predefined conditions are met. Forgery can be prevented. Allows for automatic execution contract. Smart contract refers to conditions that automatically execute the contract when all conditions are met. Can be used for streamlining the payment process even the purchase process. For example, when the aircraft enters a certain airspace, the date is recorded in the smart contract system. The provided service is automatically recorded along with the due amount, and whether it's paid. No payment or invoicing process is required. The ATM ecosystem information will be updated across all chains ensuring efficient customer service delivery. Overall, enforce regulatory compliance, ensuring adherence to safety standards.
- 2.12.2 Aeronautical Information Management Blockchain  
Managing aeronautical information such as NOTAMs, Weather data, and Airspace restrictions in real time on a blockchain. These can even be integrated and extended to dynamic routing of flights such as diverted flights, and incident management.
- 2.12.3 Inter ANSP information exchange  
Handover between airspaces includes flight plans, and airspace usage for improving coordination across regional airspace boundaries.
- 2.12.4 Digital Certificates for Air Traffic Controller (ATC)
- 2.12.5 Regulatory compliance tracking ledger  
For compliance records such as certifications and audits.

#### 2.12.6 Use of cryptocurrencies for payments

There are often discrepancies in the amounts invoiced to customers. Using cryptocurrencies as payment will allow a transparent process and reduce third-party fees. Some airlines have established payment systems to reserve seats with Bitcoin or make payments. Non-aviation sectors are embracing blockchain technology such as Pick n Pay which has recently introduced a system that allows customers to pay with cryptocurrencies. This can be adapted by the ATM ecosystem in the AFI region to improve efficiency.

#### 2.12.7 Maintenance

To create secure and verifiable records for maintenance. Reducing the risk of errors and ensuring compliance with standards. Air service provision assets require maintenance and support throughout the design life. Maintenance, Repair, and Overhaul (MRO) importance cannot be underestimated. Reliable parts are required and require high investments. This creates an opportunity for below-standard parts or defective parts to be sold to unsuspecting users. Maintenance record keeping is a problem as well. Blockchain records reduce this risk as maintenance history cannot be altered, ensuring trust amongst the users and reducing accidents.

#### 2.12.8 Security

The System Wide Information Management (SWIM) concept enables the ATM information exchange and management amongst the authorised ATM ecosystem ensuring interoperable services. A service-oriented consisting of standards, applications, services, and policies for the SWIM concept supporting the ATM stakeholders. There is a requirement to ensure safe and secure information is guaranteed between parties. Blockchain technology provides an opportunity to ensure that only authorised stakeholders have access to write or read the data. The stakeholders will be able to validate the transactions through networks that are known by the authorised users. This enhances the security of the shared data amongst the users.

2.13 The aviation industry is prone to cyber threats, blockchain technology can make it difficult for hackers to compromise the system. The use of hash function encryption in each transaction provides advanced data security. Ensures that only authorised ATM ecosystem stakeholders access the data. Supporting the requirement for personal information protection as per information regulations.

2.14 The ATM ecosystem needs to address the transformative blockchain technology. This calls for collaborative, coordinated, and cooperative decision-making approaches for the blockchain environment.

### 3. ACTIONS BY THE MEETING

3.1 The meeting is invited to:

3.1.1 Note that the aviation industry faces numerous challenges due to emerging technologies. System interconnectedness introduces cybersecurity threats calling for secure systems. Data integrity and trust across stakeholders is critical to ensure efficient, safe, and secure service provision.

3.1.2 Embrace the opportunity to improve efficiency and transparency. Transparency ensures real-time information and quick decision-making.

3.1.3 Understanding the role of blockchain technology in the ATM ecosystem. Blockchain technology can solve the security challenges as it is built on a decentralized approach to data management security. Fast and efficient sharing of information. Resulting in cost optimisation and a new competitive edge. Collaboration and partnership among the stakeholders can address these challenges.

3.1.4 Develop blockchain guidance material in the AFI region.

**3.2 Draft IIM/SG7 Conclusion /Decision 7/xx : Title of Conclusion/Decision  
That ;**

3.2.1 To identify the blockchain technology applications, challenges, and regulatory requirements that can enhance efficiency and transparency.

3.2.2 Develop the blockchain guidance material to enhance security, transparency, and efficiency for all ATM ecosystems through the COM 5: Assessment of AFI aeronautical networks cyber security project by 31 October 2025.

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