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Item 8A
Of the Agenda: Other Issues

AERONAUTICAL INFORMATION SECURITY STRATEGY FOR ADS-B

Working Paper presented by the Republic of Colombia *"The country of Beauty"*

SUMMARY

ADS-B technology has transformed air traffic management by offering high precision, real time data availability, and increased efficiency in airspace administration. However, its design based on unencrypted protocols makes it vulnerable to cyber and electronic attacks, as well as risks related to information privacy and data protection. These vulnerabilities can compromise the quality of information used for ATC and create threats regarding the use and privacy of the data transmitted by aircraft operating with this technology.

To mitigate these risks, comprehensive strategies must be developed that combine multiple surveillance data sources from both cooperative and non-cooperative systems, correlating information and generating a reliability measure to enhance resilience and technological robustness. Additionally, incorporating advanced cybersecurity practices and developing anomaly detection techniques based on big data and artificial intelligence will help evaluate and ensure the reliability of transmitted information. Furthermore, national laws and regulations should clearly define the limits between public and private use of data transmitted by these systems and the impact on privacy for private and state aircraft users.

Developing this comprehensive strategy will improve the quality and trustworthiness of aeronautical information provided by this technology, identify unusual patterns and discrepancies in altitude or position, and even detect false messages, ensuring high-quality information for ATC services while protecting personal and private data in accordance with national legislation.

This aspect is particularly relevant as it presents a new challenge for States, the aeronautical community, and private companies, which must define the boundaries and consequences of the improper use of aeronautical data (ADS-B) concerning national legislation on data privacy.

References:

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ICAO Strategic Objectives:	- Aviation security. - Every flight is safe (Safety and Security). - Aviation provides seamless, accessible, and reliable mobility for all. - No country is left behind.

1. Introduction

1.1 The Automatic Dependent Surveillance-Broadcast (ADS-B) system has revolutionized air traffic management by offering greater precision, efficiency, and real-time data availability. This technology enables better airspace management, optimizes routes, improves congestion prediction, and facilitates real-time decision-making. However, ADS-B also presents security vulnerabilities that must be addressed to ensure data integrity and operational safety.

1.2 ADS-B's design, based on open transmission protocols, makes it susceptible to cyber and electronic attacks. The possibility of injecting false messages, identity spoofing, or interfering with signals poses risks to aircraft safety. Additionally, the privacy of data transmitted via ADS-B is a critical issue requiring attention, particularly in terms of personal data protection, national security, and the impact of private exploitation of aeronautical data on individuals' privacy in private and state flights. This situation highlights the need to regulate access and authorization levels for the private use of aeronautical data, such as that generated by ADS-B.

1.3 This challenge lies in balancing the need to use aeronautical information to enhance safety and operational efficiency with the obligation to protect personal and private data under each country's legislation. The increasing commercial exploitation of ADS-B data via private platforms raises significant concerns about the implications of these practices on user privacy and aviation security.

1.4 To mitigate these risks, an integrated security strategy must be implemented, addressing various aspects, from strengthening technological infrastructure to developing data analysis tools and establishing robust legal and regulatory frameworks. International cooperation and information sharing among States are crucial to addressing ADS-B security challenges and ensuring the safety and efficiency of global airspace.

2. Discussion

2.1 ADS-B technology has revolutionized air traffic management by providing more accurate and abundant data, allowing greater airspace flexibility and optimizing processes such as billing and route management. The technology includes quality parameters that are evaluated by ATM systems and contribute to decision-making. Its benefits include airspace optimization, improved safety—especially in areas with limited control—integration with technologies such as big data and artificial intelligence, and the transmission of high-quality data for decision-making in ATM systems. In summary, ADS-B not only enhances efficiency and safety but also drives airspace modernization.

2.2 ADS-B technology relies on the transmission of the aircraft's own data and other technologies, such as global positioning systems. Additionally, it transmits information through open (unencrypted) protocols, making it vulnerable to: Cyberattacks (attacks on data and digital information); Electronic interference (susceptibility to electromagnetic interference in the radio layer), which could compromise the integrity of the generated information and, consequently, operational safety; and Unauthorized use of transmitted aeronautical information.

2.3 The first aspect relates to cybersecurity risks, which could include data injection attacks, identity spoofing, data manipulation, and denial-of-service attacks. The second includes signal jamming, electromagnetic noise, spoofing of positioning sources, and interference (jamming). The third aspect could pose risks to personal privacy, unauthorized use, or publication of private data. Altogether, these risks could lead to hazardous situations for aircraft, ATC systems, airline credibility, and user privacy concerns.

2.4 To mitigate risks associated with the first two aspects, Colombia has been working on strengthening its surveillance systems. The country has implemented a comprehensive strategy that combines multiple layers of information protection, including technological infrastructure (hardware), the development and analysis of information systems integrating big data and artificial intelligence technologies to enhance trust in information (software).

2.5 Regarding technological infrastructure (hardware), Colombia has begun integrating multi-sensor surveillance systems through a triple-layer strategy, which integrates primary, secondary, and ADS-B sensors. This strategy is designed based on high-flight-density areas, allowing multi-sensor correlation processes through ATM systems. Additionally, physical security measures for communications and ATN networks have been reinforced through firewalls and intelligent monitoring systems. These approaches ensure redundancy, reliability, availability, and continuity of information for air traffic service provision.

2.6 Regarding the second layer (software), efforts are being made to develop computing systems that leverage multiple data sources. By integrating big data and artificial intelligence, ATM systems can develop functionalities that enable traffic characterization and automatic anomaly detection in information. This ensures a new level of confidence in data, based on the prediction of unusual patterns, altitude discrepancies, and sensor position variations, according to permissible accuracy tolerances and data arrival times. These systems can even detect false messages, improving information synergy and trust for ATC services.

2.7 Regarding the third aspect, a discussion among States is proposed on limiting the use of ADS-B-generated aeronautical information from a regulatory or legislative perspective, depending on each country. This discussion should help clarify the balance between aeronautical data privacy, the right to commercial exploitation by private entities, and the security and privacy of aircraft, especially for private and state aviation. Additionally, it should address the legal protection mechanisms necessary to uphold these rights in accordance with national regulations.

2.8 This issue arises from the increasing commercial exploitation of aeronautical data, such as ADS-B information shared through commercial platforms, raising serious concerns about its impact on aviation security and user privacy. The lack of encryption and broadcasting nature of ADS-B make flight information, including aircraft position and unique identification, publicly accessible. This could compromise operational security and passenger privacy. It is crucial that the aviation community, States, and private companies collaborate to establish standards and mechanisms that regulate access and use of this information, ensuring privacy and security without undermining ADS-B’s benefits.

2.9 Regarding legal and regulatory aspects, a discussion is proposed between States, operators, and private companies that publish aeronautical data to determine appropriate measures within national legislations and through civil aviation authorities to ensure personal and private data protection from unauthorized publication, in line with each country's laws.

2.10 It is essential to address the security and privacy risks for passengers that may result from the unauthorized disclosure and commercial use of aeronautical information on online platforms. Only through constructive dialogue with data management companies and effective aviation information regulation can the online exploitation of such data be mitigated. This will help guarantee privacy and security for flights and their occupants, particularly in private and state aviation.

2.11 Colombia's comprehensive ADS-B information security strategy aims to enhance aviation operational security by protecting against cyber threats and electronic interference, while also establishing limits on the use of public aeronautical data in private applications. This is intended to safeguard user privacy and national security. The integration of surveillance sensors, analytical tools, and a robust legal framework will allow a more effective response to unexpected events, ensuring the continuity of air traffic control services. This holistic approach protects information at physical, cyber, and legal levels, addressing the multidimensional threats faced by modern aviation.

2.12 In conclusion, while ADS-B is an essential tool for air traffic management, it also presents vulnerabilities that require State attention. A comprehensive strategy combining technological advancements, data analysis, and legal frameworks is crucial to protect information and privacy. Additionally, mechanisms should be developed to regulate ADS-B data usage, particularly concerning the commercial disclosure of private and state aircraft data, to safeguard user privacy and prevent security risks to States.

3. Suggested Action

3.1 The meeting is invited to:

a) Recommend ICAO to analyze big data and artificial intelligence technologies as predictive mechanisms for automatic monitoring of ADS-B data quality and establishing a confidence value derived from correlating ADS-B accuracy with other surveillance systems.

b) Recommend ICAO to analyze and promote the use of multisensory surveillance systems to ensure redundancy in surveillance technologies as part of the robust technological infrastructure required for ATC services.

c) Encourage ICAO and States to develop national regulations establishing clear rules for access, publication, and private use of ADS-B aeronautical information to protect privacy and security while maintaining the benefits of ADS-B technology.

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