



ICAO

International Civil Aviation Organization
North American, Central American and Caribbean Office

**NAM/CAR/SAM Workshop on the Development of the regulation for the implementation of
Automatic Dependent Surveillance – Broadcast (ADS-B) (ADS-B-Imp)**
ICAO NACC Regional Office, Mexico City, Mexico, 17 to 21 July 2023

Summary of Discussions

Date	17 to 21 July 2023
Location	ICAO NACC Regional Office, Mexico City, Mexico
Participants	The Workshop was attended by 73 delegates (in person and virtual) from 23 States/Territories and 3 International Organizations from the NAM/CAR/SAM Regions. The list of participants is shown in the Appendix A .

1. Objectives

1.1 This workshop aimed to support States who have already implemented Automatic Dependent Surveillance – Broadcast (ADS-B) stations in the development or review of their regulation in order to conclude this implementation. In addition, this event provided continuity to Conclusion GREPECAS/20/03 through which a "Study on operational priorities for the implementation of ADS-B and aspects of the use of ADS-B in ATC units" is requested, thus supporting the operational use of this facility.

2. Introduction

2.1 ICAO, through Mr. Julio César Siu, Acting Director of the Regional Office for North America, Central America, and the Caribbean, welcomed all the participants to the workshop and emphasized the importance of ADS-B implementation. and the benefits that this implementation brings not only to the States, but to the NAM/CAR Regions.

2.2 Mr. Eddian Mendez, Regional Officer, Air Traffic Management and Search and Rescue (RO/ATM/SAR) emphasized the importance of ADS-B for the management of air traffic control operations.

2.3 Finally, Mr. Alejandro Rodríguez, representative of United States , rapporteur of the Surveillance Task Force of the North American, Central American and Caribbean Working Group (NACC/WG/SURV), shared the importance of the work carried out since the management of the SURV Group in different events and that the workshop would be of enormous benefit for the States to acknowledge of lessons learned regarding the implementation and regulation of ADS-B to take advantage of this information on their own implementation. He invited the delegates actively participate in the workshop.

3. Workshop Schedule and Activities

3.1 The workshop schedule and documentation are located in the webpage:

<https://www.icao.int/NACC/Pages/meetings-2023-adsb.aspx>

4. Workshop Development

4.1 ICAO shared the importance of the Global Air Navigation Plan (GANP, Doc 9750) as it is ICAO's highest level air navigation strategic document and the plan to drive the evolution of the global air navigation system, in line with other important documents such as the Global Air Traffic Management Operating Concept (GATMOC, Doc 9854), Manual on Air Traffic Management System Requirements (Doc 9882) and the ICAO Global Aviation Safety Plan (GASP) and the Global Aviation Security Plan (GASEP).

4.2 ICAO indicated that ADS-B is an element of the technology common thread, integrating the Alternative Surveillance (ASUR) module, first element of Block 0 (B0/1).

4.3 The importance of the work on the implementation of the different enablers that, according to the GANP, allow an effective and successful implementation of ADS-B, was explained:

1. Earth system infrastructure
2. Aircraft system capacity on board (avionics)
3. Training
4. Legislation/Regulation

4.4 The States developed a work to evaluate the level of implementation of each of the enablers in their own national implementation and indicated:

- the need for the involvement of all stakeholders
- their challenges in terms of the geography of their States and the need to cover all their airspace with comprehensive surveillance coverage
- the need to obtain reliable data not only on the capacity of commercial aircraft, but also on general aviation aircraft
- that they should improve and update the objectives for the implementation of ADS-B
- the technical requirements and standards applied to ADS-B and the need for States to ensure that they comply with the requirements for the implementation of ground infrastructure.

4.5 Information on previous ADS-B events carried out under the auspices of the ICAO NACC and SAM Regional Offices was shared with the participants, indicating that it is important for States to review this documentation, since the events have been progressive. and important information has been shared which States should take into account in their ADS-B implementation planning process. The information is found under the following link:

<https://www.icao.int/NACC/Documents/Meetings/2023/ADSB/ADS-BImp-02.pdf>

4.6 The Air Navigation Services Corporation (COCESNA) shared with the participants the development process of the Central American States and COCESNA itself in the implementation of ADS-B.

4.7 COCESNA indicated that its objective with the implementation of ADS-B has been the development of a comprehensive investment plan and has modernized the Air Navigation Systems of

Central America, which include the Area Control Centres, the Approach Control Office (APP), the Aerodrome Control Towers (TWR), as well as the ground-based surveillance sensors that include mode S radars with ADS-B capability, ADS-B systems and a Wide Area Multilateration System (WAM) with ADS-B capability, which has made it possible to have dual radar + ADS-B surveillance coverage in radar and satellite-based ADS-B spaces in the Pacific oceanic airspace, for the use and benefit of COCESNA and its Member States.

4.8 After its presentation, COCESNA provided the following recommendations:

- Publish the use of ADS-B as a secondary surveillance source in radar airspace according to the roadmap and as a phase prior to the mandatory use of ADS-B avionics, considering the degree of implementation of ADS-B enablers.
- States should revise the 24-bit code request and assignment procedures, incorporating additional on-board equipment information, notifications and code release in the records; such modification could be done by means of an Aeronautical Information Circular (AIC).
- Based on the information gathered from ADS-B, notify operators whose transponders do not present a correct 24-bit code, so that they can request and update the code in the equipment, including notifying the Civil Aviation Authorities of those aircraft identified with foreign registration and that present a national 24-bit code for the corresponding adjustments.
- In the case of establishing a mandate for a registry of unequipped aircraft, the deadlines for their equipment should be considered given the capacity of the existing workshops, suppliers, among other aspects.
- It is necessary to maintain control and follow-up at the regional level of the assignment of surveillance data sources with their System Identification Code (SIC)/System Area Code (SAC) as established by ICAO.
- It is necessary to continue with the support of the Member States, identifying the workshops that carry out transponder installation work with ADS-B capabilities, the approximate cost, the equipment available and the estimated duration of the work.
- Focus on the implementation of 1090 ES ADS-B and discourage the installation of Universal Access Transceiver (UAT)-based avionics (not included in the regulations), considering the experiences of other States and the complexity of managing this signal. This will require modification of existing regulations.
- Continue with implementation plans, generating the required regulations, coordinating with adjacent Air Traffic Control Centres (ATCs) and, to the extent possible, harmonizing implementation deadlines so that there is only one implementation deadline in the Central American subregion.

4.9 United States detailed important information about ADS-B implementation under its presentations: avionics and ground and the ADS-B regulatory process.

4.10 United States, through the lessons learned based on its implementation and experience, indicated that:

- there is a need to work through the appropriate processes to ensure all safety and operational requirements are being addressed and met, this includes development of any guidance or training material that may be needed for the Air Traffic Controllers
- it is do not necessary to wait until the publication of your regulation to begin working on implementation and deployment of ADS-B infrastructure (if applicable) and addressing avionics certification or aircraft installation barriers.
- both of these items will come up as part of your industry engagement.
- Universal Access Transceiver (UAT) for ADS-B Out adds additional complexity to your implementation.
- consider the need for developing a monitoring tool.

4.11 Options for the application of the regulation according to the lessons learned from the United States:

1. FAA's regulation was published in May 2010 with a January 2020 compliance date
 - Both airlines and general aviation wanted to ensure that the FAA ADS-B ground system was deployed and operational before they committed to equipping
 - Airlines stated that they needed 5-6 years to equip (though they did it in less time)
 - Compliance date was established assuming that FAA ADS-B ground system would be fully deployed by the end of 2013, allowing 6 years after that for aircraft operators to equip
 - FAA worked with general aviation stakeholders to develop an ADS-B Out equipage rebate program for single-engine piston-powered aircraft – from 2016 to 2018, FAA spent \$10M to incentivize ADS-B Out equipage of 20,000 aircraft
 - FAA Lesson: General aviation community can take the longest to equip, due to individual aircraft operators making independent decisions about when to visit a repair shop for equipage installation (shop capacity and equipment certification for specific aircraft can limit the equipage rate)

2. FAA's regulation affected all airspace at once
 - If FAA hadn't sponsored some avionics development activities, the community might not have achieved the compliance date
 - United States would have benefited from an earlier "forward-fit" (new aircraft) compliance date, as it would have encouraged all avionics companies to create products more quickly, allowing more time for retrofit activity
 - FAA Lesson: consider earlier compliance date for new aircraft versus current aircraft

- FAA Lesson: Original United States ADS-B regulation did not allow for certain operations of State aircraft to be performed without ADS-B; regulation was amended in 2019 to allow “national defense, homeland security, intelligence or law enforcement” operations to operate without ADS-B active when “transmitting would compromise the operations security of the mission or pose a safety risk...”
- FAA Lesson: Original United States ADS-B regulation did not explicitly address RPAS operations; the US ADS-B regulation was amended in 2021 (https://www.faa.gov/sites/faa.gov/files/2021-08/RemoteID_Final_Rule.pdf) to prohibit unmanned aircraft operations with ADS-B Out equipment “unless the operation is conducted under a flight plan and the person operating that unmanned aircraft maintains two-way communication with ATC; or the use of ADS-B Out is otherwise authorized by the Administrator.”
- FAA Lesson:
 - FAA specified the required use of ADS-B v2 (DO-260B/ED-102A) and “incorporated by reference” the MOPS for 1090ES and UAT
 - FAA must amend our regulation whenever ADS-B avionics standards change (example: ADS-B v3)

4.12 **Appendix B** presents the Table "ADS-B Implementation Action Plan Project Plan Development" developed by the NACC Regional Office, which integrates a list of requirements to be considered when carrying out an ADS-B implementation project.

5. Results/Recommendations

5.1 The implementation of ADS-B is a complex process, which integrates many areas of aviation that must work together to achieve a successful implementation. Based on the results of this Workshop and the presentations made by the participating States, the following recommendations are provided:

Design of the ADS-B Implementation Project

Recommendation 1: The implementation of ADS-B is a project, which as such must have specific development objectives and goals. Considering that ADS-B supports the provision of Air Traffic Services and operational applications, it is necessary that these objectives are clear to all project participants.

Recommendation 2: In the State, a multidisciplinary group shall be created that integrates the technical, operational, safety, and other administrative, financial, and legislative requirements from the beginning of the project.

Recommendation 3: The integration in the project of all the interested parties; in this regard, it is important that an analysis of who and why should be integrated into the project be carried out. The stakeholders may vary from State to State and therefore an analysis by the State is necessary to include everyone within the implementation project.

Recommendation 4: Establishment of a clear leadership for the development of the project, also indicating the role and responsibilities of each one of those involved in the development of the implementation.

Recommendation 5: Create a project development roadmap, indicating the clear involvement of each of the participants, as well as their roles and responsibilities and the development schedule.

Technical criteria to consider

Recommendation 6: Carry out an ADS-B coverage analysis that allows the identification of the scope of the implementation on the ground to fulfil the objectives of the project.

Recommendation 7: Integrate the analysis of other technical requirements for the operation of ADS-B stations, such as communications, energy, security, cybersecurity, maintenance logistics, among others that may vary according to the implementation, implementation site, and terrain characteristics.

Recommendation 8: For the definition of the technical/operational criteria, the integration requirements between the different ground systems, technical characteristics, integration protocols, verification, validation and certification criteria of the data must be taken into account before its processing in the ATC Control Centre and criteria for monitoring the data during its presentation at the control positions, to ensure the quality of the information.

Avionics criteria

Recommendation 9: Having statistics of the avionics version of the commercial and general fleet, and including the military part is important to define the implementation requirements. In the different presentations provided by the States, a clear and high percentage of aircraft capable of version 2 (DO-260B) was identified. In this sense, the States should benefit from this advantage and direct their implementation and the development of the legislation using as a minimum requirement that the aircraft be equipped with this version.

Other important factors to consider

Recommendation 10: The ADS-B implementation process must integrate a clear identification of the implementation benefits and accompany them with a measurement process that ensures measurement data before and after the ADS-B implementation.

Recommendation 11: Other information must also be integrated into the ADS-B implementation process, such as risk analysis, feasibility analysis, benefit analysis, safety analysis, financial and human resources, among others, that provide information that is integrated into the project, to ensure its success. A follow-up mechanism for the implementation of the project must also be implemented to allow the activities to be adjusted according to the development of the project.

Recommendation 12: Finally, the development of legislation is a process that must be carried out from the beginning of the development of the project, taking into account all the factors listed above, incorporating the different interested parties and establishing correct communication mechanisms that allow the establishment of clear regulations for all.

6. Achievements

6.1 The information provided during the event provided important knowledge about the lessons learned from the States on the ADS-B implementation process, and also allowed the participating States to better identify the necessary, multidisciplinary requirements to carry out a correct implementation of this function.

APPENDIX A/APÉNDICE A



North American, Central American and Caribbean Office (NACC)
Oficina para Norteamérica, Centroamérica y Caribe (NACC)

NAM/CAR/SAM Meeting Workshop on the Development of the regulation for the implementation of Automatic Dependent Surveillance – Broadcast (ADS-B)
Taller NAM/CAR/SAM sobre el Desarrollo de la regulación/normativa para la implementación de la Vigilancia Dependiente Automática – Radiodifusión (ADS-B)
(ADS-B-Imp)

ICAO NACC Regional Office, Mexico City, Mexico, 17 to 21 July 2023 /
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APPENDIX B/APÉNDICE B



North American, Central American and Caribbean Office (NACC)
Oficina para Norteamérica, Centroamérica y Caribe (NACC)

NAM/CAR/SAM Workshop on the Development of the regulation for the implementation of Automatic Dependent Surveillance – Broadcast (ADS-B)

17-21 July 2023

**ADS-B IMPLEMENTATION ACTION PLAN
PROJECT PLAN DEVELOPMENT**

ADS-B IMPLEMENTATION		
Why? the main purpose is that it provides a summary of the essence of the element for the operational elements, and information of the direct relationship of the performance.	What? description of what stakeholders can do with this element that could not be done before. This section is not intended to describe performance enhancement or benefits	How? additional information to improve the understanding of the element.
<ul style="list-style-type: none"> - Define Objective 	<ul style="list-style-type: none"> - Define stakeholders - Integrate all stakeholders in the project - Define action plan - Define benefits 	<ul style="list-style-type: none"> - Case study - Technical evaluation - Risk analysis - Cost benefit analysis - Business and safety case - Schedule - Implementation Strategy - Others
Relationship of the performance (Key performance indicators)		
“What cannot be measured cannot be improved”		
KPI01 Departure punctuality	KPI09 Airport peak capacity	KPI17 Level-off during climb
KPI02 Taxi-out additional time	KPI10 Airport peak throughput	KPI18 Level capping during cruise
KPI03 ATFM slot adherence	KPI11 Airport throughput efficiency	KPI19 Level-off during descent
KPI04 Filed flight plan en-route extension.	KPI12 Airport/Terminal ATFM delay	KPI20 Number of aircraft accidents
KPI05 Actual en-route extension	KPI13 Taxi-in additional time	KPI21 Number of runway incursions
KPI06 En-route airspace capacity	KPI14 Arrival punctuality	KPI22 Number of runway excursions
KPI07 En-route ATFM delay	KPI15 Flight time variability	KPI23 Number of airprox/TCAS alert/loss of separation/near midair collisions/midair collisions (MAC)
KPI08 Additional time in terminal airspace	KPI16 Additional fuel burn	

ADS-B ENABLES

1. Infrastructure

Ground system infrastructure: The type of infrastructure to be implemented can depend on different factors (e.g., Terrain, operational requirements, coverage requirements, avionics compatibility, etc.)

Element	Technical Needs	Standards and technical information to incorporate in the analysis
ADS-B ground stations receive information from aircraft and transmit it to one or more service	<ul style="list-style-type: none"> - Technical requirements - Evaluation terrain - Communication needs (main and back-up needs) - Energy needs - Security - Maintenance logistics - Others according to implementation 	<ul style="list-style-type: none"> - ICAO Annex 10 Volume IV Chapters 2,3 and 5 - ICAO Doc 9871 Technical Provisions for Mode S Services and Extended Squitter - RTCA/EUROCAE MOPS: DO-260/ED-102, DO-260A, or DO-260B/ED-102A EUROCAE ED-129, ED-129A or ED-129B - ICAO Doc 9924 Aeronautical Surveillance Manual
Service Delivery Point(s) for ADS-B information	<ul style="list-style-type: none"> - Technical requirements - ATC integration protocols - Surveillance system purpose and scope - Definition of parameters contributing to quality of services - Components of an aeronautical surveillance system - Definition of parameters contributing to quality of services. - Monitoring system. - Surveillance data evaluation - ATC alarms 	<ul style="list-style-type: none"> - ICAO Doc 9924 Aeronautical Surveillance Manual. - ICAO Doc 4444 PANS ATM
Human Machine Interface (HMI) of the Air Traffic Controller Working Position (ATCo CWP)	<ul style="list-style-type: none"> - Integrate technical language. - Integrate in the HMI operational requirements. - Integrate HMI for technical needs. 	<ul style="list-style-type: none"> - ICAO Doc 9924 Aeronautical Surveillance Manual. - ICAO Doc 4444 PANS ATM
2. Aircraft Avionics		
SSR Mode S transponder with extended squitter version 0, version 1 and version 2.	Three versions of ADS-B: <ul style="list-style-type: none"> - Version 0 = DO-260/ED-102 - Version 1 = DO-260A - Version 2 = DO-260B/ED-102A 	<ul style="list-style-type: none"> - ICAO Annex 10 Volume IV Chapter 2,3 and 5 - ICAO Doc 9871 Technical Provisions for Mode S Services and Extended Squitter - RTCA/EUROCAE MOPS: DO-260/ED-102, DO-260A, or DO-260B/ED-102A - ICAO Doc 9924 Aeronautical Surveillance Manual

<p>Basic Aviation GNSS receiver with RAIM *Receiver autonomous integrity monitoring (RAIM)</p>	<p>Position source. Basic Aviation GNSS receiver with RAIM. Receiver Autonomous Integrity Monitoring (RAIM) provides integrity monitoring of GPS for aviation applications. In order for a GPS receiver to perform RAIM or fault detection (FD) function, a minimum of five visible satellites with satisfactory geometry must be visible to it</p>	<ul style="list-style-type: none"> - Technical performance requirements of either [E]TSO-C129, or [E]TSO-C196, or [E]TSO-C145/-C146. (Note that the US/Europe and equivalent ADS-B mandates require more – see FAA AC 20-165 or EASA CS-ACNS)
<p>Training requirements ADS-B implementation</p>	<ul style="list-style-type: none"> - Technical training - Operative training - Inspector training - Aircraft certification training - Other according with the different stakeholders and project scope. - Training basic on operational procedures - Others 	<p>ICAO Doc 8071 Manual on Testing of Radio Navigation Aids.</p> <ul style="list-style-type: none"> - Volume I - Testing of Ground-based Radio Navigation Systems - Volume II - Testing of Satellite-based Radio Navigation Systems - Volume III - Testing of Surveillance Radar Systems
<p>Legislation/regulation</p>	<ul style="list-style-type: none"> - CNS implementation Strategy - Rules - Technical information (data) - Operational procedures - Aircraft requirements 	

— END/FIN —