INTERNATIONAL CIVIL AVIATION ORGANIZATION

NACC AND SAM REGIONAL OFFICES

NAM/CAR/SAM MEETING/WORKSHOP ON THE IMPLEMENTATION OF AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B)
(ADS-B/IMP)

(Lima, Peru, 13 to 16 November 2017)

SUMMARY OF DISCUSSIONS

Presented by the Secretariat November 2017

NAM/CAR/SAM AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B) IMPLEMENTATION MEETING/WORKSHOP (ADS-B/IMP)

SUMMARY OF DISCUSSIONS

Date: 13 to 16 November 2017

Venue: Lima, Peru

Participants: The Meeting/Workshop was attended by 51 representatives of 19 States from the NAM/CAR/SAM Regions, 1 International Organisation of the Regions and 6 companies. The list of participants appears in the **Attachment** to this document.

1. Introduction

1.1 Upon reviewing the projects of the CAR/SAM Planning and Implementation Regional Group (GREPECAS) Automation and ATM Situational Awareness Programme, the Fourth Meeting of the GREPECAS Programmes and Projects Review Committee (PPRC/4), held in Lima, Peru, on 12-14 July 2016, recognised the agreement to hold a NAM/CAR/SAM meeting/workshop in 2017 on the implementation of automatic dependent surveillance - Broadcast (ADS-B).

1.2 The objective of the workshop was to assist the States in the implementation of ADS-B, in accordance with the goal established in the Regional Performance Objectives (RPOs) concerning situational awareness (Module B0-ASUR and B0-SURF), as specified in the NAM/CAR Regional Performance-Based Air Navigation Implementation Plan (RPBANIP) and the Performance-Based Air Navigation Implementation Plan (PBIP).

1.3 This event supported the implementation of the following modules of Block 0 of the Aviation System Block Upgrades (ASBU) contemplated in the NAM/CAR and SAM regional plans, B0 *SURF – Safety and efficiency of surface operations;* Module B0 ASURF – *Initial ground surveillance capacity, and* B0 SNET – *Greater efficiency of ground safety nets.*

2. Conduction of the Workshop/Meeting

2.1 The workshop was delivered in 5 work sessions through 33 presentations. All the presentations are posted on the following website https://www.icao.int/SAM/Pages/ES/MeetingsDocumentation_ES.aspx?m=2017-ADSB

***SESSION 1:* ICAO STANDARDS, DOCUMENTATION AND GLOBAL AND REGIONAL ADS-B IMPLEMENTATION PLANS**

Three presentations were made in this session

2.2 In **Presentation 2**, ICAO offered an overview of the Global Air Navigation Plan (GANP), fifth edition (2016), and of the aviation system block upgrades (ASBU) framework, describing in detail the modules in Blocks 0, 1 and 2 related to surveillance.

2.3 In **Presentation 3**, ICAO also provided surveillance information related to the CAR/SAM Air Navigation Plan (Doc 8733 - *Caribbean and South American Regions*), the NAM/CAR and SAM Regional performance-based plans (RPBANIP and PBIP), the GREPECAS organisation, and its implementation in the NAM/CAR and SAM Regions.

2.4 A list of ICAO Annexes and documents containing technical information on ATM surveillance systems in ATS units, concerning technical, operational, and training aspects, was presented by ICAO through **Presentation 4**.

SESSION 2: **STATUS OF IMPLEMENTATION AND FUTURE DEVELOPMENT OF SPACE-BASED ADS-B EQUIPMENT AND EXPERIENCE IN THE USE OF ADS-B SYSTEMS IN THE REGION**

2.5 In this session, 7 presentations were made by BOEING, EMBRAER, NAV CANADA, AIREON and United States, in that order.

2.6 **Presentation 6**, prepared by BOEING, was delivered by the Secretariat since the Boeing representative could not attend the meeting. The Presentation highlighted compliance by Boeing with global mandates requiring the installation of avionics for ADS B. It also noted that Boeing had already implemented the standard version DO-260 B in its 737 NG, 747-8, 767, 777, and 787 fleet. Boeing was working with the Air Navigation Services Providers (ANSPs) to ensure common avionics requirements and global harmonisation, and was participating in ADS B IN tests and demonstrations.

2.7 In order to improve efficiency, reduce costs and increase airspace capacity, a higher safety level needs to be attained. In this regard, through **Presentation 7**, EMBRAER noted that ADS-B played a very important role, and EMBRAER had supported technology through its participation in regulatory mandates, pooling efforts with the industry in the working groups to define new standards, encourage debates with the providers, operators and regulators, monitoring field data to improve the system, and pioneer new developments.

2.8 The first development of ADS-B (DO-260A) in EMBRAER came after the launching of EASA standard AMC 20-24 (ADS-B out for non-radar areas) in 2008. Airworthiness certification was approved in EMBRAER E-Jet models in 2010. Also in 2010, an upgrade was started in order to comply with the new ADS-B standard, DO-260B, and FAA AC 20-165. The DO-260B airworthiness approval for E-Jets and Lineage 1000E models was published in 2012. The Legacy 600/650 has had the DO-260B approved since 2013. The DO-260 B for EMBRAER aircraft models Phenom 100/300 and Legacy 450/500-260B was approved in 2016. The ERJ-145 model was expected to have ADS-B with DO-260B approved by the end of 2017.

2.9 All ADS-B implementations in EMBRAER aircraft use, as the positioning source, the SBAS and the basic GNSS directly connected to the transponders. Low latency and high availability of the GPS signal is provided. The transponder is compatible with the specifications of FAA AC 20-165 and EASA CS - ACNS. Regarding ADS-B IN, EMBRAER does not see any mandate being applied anywhere in the world. However, some moves in the direction of the potential benefits for equipped aircraft have been observed (best equipped, best served). E-jets have some provisions, although not yet approved, for AIRB, IM-S, CAVS, and ITP applications. E-Jets E2 will also have AIRB installed on an optional basis and provisions for VSA, SURF, and ITP.

2.10 At present, ADS-B technology is mature for air traffic control and can significantly improve safety in airspace control. In this sense, EMBRAER jets are ready to support any future mandate on this issue. However, in order to obtain the benefits of this technology, all aircraft in designated airspace must be equipped with the ADS-B OUT system, which will require a mandate to ensure fleet uniformity. Based on lessons learned with other mandates, special attention should be placed on the time required to upgrade the ground infrastructure and the development of a mandate requiring ADS B on board aircraft in order to prevent casting discredit on the plan and the benefits.

2.11 To this end, the creation of an open forum with all the aeronautical community for anticipating and resolving possible issues would be very useful to ensure the transition.

2.12 In the **Presentation 8**, which was delivered through teleconference, United States noted that in 2010, the United States Federal Aviation Administration (FAA) had published a requirement for all aircraft operating in a given airspace to be equipped with automatic dependent suveillance – Broadcast (ADS-B) Out technology as of 1 January 2020, in accordance with Title 14 of the US Code of Federal Regulations (14 CFR), sections 91.225 to 91.227. This requirement will affect all flights in designated airspace.

2.13 Many airlines had previously equipped their aircraft with Global Positioning System (GPS) as part of the transition to satellite navigation. However, this early intallation did not include the more modern GPS receivers. The early-generation GPS receivers can experience brief interruptions, below the performance required by the FAA for ADS-B Out. Aircraft manufacturers are upgrading GPS receivers in their aeronautical models, but specifying that these receivers will not be available until 2018/2020. The operators must install ADS-B Out by 1 January 2020, using last-generation GPS equipment rated for ADS-B. The FAA approved a limited five-year exemption (Exemption 12555).

2.14 The FAA maintained a database of ADS-B avionic solutions offered by commercial and general aviation aircraft manufacturers http://www.faa.gov/nextgen/equipadsb/adsb_ready. The FAA publishes ADS-B out equipage levels by type of link (1090ES, Universal Access Transceiver (UAT), dual) and industrial segment (GA, airline, etc.), showing the number of aircraft equipped to meet ADS-B requirements at http://www.faa.gov/nextgen/equipadsb/levels

2.15 In the **Presentation 9**, the workshop was provided with an overview of the expanded surveillance coverage of Air Traffic Services (ATS) in Canada and part of the ICAO North Atlantic Region. This Presentation focused on the importance of planning specific safety, efficiency or capacity improvements based on the requirements of airspace users and ANSPs. A requirement-based planning approach guarantees that the appropriate technologies will be used and that the stakeholders, including the regulator, will understand and agree on the required performance for communication and ATS systems and on-board avionics.

2.16 When NAV CANADA needed to expand the ATS surveillance coverage over the Hudson Bay, a large body of water crossed by polar and North Atlantic traffic, they consulted with the operators, who suggested using ADS-B, which would be much less expensive than radar. They coordinated with Airservices in Australia that already had ample experience with ADS-B. Thus, NAV CANADA benefitted from their experience and avoided some of the issues they had encountered. If the neighbouring ANSPs were already using ADS-B, coordination with them would be easier and mutual benefits would be derived from increased interoperability.

2.17 NAV CANADA currently uses a combination of radar, ground-based ADS-B, and multilateration, and is planning to implement space-based ADS-B. Traffic along the polar and North Atlantic zone is increasing and efficiency and capacity problems will arise unless air traffic management methods are implemented. At present, oceanic and Northern traffic must be separated using procedural standards, which are very high, in the order of 60 NM laterally and 80 NM longitudinally. The installation and maintenance of ground-based infrastructure is difficult and expensive in the northern and mountainous areas of Canada, and impossible in the North Atlantic.

2.18 Space-based ADS-B is simply ADS-B; it is ATS surveillance. Wherever there is Very High Frequency (VHF) voice, NAV CANADA will apply a 5-NM separation between aircraft. ICAO is developing smaller procedural separation standards for using space-based ADS-B for positioning and Controller-Pilot Data Link Communications (CPDLC) for communication purposes. NAV CANADA is planning to use these standards on a trial basis in Canada and the North Atlantic until they are published in the Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM; Doc 4444). ICAO will also develop targeted separation for use with CPDLC. This is necessary because space-based ADS-B means that there will be global ATS surveillance.

2.19 Consultation with, and participation by, stakeholders are critical for deriving benefits from the implementation. Aircraft operators must properly equip the aircraft and train flight crews. It might be necessary to change flight planning and operational methods in order to take advantage of enhanced ATS services. The regulator might need to change the wording of ATS regulations to allow for the use of both ADS-B and radar. The regulator will need to certify aircraft and operators. The technical and maintenance personnel of operators and ANSPs may need to learn new systems and procedures. Coordination and operational arangements with neighbouring ANSPs may need to be updated.

2.20 The safety measure must be planned from the beginning. An interesting benefit that is foreseen from space-based ADS-B is that it would significantly reduce the estimated vertical collision risk in the North Atlantic, making it fall below the target level of safety for the first time in many years. Real-time positioning data permit detection of errors and deviations as soon as they occur. If aircraft are equipped with DO-260B, it would even be possible to fully prevent vertical error, using the selected altitude.

2.21 Everybody must undertand the implementation objectives and work towards the attainment of such benefits. Expected benefits must drive planning and actions by all stakeholders, or the project will be “implementation just for the sake of implementation”. Such an approach is unlikely to deliver the benefits that everybody deserves.

2.22 **Presentation 10** provided information on the activities carried out by Airservices Australia, which stated that it had been using ADS-B for more than a decade, and had completely changed the nature of air traffic control (ATC) in the country. Safety and efficiency had improved and were strongly supported by the industry. Australia has been using ADS-B for several years for various applications, including:

- Five- and three-nautical mile separation services en route and in terminal areas, using all variants of DO-260
- Situational awareness and safety networks have improved in boundaries with coordination points and oceanic areas.
- Situational awareness has improved in 5 low-density control towers (for airborne aircraft)
- It has supported surface surveillance at airports with ASMGCS
- Reduced Vertical Separation Minimum (RVSM) monitoring
- Used in search and rescue

The Australia ATC is satisfied with ADS-B performance over the years.

2.23 Australia allows for the use of DO260 and SA-ON avionics, but supports the use of DO-260B and updates situational awareness based on these data. The ICAO APANPIRG supports this approach. Acceptance of DO-260 gained strong support from IATA and the airlines, because it allowed them to avoid expensive modification of avionics. States using DO-260 normally use flight ID to match ADS-B data with the flight plan, instead of the 4-bit SSR octal code. Accordingly, changes will probably be required in the ATC system.

2.24 Australia has published a number of mandates that are currently active, including:

- Prohibition of misleading transmission of ADS-B messages
- Requirement of ADS-B for operations above FL290
- Requirement of ADS-B for all IFR operations (with some exceptions)

2.25 A key to success in Australia was coordination with industry stakeholders for making critical decisions. For example, the industry formally wrote to the regulator requesting the mandate based on a shared vision of the industry, specifying “on what issues could an agreement be reached amongst all sectors”, and acceptance of the commitment.

2.26 The FAA delivered **Presentation 11** informing on the lessons learned from ADS-B implementation in the United States, highlighting the need to coordinate ADS-B implementation with all the aeronautical community (stakeholders), informing them about the changes being proposed, the cost and duration of the implementation, benefits and risks, so as to involve them in the implementation. In this regard, it presented a case study on this activity. For the 2020 ADS-B implementation programme, 5 groups were created: commercial airlines, general aviation, GPS receivers and rule-based performance implications, training and benefits, and installation and approval.

2.27 The FAA will maintain half of the existing secondary radars as backup for en-route and high-density terminal area operations. The FAA uses primary radars to mitigate avionic failures in aircraft. Risks include jamming of GPS signals and the generation of malicious surveillance signals (spoofing). Cost-benefit studies are required.

2.28 In the **Presentation 12**, the FAA presented its ADS-B ground infrastructure, the status of implementation of ADS-B in commercial and general aviation, standard and enhanced validation mechanisms for avionics and radar performance, as well as future activities, such as monitoring of the 2020 initiative.

SESSION 3: STATUS OF THE AIRCRAFT FLEET IN THE REGION, ADS-B DATA PROCESSING AND INTEGRATION SYSTEMS

In this session, 8 presentations were made, whose contents are summarised below:

3.1 In **presentations 13** and **28** (ADS-B, multilateration, and surface solutions), Indra described the architecture and design of its ADS-B and MLAT solutions, and its experience in the implementation of these projects. It shared key issues that States should take into account for this type of implementations. Regarding recommendations for MLAT implementation, it mentioned the need to define the volume where surveillance needs to be implemented so that MLAT antennae may properly cover the surface, define the traffic environment (Mode A/C, Mode-S, ADS-B), establish operational redundancy, and conduct a prior study.

3.2 In the case of ADS-B, Indra presented its experience in the development of several projects and the benefits obtained therefrom. It also presented new technologies, such as radar Mode-S/ADS-B, which is a surveillance radar that integrates both signals in the same surveillance system.

3.3 Surveillance solutions (Thales): In **Presentation 14**, Thales indicated that surveillance needs and operational limitations are specific to each implementation, and thus implementation solutions should be tailored to such needs.

3.4 Thales informed that, as a manufacturer, it could offer and support all the range of surveillance products and provide an individual solution to each need.

3.5 Thales offers "Multilateration and ADS-B Ground Surveillance" (MAGS) products; Asterix Category 21 ADS-B systems; centralised ADS-B systems with an ADS-B core processor (ADS-B sever); multilateration systems; MLAT systems for airports; and broad-area multilateration systems covering approach, TMA or en-route airspace.

3.6 All applications are based on the same hardware and software elements. The specific configuration determines the actual application. Each ground station can operate as MLAT or as ADS-B.

3.7 System elements and algorithms used in the MAGS product family provide outstanding performance, high sensitivity, maximum robustness, low maintenance requirements, and fail-safe operation, and have been tested in various implementations for aircraft separation in some of the busiest airspaces of the world.

3.8 Thales noted that it had developed rigorous testing, integration, and certification processes, and based on this valuable experience, had tailored its products to simplify implementation and integration, and to minimise risks.

3.9 For example, it offered system features and configurations to address real-life limitations:

- Variety of editions and selectable Asterix output formats to simply integration with ATM infrastructure
- ADS-B integrity/security functions to detect unlawful interference, such as identity theft, data tampering, jamming, etc.
- Resolution of the Mode 3/A code issue that was pending in old versions of the ADS-B transponder
- Selection of versatile multilateration processing algorithms with flexible configuration for optimum adaptation to local characteristics
- Efficient redundancy management in multilateration systems ("virtual WAM", also applicable to airport MLAT)
- A powerful set of tools to support performance modelling and system planning, as well as for performance assessment, and to compare the model with the reality
- Real-time performance monitoring
- Thales is ready to analyse solution options and support customers in their system planning process. They also offer workshops and training to get acquainted with the various technologies and specific questions.

3.10 Aireon delivered **Presentation 15** on the space-based ADS-B surveillance system, which will provide global real-time surveillance data on ADS-B-equipped aircraft in all DO-260 variants, in all airspaces, including areas without effective surveillance, such as oceanic and remote areas (polar and mountainous areas, big deserts, and large forests), where it is currently impossible or unfeasible to install radars or ADS-B ground stations.

3.11 The system is based on a constellation of Iridium NEXT new-generation satellites consisting of 66 operational satellites, 9 orbiting spare satellites, and 6 spare satellites on the ground. At the time of the workshop, 3 successful launches of 30 satellites and test flights had been conducted. Satellite performance measurements showed that the technical requirements established for a surveillance system, based on industry standards, were met and exceeded. The constellation was expected to be complete and the satellite ADS-B system operational by mid-2018. Likewise, Aireon was in the process of obtaining the EASA’s certification as a surveillance data provider, which was expected to finalise by the third quarter of 2018.

3.12 The ground segment of Aireon consisted of a network of 5 teleports that received data from the satellites, 2 control centres in Virginia and Arizona, and 2 data processing and distribution centres in Virginia and Arizona, ensuring information redundancy.

3.13 In addition to the possibility of offering global surveillance, the satellite ADS-B system would provide significant benefits to the industry in terms of increased flight safety and operational efficiency improvements through the possibility of reducing (lateral and longitudinal) separation minima in both oceanic and ground areas, route optimisation with better flight and speed levels, and use of UPRs, resulting in time, fuel and carbon emission savings. Through this system, significant improvements were also expected in SAR operations, and Aireon was developing the Aireon ALERT system to provide, free of charge, the latest location of aircraft in distress, to facilitate their search by duly registered bodies. Registration will start the first quarter of 2018 through the Aireon website.

3.14 ANSPs will be able to use the satellite ADS-B system in different ways: as sole source of surveillance, as augmented surveillance system, supplemented by ground infrastructure, and as a contingency (redundant) system of ground systems.

3.15 The implementation of the system at air traffic control centres requires only a single delivery point (SDP), connected to two redundant telecommunication lines towards the data processing and distribution centre of Aireon. Aireon is analysing the possible distribution of surveillance radar data over the MEVA III and REDDIG II regional networks, seeking to:

a) Reduce the cost of system implementation at regional level
b) Share information at regional level for various applications: ATFM, Gestión de la Información de todo el Sistema (SWIM)
c) Use the space-based ADS-B system as a regional contingency system to reduce the impact of ground infrastructure failure due to weather or other adversities.

3.16 REDDIG II analyses have been completed, leading to the conclusion that it is possible to distribute satellite ADS-B surveillance data through that network to all REDDIG II member States, with the possibility of installing only 2 SDPs and distribute the information to the rest of ANSPs.

3.17 At the initiative of the SAM ATM Implementation Group (SAM/IG – Technical Cooperation Project RLA/06/901), a study will be conducted for submission to the forthcoming SAM/IG/21 meeting (May 2018), to analyse the convenience and feasibility of adopting the space-based ADS-B service proposed by Aireon in the Region. The ICAO SAM Regional Office will designate an expert to conduct the study, with the support of Aireon and the representatives of the States on the subject (ADS-B focal points).

3.18 The space-based ADS-B system has been included in the ICAO Global Air Navigation Plan and in the CAR/SAM regional air navigation plan. It will meet the expectations of ANSPs set forth in their CNS/ATM implementation plans, facilitating transition to the next ASBU phases and achievement of performance objectives for trajectory-based operations and the 4D flight concept. It will also significantly reduce the cost of surveillance infrastructure and training of technical maintenance personnel, since the infrastructure is much easier and inexpensive to acquire and maintain, as well as other costs involved (rental of areas/space, security, etc.).

3.19 In **Presentation 16** and **17**, Comsoft Solutions, member of the Frequentis group, noted that they had almost 30 years of proven experience in the conversion, distribution, and processing of surveillance data on which customers can rely. Comsoft Solutions Quadrant ADS-B and multilateration provide a simple solution for any ADS-B and secondary surveillance requirement, for operational requirements from ADS-B to more complex surveillance requirements, from the application of an ADS-B at a less frequented airport to complex control tower solutions, all through standard interfaces.

3.20 Higher airspace performance is achieved when the regulator, the ANSP, and the industry, work together, each sharing its experience. The ANSP knows its environment better and can better advise on the performance level required in its airspace or airport, based on which the industry can design the most appropriate surveillance solution, applying primary or secondary ADS-B or multilateration surveillance technology, through open interfaces. With the increased use of these standard interfaces, Comsoft Solutions products become a tool for the acceptance of new surveillance systems or centres, provide a solution for the provision of the correct surveillance data for the correct consumer, and can merge data from almost any surveillance data source.

3.21 All this technology is available and ready for implementation today. Therefore, there is no excuse to postpone its implementation.

3.22 In **Presentation 18** (Use of tools to measure service levels), Indra explained the operation of its tool based on Eurocontrol specifications for ATM surveillance, containing surveillance data quality assurance parameters. It explained its operation, surveillance data assessment, and services provided by the tool.

3.23 The assessment system is automated, does not require human intervention, conducts a continuous 24h real-time analysis of services, provides incidence monitoring, early deviation warning, access to results through web interface from anywhere in the world, storage of all the data of the surveillance system, and can be used for looking into system malfunctions.

3.24 In **Presentation 19** (Software tools for assessing surveillance system services), COCESNA informed about the software tools used by COCESNA to assess the performance of aeronautical surveillance systems used by COCESNA and member States for ATC services and which have been obtained through cooperation agreements with the FAA and Eurocontrol, in addition to the automated surveillance sensor quality assurance system (PASS) acquired through support contract from INDRA, for the conduction and continuous publication (H24) of analyses performed using Eurocontrol SASS-C software.

3.25 An assessment is currently being made of radars of COCESNA, member States, radars shared with adjacent Flight Information Regions (FIRs) and the new ADS-B systems that are being implemented.

SESSION 4: REVIEW AND UPDATING OF ADS-B ACTIVITIES BY NAM/CAR/SAM STATES

Ten presentations were made in this session

4.1 Argentina informed that ADS-B had not been installed and its installation was under study.

4.2 Barbados informed that a radar surveillance system had been recently installed. However, they were planning the implementation of 7 MLAT stations and 5 surface movement stations.

4.3 In **Presentation 20**, Bolivia informed about the national surveillance and automation project, consisting of the installation of 7 primary and secondary radar stations, and the installation of ATM automation systems in APPs and the national ACC. The project started in 2015, and is to be completed by 2019. Thales of France would be in charge of this implementation.

4.4 In **Presentation 21**, Brazil noted that 6 ADS-B stations had been installed so far to cover oceanic airspace in Campo Basin. Use of ADS B in this airspace will be mandatory by 2018 (segregated airspace). Likewise, there are plans to install 10 ADS-B stations in oceanic areas, in Santos and Espirito Santos, by 2021 and 2022, and 62 ADS-B stations in continental area by 2018-2021. Non-mandatory use of ADS-B.

4.5 In **Presentation 26**, Chile presented the results of an ADS-B implementation study, describing the advantages of ADS B in terms of equipment cost, maintenance, and energy savings, but considering that the geography of Chile required the installation of more than one receiver sensor, some in sites of difficult access. The percentage of aircraft with ADS-B technology is mostly limited to major commercial aviation, according to the year of manufacture. A large percentage of general aviation is not equipped and is not considering it because of its cost. Therefore, for the time being, ADS-B must be considered as a supplement to radar information. The development and implementation of the necessary regulations are under study, together with deadlines for requiring on-board ADS-B surveillance system for commercial aviation and general aviation, and the development of a project for ADS-B implementation in continental and maritime airspace to assess all information delivery options available, including the delivery of the space-based ADS-B signal by external providers.

4.6 In **Presentation 22**, **COCESNA** presented the progress made in the implementation of ADS-B technology in the Central American Region, which included the installation of ADS-B test receivers, installation of an ADS-B station in COCO island to improve surveillance in the southern part of the Central American FIR, upgrading of the seven en-route Mode S radars with digital receivers plus ADS-B, and replacement of mono-pulse radars of the States in TMAs with Mode S + ADS-B systems.

4.7 The upgrading of radars plus ADS-B allowed COCESNA to restart their lifecycle, improve their services through the digital receiver, optimise maintenance, and incorporate ADS-B technology. The need has been identified to update the area control centres to the last editions of CAT 21 for processing versions DO-260, 260A and 260B.

4.8 The need was identified in the Region, as a whole, to find a surveillance solution for oceanic airspace, in order to obtain operational improvements in surveillance and safety.

4.9 In the **Presentation 23**, Cuba described its experience in MLAT implementation through three projects:

- Varadero system. Conceived only for 20 miles, TMA and APP.
- Havana system. Conceived for 40 miles, TMA and APP.
- WAN system. Conceived for unifying both systems.

4.10 Cuba pointed out the advantages obtained through the implementation of the project:

- Easy to assemble, the antennae weigh only 3 to 4 Kg.
- Very easy to maintain at a very low cost.
- Very broad system that provides service to flights in the en-route and approach phases, surface control, and effective apron control.
- Under nighttime and rainy conditions, real-time control of aircraft and vehicles is very easy at the aerodrome.
- Low consumption of its facilities.
- Information refresh rate every second and user programmable.
- Each MLAT station has ADS-B 260 B for a distance of 500 km.
- Aircraft separation can be reduced.
- It is almost impossible to lose coverage due to failure.

4.11 And identified some disadvantages:

- It is complicated to ensure redundancy in communications.
- It is complicated to find station locations with good coverage and full mounting facilities (guaranteed power supply for communications).
- Very complex airports, like Havana, require many stations.

4.12 **Jamaica** noted that the State was completing a process to renew its ATS system, a project that included the renewal of surveillance systems, but not ADS-B.

4.13 In **Presentation** 31, Mexico noted that ADS-B implementation in Mexico obeyed to the need to increase safety and efficiency of air/ground operations, coverage redundancy, and surveillance in areas with no radar coverage.

4.14 Mexico expected to obtain a more efficient airspace and the application of arrival and departure routes for VFR flights with helicopters in the Mexico TMA; enhanced alert systems both in flight and on the ground; reduction of runway incursions; more efficient flight paths, especially in the Gulf of Mexico and remote areas; reduction in fuel consumption upon reducing CO2 emissions.

4.15 So far, SENEAM has installed 10 ADS-B stations in the following sites:

- 5 in the Mexico City valley (Toluca, Cerro Peñón, Cerro Catedral, Cerro Gordo airports and the Mexico ATC TWR):
- 1 in the radar station of Cerro Los Gallos, Aguascalientes (LGS).
- 1 in the southeast of Mexico, in Ciudad del Carmen (CME).
- 2 in the northeast of Mexico, at the Monterrey (MTY) airport and in the radar station of Cerro de Potosí (CPT).
- 1 at the radar station of Puerto Peñasco Sonora (PPE), in the northeast of Mexico.
- At present, there is a project to update the surveillance processing system software of the

four area control centres (ACCs):

4.16 The FAA ADS-B stations in Mérida (MID), Tampico (TAM) and Cancún (CUN) are already operational since February 2016, but not in use in the MID, MEX and MTY control centres (ACCs).

4.17 In the Mexico, Mérida, Monterrey and Mazatlán ACCs: ten ADS-B stations have been installed and are being tested, with plans for data collection and assessment with a view to starting data integration in ATM systems. A review and update is currently underway for the publication of rules on the use of ADS-B in Mexico.

4.18 In **Presentation 24**, Panama noted that it had installed two ADS-B stations, which were already integrated with radar information in the Panama ACC, and had plans to purchase and install 2 new ADS-B stations.

4.19 In **Presentation** 27, Paraguay informed that it had six ADS-B stations, each with different levels of coverage. ADS-B information was not being merged with the only Mode S secondary radar installed, since the system did not process Asterix 21; work was underway to resolve this problem.

4.20 In **Presentation 32**, Peru noted that the upgrade of the Lima ACC system became operational in November this year, which included improvements in AIDC, AMAN, ADS-B integration, and other functionalities. Peru has installed two ADS-B stations, which will be integrated into the new system.

4.21 In **Presentation** 33, the Dominican Republic explained that it was in the process of developing a WAM system through Thales. Based on the technical proposal of Thales, the representative of the Dominican Republic explained the concept of preliminary siting with respect to the implementation of the WAM system, consisting of the selection criteria for WAM sites; technical configuration data used for simulations; theoretical background and basic principles of WAM design; computer modeling results for the proposed WAM sites; a list and a map view of the proposed WAM sites; theoretical demonstration of WAM coverage through a series of precision coverage diagrams.

4.22 Trinidad and Tobago explained that the State was in the process of developing a project for updating the ATM system, which included new features, including ADS-B data management. It was also noted that Trinidad and Tobago received surveillance data from the islands of Martinique and Guadeloupe, which was then merged with radar data of Trinidad and Tobago, and used for the provision of surveillance coverage in the continental part of the FIR. Trinidad and Tobago also redistributed data received from Guadeloupe and Martinique to the States within the FIR in order to improve situational awareness.

4.24 In **Presentation 25**, Venezuela informed about its short-term plans, such as the technological upgrading of the AIDC capacity of the Maiquetia ACC, and the exchange of radar data between adjacent centres and APPs, with the capacity to integrate a minimum of 48 radars, ADS-B, MLAT systems and installation of 7 ADS-B stations during the period 2013-2028.

SESSION 5: REVIEW OF REGIONAL AND INTER-REGIONAL PROGRAMMES FOR SHARING SURVEILLANCE DATA

5.1 In this session, information was provided on NAM/CAR and SAM plans for sharing surveillance data. In this regard, and taking into account the importance of having common situational awareness information resulting from the sharing of surveillance data, CAR/SAM States/Territories were urged to continue making efforts to achieve this data sharing both at radar and ADS-B system level.

5.2 In order to complete regional and inter-regional programmes, the Meeting/workshop agreed that each CAR/SAM State that had not yet sent its updated data to ICAO, in accordance with Attachment C to the invitation, should do so no later than 30 January 2018.

SESSION 6: INTEGRATION OF THE REGIONAL WORK PLAN

6.1 Through **Presentation 30**, Cuba informed that in the NAM/CAR Regions, the ADS-B task force had modified its scope to cover other surveillance systems, changing its designation to surveillance system implementation group. This had been approved at the NACC/WG/5 meeting held in Port-of-Spain, Trinidad and Tobago, on 22-26 May 2017. The participants took note of the new terms of reference.

RESULTS OF THE MEETING/WORKSHOP - RECOMMENDATIONS

Based on the information presented at the Meeting/workshop, the participants formulated the following recommendations:

ADS-B benefits: All the participants identified and agreed on the benefits derived from ADS-B implementation in terms of surveillance coverage and operation, and cost reduction, compared with the implementation of conventional and Mode-S radar systems. However, most CAR/SAM States have considered maintaining the conventional surveillance solutions currently in use for the short and medium term.

Current use of ADS-B: The CAR/SAM States that have implemented ADS-B or have plans to implement ADS-B in the short term are planning to use it as backup to radar surveillance or as an alternative for areas currently lacking radar coverage.

Need for data on aircraft equipage: The participants felt the need to have data on aircraft equipage in terms of the avionics required for ADS-B, in accordance witih the different interrogation protocols. Accordingly, the recommendation was to consult the possibility of obtaining fleet statistics from the FAA, NAV Canada, IATA, and Aireon. In this sense, ICAO will discuss with the FAA, Nav Canada, and Aireon the possibility of sharing this information with the States so as to have it available by the end of the first quarter of 2018.

List of activities required for ADS-B implementation: Taking into account the importance of consulting stakeholders and having comprehensive and strategic plans for ADS-B implementation, the Meeting recommended that ICAO, through its NAM/CAR/SAM working groups, develop a checklist of stakeholders and a detailed outline of ADS-B implementation activities required to assist States in joint and consistent implementation planning. Each ICAO Office, both NAM/CAR and SAM, will fulfil the activity within their corresponding working groups. Upon completion, it will be integrated into a single regional version that will be available to NAM/CAR/SAM States. This would be prepared during the first semester of 2018.

ADS-B implementation: The meeting identified the need for a long-term ADS-B vision that will allow States to update their short-, medium-, and long-term regional and national plans, taking into account the following factors:

a. The meeting noted the importance of planning specific safety, efficiency, or capacity improvements based on the requirements of airspace users and air navigation service providers (ANSPs). Requirement-based planning ensures the selection of the appropriate technologies and that all stakeholders, including the regulator, understand and agree on the required performance for communication and ATS systems and on-board avionics.

b. It was recommended that CAR/SAM States follow the Global Air Navigation Plan (GANP), its technological roadmaps, the ICAO ASBU methodology, and the NAM/CAR and SAM regional performance-based plans, taking them into account when developing their national air navigation plans.

c. When implementing ADS-B, the States should consult and ensure the participation of all stakeholders as a priority to obtain the benefits of implementation.

d. When implementing management projects, States should include in their feasibility and risk analyses the aeronautical infrastructure and operations with each of the adjacent FIRs, in order to ensure standard, harmonised and efficient coordination.

e. In their strategic planning, States should define surveillance data requirements (speed, precision, Pd, routes/levels, etc.) in order to define minimum technical/operational requirements to be met, and subsequently define the surveillance technology best suited to meet their needs (radar, ground-based ADS-B, space-based ADS-B, multilateration). This information would support the decision whether or not to eliminate radars and determine future investments in technology.

f. It is recommended that, when conducting the risk analysis for selecting a new technology, States include the risk analysis of both its implementation and lack of implementation to ensure that projects to be executed include all risk factors when selecting new surveillance technologies.

g. It is recommended that, based on the ATM operational concept of achieving seamless paths, and in order to meet the regional goals of ASBU Block 0, and taking into account the mandatory use of ADS-B in North America as of 1 January 2020, States make the necessary efforts to plan for the implementation of ADS-B and define whether mandatory actions should be established.

h. In order to obtain the benefits of ADS-B technology, all aircraft in designated airspace should be equipped with the ADS-B OUT system. To this end, States should analyse whether a mandate would be required to ensure fleet uniformity.

i. States should make sure that the investments to be made in subsequent years contemplate current and future requirements, minimising the risk of having to make unexpected investments in the short term.

j. The meeting/workshop deemed it advisable for CAR/SAM States to study the possibility of co-locating ADS-B station(s) with existing radar surveillance systems that are reaching the end of their lifecycle, so that they can be used as backup to the latter. Likewise, to analyse the status of implementation of ADS-B in the aircraft fleet. At the end of the radar lifecycle, and based on the experience gained with ADS-B during this period, a more informed analysis can be made whether to continue with radar or replace it with ADS-B.

For data exchange, the meeting recommended: that each State share information on surveillance systems with adjacent States in order to analyse the coverage and overlap of surveillance data to serve as backup in air traffic control coordination areas between FIRs. States that have not yet delivered their updated data to ICAO, in accordance with attachment C to the invitation, must do so by 30 January 2018.

Improved situational awareness in the Region: Taking into account the importance of having common situational awareness information, which is obtained by sharing surveillance data, CAR/SAM States/Territories were urged to continue making efforts to complete data sharing both at radar and ADS-B system level.

ATS infrastructure: States must conduct an analysis of their ATS infrastructure and determine whether it is capable of ADS-B management, directly integrated in the ATS system, without the need for conversion of surveillance protocols, thus offering optimum surveillance data management to operational personnel.

Commitment by system and equipment providers: The participants noted that the commitment of system providers (Thales, Indra, etc.) was required for the implementation of solutions that ensured compatibility and easy integration of ADS-B systems. In this sense, providers were requested, when implementing new projects in the Region, to assist States in ensuring standardisation, harmonisation and integration of systems.

Assessment of space-based ADS-B: The participants pointed out the need for an integrated and cooperative assessment to determine the correct use of space-based ADS-B. In this regard, the SAM Region will include this activity within the actions to be carried out by the working group that is currectly validating the use of the communication infrastructure for this purpose. The NAM/CAR Region will include this task within the activities of the NAM/CAR Survillance Working Group.

Development by the State of regulations for ADS-B implementation: The regulator may need to change the wording of ATS regulations to allow for the use of both ADS-B and radar. The regulator will need to certify aircraft and operators. The technical and maintenance personnel of operators and ANSPs will need to learn new systems and procedures. Coordination and operational arrangements with neighbouring ANSPs may need to be updated. Taking into account the experiences shared at the meeting, the participants concluded that States should start developing legislation/regulations on the use of ADS-B in each State.

Regional meeting: The participants agreed on the need to hold a NAM/CAR/SAM regional meeting on the second half of 2018 in order to follow up on ADS-B implementation. The meeting would analyse, *inter alia*, aspects related to operational and airworthiness requirements for ADS-B implementation and the lessons learned by States that have already implemented ADS-B in the NAM/CAR/SAM Regions.

— END —

NAM/CAR/SAM Automatic Dependent Surveillance – Broadcast Implementation Meeting/Workshop (ADS-B/IMP)
Reunión/Taller NAM/CAR/SAM de Implementación de la Vigilancia Dependiente Automática – Radiodifusión (ADS-B/IMP)

Lima, 13-16 November 2017 / Lima, 13-16 de noviembre de 2017

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