



ICAO

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North American, Central American and Caribbean Office

INFORMATION PAPER

ADS-B/IMP — WP/04
24/04/15

Automatic dependent surveillance – broadcast (ADS-B) Implementation Meeting (ADS-B/IMP)
Mexico City, Mexico, 27-29 April 2015

Agenda Item 4: Review of ADS-B Receiver Specifications and Project RLA/09/801 — Implementation of Performance Based Air Navigation Systems for the CAR Region

ICAO RLA/09/801 Project: ADS-B EQUIPMENT SPECIFICATIONS

(Presented by the Secretariat)

EXECUTIVE SUMMARY	
The RLA/09/801 Project is a regional tool agreed to support the implementation of Air navigation and Safety matters in the CAR Region. One of the supporting activities of the project is the lending of ADS-B Equipment to allow the familiarization and State involvement in the ADS-B use, for the projection of its final implementation by the end of 2018.	
Action: The Meeting is invited to consider this information for the final version for the ADS-B Technical Specifications.	
<i>Strategic Objectives:</i>	<ul style="list-style-type: none">• Safety• Air Navigation Capacity and Efficiency• Environmental Protection
<i>References</i>	<ul style="list-style-type: none">• Fourth Meeting of North American, Central American and Caribbean Directors of Civil Aviation (NACC/DCA/4), San Pedro Sula, Honduras, 20 to 24 June 2011• Project RLA/09/801 — <i>Implementation of Performance Based Air Navigation Systems for the CAR Region</i>

1. Introduction

1.1 Based on the NACC/DCA/4/2 Conclusion, the CAR States/Territories decided to develop a Regional Project to serve as a tool to streamline the implementation in Air navigation Regional Priorities.

1.2 In this regard, the ICAO Regional Technical Cooperation Project — “CAR Region Implementation of The Performance Based Air Navigation System” (RLA/09/801) was agreed by the CAR States/Territories to support the CAR Region at the national/regional level in the implementation of Air Navigation and Safety matters aligned with regional air navigation and safety priorities contained in the NAM/CAR Regional Performance Based Air Navigation Implementation Plan (RPBANIP).

1.3 The RLA/09/801 Project is implementing their tasks under the following sub-projects:

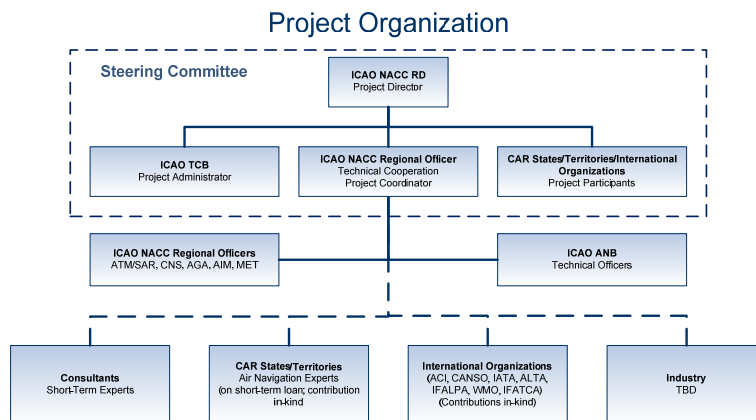
- Sub-Project 1. Implement a CAR Region PBN Airspace Concept*
- Sub-Project 2. Implement Regional Air Traffic Flow Management (ATFM)*
- Sub-Project 3. Implement Flexible Use Airspace (FUA)*
- Sub-Project 4. Enhance ATS situational awareness and improve operational efficiency of ATS Unit(s)*
- Sub-Project 5. Enhance Aerodrome Operations Capacity and Efficiency*
- Sub-Project 6. Improve Regional Safety*
- Sub-Project 7. Improve Search and Rescue System*

2. Discussion

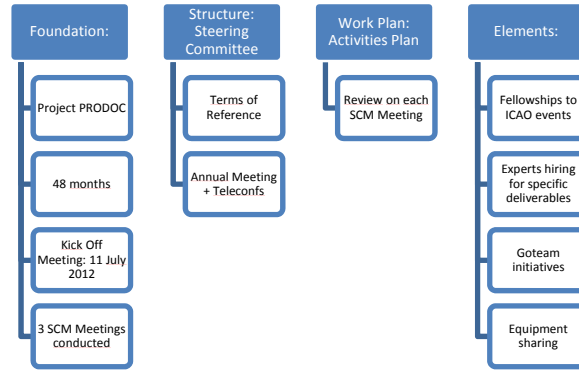
2.1 The CAR RLA/09/801 Project is formed by the following States:

 Bahamas Bahamas	OECS States through ECA Estados OECS a través de ECA		Central American States through COCESNA Estados Centroamericanos a través de COCESNA	
 Barbados Barbados	representing the following States representando a los siguientes Estados		representing the following States representando a los siguientes Estados	
 Cuba Cuba	 Antigua and Barbuda Antigua y Barbuda	 Belize Belice	 Curaçao Curazao	 Costa Rica Costa Rica
 Dominican Republic República Dominicana	 Grenada Grenada	 El Salvador El Salvador	 Haiti Haiti	 Guatemala Guatemala
 Jamaica Jamaica	 Saint Kitts and Nevis San Kitts y Nevis	 Honduras Honduras	 Mexico México	 Nicaragua Nicaragua
 Trinidad and Tobago Trinidad y Tabago	 Saint Lucia Santa Lucia	 Saint Vincent and the Grenadines San Vicente y las Granadinas	 United States - in kind support Estados Unidos - en especie	

2.2 The governing body of the Project is formed as follows:



2.3 The Project 's elements for this assistance including the task of equipment sharing involving ADS-B equipment as detailed as follows:



2.4 For this equipment sharing, the Project will conduct a tender process for its acquisition and will define a sharing procedure among the Project Members. For the acquisition the technical specification for the desired ADS-B equipment, the ANI/WG ADS-B TF was required for they support on the development of these specifications. A draft document on Technical specifications for the ADS-B Equipment is presented in **Appendix** to this paper.

3. Suggested Actions

3.1 The Meeting is invited to:

- a) take note of the CAR Project RLA/09/801 information presented in this paper;
- b) include the draft Technical Requirements shown in **Appendix** to this paper for developing the final version of these specifications; and
- c) take any action as deemed necessary

**APPENDIX
TECHNICAL REQUIREMENTS**

SECTION C – TECHNICAL REQUIREMENTS

1. GENERAL REQUIREMENTS

1.1 System Scope - Overall

1.1.1 ADS-B SYSTEM

The system shall have as a minimum the following functionality and configuration:

1.1.1.1 Consist of remote ground based terminals and one or more remote control and monitoring systems

1.1.1.2 Be able to operate on narrowband communication lines such as VSAT connections.

1.1.1.3 Receive and process 1090 MHz Extended Squitter (1090ES) ADS-B messages.

1.1.1.4 Allow detection and identification of over flying aircraft.

2. ADS-B MINIMUM REQUIREMENTS

2.1 Ground Station Configuration

The ground station equipment shall:

2.1.1 Be fully redundant including the antenna structure.

2.1.2 Be fully configurable via SNMP and locally at the site by means of command line interface. The tenderer shall utilize open architecture concepts as much as possible to ease interface requirements.

2.1.2 Allow up and down loading of the complete configuration as a text file.

2.1.3 Be able to receive software updates from a remote control and monitoring station in a failsafe way without interruption of service.

2.1.4 Allow filtering of the ADS-B targets according to the following criteria:

- 1) altitude level(s)
- 2) airborne/ground
- 3) MOPS version

2.1.5 Be able to output a Figure of Merit Position Accuracy Value (FOM/PA) according to the Navigation Uncertainty Category contained in the messages complying with MOPS DO260 and to output a FOM/PA mapped according to a configurable mapping table out of Navigation Integrity Category (NIC),

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Navigation Accuracy Category (NAC) and Software Integrity Level (SIL) contained in messages complying with an ICAO approved MOPS requirement.

2.1.6 Allow editing of the DO260A FOM/PA mapping tables as a text file and up loading it to the ground station .

2.1.7 The proposed system shall process and interface in accordance with the ASTERIX data exchange protocol category 21.

2.1.8 The equipment specified herein shall possess hardware maintenance features to reduce repair time by providing the technical personnel with the capability to diagnose a fault rapidly, identify the failed unit and replace it quickly in order to satisfy the availability requirements. Minimal preventive maintenance is a fundamental design requirement. The BIT capability should be sufficient to isolate the fault to the Line Replaceable Unit (LRU).

2.1.9 Maintenance design features shall include on-line and off-line diagnostics, power-up diagnostics, test points, Built-In Test Equipment (BITE) and Fault Isolation Testing (FIT). All equipment shall be equipped with diagnostic programs as a part of the delivered software.

2.1.10 Specifically the system BITE shall have the following capabilities:

- 1) Periodically perform BITE tests to verify performance and operational status
- 2) Output the BITE status as a hardware signal, as a visual indicator at the front panel (e.g. LED) and via the communications network to the local and remote control and monitoring system
- 3) Be able to distinguish between critical failures requiring immediate attention or corrective action and warnings
- 4) Be equipped with a site monitor that periodically injects a signal containing a fixed data pattern into one of two ADS-B antenna monitor points
- 5) Be able to verify the received signal level of the site monitor signal at the ground station in order to verify the complete RF path
- 6) Be able to verify the received signal content and periodicity
- 7) Be able to verify the detected position of the internal GPS receiver in order to monitor operational status of the GPS as a basis of ADS-B status
- 8) Be able to generate a test target using the detected GPS position and the site monitor signal level.

2.1.11 The ground station equipment should have separate partitions of the background operating system and the operational software application.

2.1.12 Two versions of the operating system and the application must be resident in the ground stations

2.1.13 Provide secure access via password protection to the operating system level.

2.1.14 Two physically independent network interfaces (Ethernet 100base T)

2.1.15 Two individually configurable Asterix output data streams, for operational and maintenance access.

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2.1.16 One configurable raw data output stream

2.1.17 One serial port for local configuration.

2.1.18 Redundant GPS clock systems.

2.1.19 The ADS-B and GPS antennas shall be mounted on the VHF tower structure

2.1.20 It shall be the tenderer's responsibility to interface the equipment specified herein with all required external and existing systems (VSAT network) including the provision and installation of any cabling

3. ADS-B FUNCTIONAL PERFORMANCE REQUIREMENTS

3.1 Ground Station Functional Requirements

3.1.1 The ground station shall as a minimum have the following capabilities and equipment configuration..

1) Receive and process 1090 MHz Extended Squitter (1090 ES) and ADS-B messages as defined by ICAO Annex 10.

2) Generate Asterix Category 21 ed.0.23 target reports in a configured interval (buffered output mode) or continuously (real time mode) as the 1090 ES messages are received.

3) Interface directly with the FIC ATM systems without the need for central equipment .

4) Be able to adjust the actual target report update rate to adapt to the available network capacity

5) Detect when the actual data rate is close to the defined network transfer capacity

6) Be equipped with a high gain ADS-B antennas providing at least 11 dBi gain within its main lobe.

7) Be equipped with a GPS receiver for system time synchronisation and time stamping, as well as monitoring GPS quality and integrity

8) Be able to provide a range coverage of at least 200 nmi for targets at FL300 or above provided a line of sight exists.

9) Be fully remote controlled and monitored via SNMP protocol or equivalent

10) Be designed for unattended operation

11) Operate within the proximity of other systems without degrading its own performance as well as the performance of the existing systems.

12) Recover from short time frame transients in voltage and amperage without operational degradation.

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13) Provide interfaces for operation with:

- a. Maintenance processor system (provide an SNMP summary status)
- b. Shall provide interface with the VSAT network
- c. Ricochet recorder or any other ATC recorder .

3.2 Remote Control and Monitoring System

3.2.1 The tenderer shall investigate the potential to integrate the ADS-B RCMS data with the existing RCMS system at the facility located in XXXXXXXXXXXX which has the capability to expand to integrate any remote control and status information. This is the preferred implementation for space is limited in the technical maintenance room.

3.2.1 The remote control and monitoring system (RCMS) shall as a minimum have the following capabilities and equipment configuration :

- 1) Be able to monitor, configure and control the remote ground station equipment via SNMP protocol (or equivalent) providing access to all system parameters
- 2) Log system status for a minimum of 30 days. The log duration should be configurable.
- 3) Allow data recording of Asterix surveillance data from all or selected ground stations.
- 4) Allow recording of raw output data of selected or all ground stations. Confirm that this may require recording at the ground station if the only output from the ground station at site is Cat 21.
- 5) Allow local replay (at the RCMS) of the recorded Asterix data for analysis purposes
- 6) Allow local replay and conversion of recorded raw data (at the RCMS) into Asterix reports for analysis purposes
- 7) Implementation based on COTS equipment
- 8) Software based on the latest available operating system
- 9) Provide a technical situation display (see below) showing selected Asterix data from one or more ground stations.
- 10) Show a list of aircraft currently in coverage in an on screen menu with filtering capabilities of at least time of first plot, call sign, country of origin, etc. The tenderer shall fully describe the target filtering capabilities.
- 11) Provide the capability to log aircraft data to a database to support billing activities.
- 12) Provide the capability to produce daily reports sorted according to defined parameters such as time of entry, country of origin, aircraft type, etc. The tenderer shall fully describe the system reporting capabilities.

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3.2.2 The RCMS shall also include the functions listed below as a minimum, as well as the ones the tenderer considers necessary to fulfil this system's functions.

1. Keep information in real time of the system's status.
2. It shall be capable of executing commands to the system, limiting access to the same with a key word or password.
3. It shall be possible to determine the anomalies presented by the system.
4. It shall provide information regarding the system's fundamental parameters.
5. The alarm codes generated by the system shall be supported with the necessary information so they can be interpreted.

3.2.3. RCMS alarm messages shall be notified in a visual and audible way and shall be printed on a dedicated colour printer associated with the CMS workstation. All system events shall be recorded and logged.

3.2.4. The RCMS shall display overall system status in a graphical illustration showing with different colors each systems real time status.

3.3 Technical Situation Display

3.3.1 The technical situation display will be located in the technical maintenance room of the XXXXXXXXXXXX facility. It will be used to assess the operational status of the ADS-B network.

3.3.2 The technical situation display shall exhibit the following functionality as a minimum:

- 1) Be able to receive Asterix Category 21 target reports from one or more ground stations and display the message contents.
- 2) Be able to provide a simple map of coverage area and shall indicate target tracks as received within the target reports.
- 3) Attach a label to the most recent target position with the following minimum content information:
 - a. 24 bit Mode S address and registration
 - b. Mode 3/A code data if available
 - c. Flight level
 - d. Call sign
 - e. Target dynamics (ground speed, track angle, etc.)
- 4) Upon selecting a target, allow the display of the current Asterix target report content in a separate detailed menu list
- 5) Allow panning, rotating, and zooming of the display content
- 6) Present range, azimuth, and relative elevation between two selected targets and between targets and ground station site location.

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7) Be able to display a configurable history trail of target plots in steps of several seconds up to several hours

8) Allow the indication of the speed vector present in the Asterix target message

4. TARGET PROCESSING CAPACITY**4.1 Target Capacity/Characteristics**

4.1.1 The system shall be able to process up to 3,000 extended squitter messages/sec. and output up to 1,500 ADS-B messages/sec relating to aircraft targets in a 360 degree scan out to a range of 200 nmi.

4.1.2 The target processor shall have the capability to output as a minimum the following parameters as a target message, besides those which the tenderer considers necessary for adequate signal processing:

- a) Identification as:
 - i. Call sign
 - ii. ICAO 24 bit address or registration
- b) Aircraft Category
- c) Aircraft Size (length and width)
- d) Position (from aircraft reference point)
 - i. Lat/Long (WGS-84)
 - ii. Barometric altitude
- e) Velocity vector
 - i. Ground (or air) speed
 - ii. Vertical speed
- f) Time stamp
- g) Heading
- h) Emergency messages (medical urgency, loss of fuel, etc.)

The system shall be able to process extended squitter messages at the following rates:

1. Airborne position every 0.5 sec. This message also includes the integrity figure.
2. Ground position every 0.5 sec if the aircraft is moving, otherwise every 5 sec.
3. Identification and aircraft type every 5 sec.
4. Velocity and the accuracy quality indicator every 0.5 sec.

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5. Aircraft status, including heading and other quality indicators if necessary every 1.25 sec.
6. Emergency messages every 0.8 sec. when required.

5. INTEGRATION WITH AIR SITUATION DISPLAY (ASD)

5.1 The contractor shall support the integration of the ADS-B data with the existing Surveillance Data Processor (SDP) and Air Situation Display (ASD) at the XXXXXXXX facilities located in ZZZZZZZZ. If there is a cost associated with this requirement it shall be identified separately with a detailed scope of the level of effort and services provided. The tenderer, during the site survey shall evaluate the existing functionality and propose the best method to integrate the ADS-B information to facilitate operational control.