



International Civil Aviation Organization

WORKING PAPER

A42-WP/142

EC/11

31/07/25

Revision No. 1

26/08/25

English and Chinese only

ASSEMBLY — 42ND SESSION

ECONOMIC COMMISSION

Agenda Item 27: Other issues to be considered by the Economic Commission

APPROACH TO CAPTURE FLIGHT MOVEMENT DATA USING SDR-BASED ADS-B RECEIVERS FOR NON-SURVEILLANCE PURPOSES

(Presented by India)

EXECUTIVE SUMMARY

This Paper highlights an Approach to employ Software Defined Radio (SDR)-based Automatic Dependent Surveillance–Broadcast (ADS-B) receivers for capturing aircraft movement data for non-surveillance operational and analytical purposes. It outlines the importance and challenges in acquiring accurate aircraft movement data and presents SDR-based solutions as an economically viable option for States. The paper also proposes a deployment framework for different airport categories and a centralized data aggregation system to support national air traffic and airport operational management.

Action: The Assembly is invited to:

- a) Form a Working Group to standardize the recommendations and guidance for adoption of SDR based ADS-B for Non-surveillance / Statistics purposes.

<i>Strategic Goals:</i>	This working paper relates to following Strategic Goals: Economic Development of Air Transport: By enhancing accuracy and timeliness of data collection and billing accuracy and economic oversight through affordable data acquisition solutions, reducing costs for States and stakeholders.
<i>Financial implications:</i>	The implementation of SDR-based ADS-B data collection systems entails minimal capital and operational expenditure compared to traditional surveillance equipment. States adopting this approach can achieve significant cost savings on infrastructure investment at smaller airports and remote airstrips while improving the accuracy of operational and financial data for decision-making.
<i>References:</i>	A40-WP/19-EC/4 dated 21/6/19, <i>ICAO statistics programme and big data analytics</i> A41-WP/15-EC/5 dated 14/7/22, <i>ICAO statistics programme and big data analytics</i> A41-WP/512-TE/186 dated 12/9/22, <i>Implementation of Automatic Dependent Surveillance - Broadcast (ADS-B)</i>

1. INTRODUCTION

1.1 This Working Paper highlights India's initiative to employ Software Defined Radio (SDR)-based Automatic Dependent Surveillance–Broadcast (ADS-B) receivers for capturing aircraft movement data for non-surveillance operational and analytical purposes. It outlines the importance and challenges in acquiring accurate aircraft movement data and presents SDR-based solutions as an economically viable option for States. The paper also proposes a deployment framework for different airport categories and a centralized data aggregation system to support national air traffic and airport operational management.

1.2 Accurate aircraft movement data is fundamental to effective air traffic flow management (ATFM), airport capacity planning, infrastructure investment, environmental assessment, and economic regulation of airports and air navigation services.

1.3 Traditional surveillance infrastructure, while effective for real-time control, often lacks comprehensive data continuity at non-radar airports or remote locations and involves high acquisition and maintenance costs.

1.4 To address these limitations, Airports Authority of India (AAI) proposes leveraging cost-effective SDR-based ADS-B receivers to enhance aircraft movement data capture, supporting operational analysis, capacity management, and economic oversight, particularly for non-surveillance purposes.

2. BACKGROUND

2.1 The collection of precise flight movement data has multiple economic and operational implications:

- Billing and revenue management for airport charges and air navigation fees
- Capacity and slot allocation based on reliable traffic data
- Economic regulation and performance benchmarking of airports
- Demand forecasting for infrastructure expansion
- Environmental assessments linked to aircraft operations

2.2 Conventional systems such as MSSR and certified ADS-B stations require significant capital and operational expenditure, often beyond the economic feasibility for smaller airports and remote areas.

2.3 SDR-based ADS-B receivers, paired with open-source decoding software and centralized aggregation platforms, offer a scalable, low-cost solution for non-surveillance data acquisition.

3. DISCUSSION

3.1 Importance and Challenges in Aircraft Movement Data Collection

3.1.1 Accurate aircraft movement data is essential for:

- Transparent and fair user charges
- Evidence-based infrastructure planning
- Monitoring operational performance indicators (KPIs)
- National-level air traffic analysis and reporting to ICAO

3.1.2 Challenges include:

- Lack of surveillance infrastructure at non-radar airports
- Incomplete or delayed manual reporting of flight movements
- High capital and operational costs of certified surveillance equipment
- Inadequate integration between diverse data sources

3.2 SDR-based ADS-B Receiver Approach

3.2.1 SDR-based ADS-B receivers are generic radio devices capable of receiving Mode-S transponder signals at 1090 MHz, decoded by software to extract aircraft position, altitude, speed, and identity information.

3.2.2 SDR-based systems can operate independently or in clusters to capture:

- Enroute movements in remote airspaces
- Airport surface and terminal airspace activity
- Helicopter and drone operations

3.2.3 Common SDR devices considered include:

- RTL-SDR v3 (USD 30)
- AirSpy Mini/R2 (USD 100–170)
- SDRplay RSP1A (USD 130)
- HackRF One (USD 300)

3.3 Economic Benefits to States and Aviation Entities

3.3.1 Deployment of SDR-based receivers offers several economic benefits:

- Reduced infrastructure costs at secondary and non-towered airports

- Lower operational expenditure compared to MSSR and certified ADS-B
- Enhanced accuracy in billing and fee collection
- Improved data-driven airport performance management
- Enhanced support for air traffic growth forecasts
- Facilitated environmental emission and noise reporting

3.3.2 States can leverage this data for more transparent economic regulation of airports and air navigation services while reducing the financial burden of infrastructure expansion.

3.4 Proposed Deployment Framework

3.4.1 AAI proposes a tiered deployment strategy:

- Major International Airports: Certified surveillance and SDR backup
- Regional Domestic Airports: SDR-based ADS-B receivers for movements
- Remote Airstrips and Helipads: SDR-based ADS-B with satellite backhaul

3.4.2 A centralized software application will consolidate SDR feeds from multiple locations into a national repository, enabling:

- Real-time and historical data analysis
- Integration with billing, slot management, and ATFM systems
- National traffic reporting for ICAO submission

4. CONCLUSION

4.1 The use of SDR-based ADS-B receivers presents an effective, economically sustainable approach to capture comprehensive aircraft movement data for operational, analytical, and economic management purposes.

4.2 AAI's model offers potential replicability for other States facing similar challenges, supporting ICAO's objectives for efficient air transport system management and economic oversight.

—END—