International Civil Aviation Organization

MIDANPIRG Communication, Navigation and Surveillance Sub-Group (CNS SG/15)

(Doha, Qatar, 11 – 14 May 2026)

Agenda Item 4: Surveillance Matters

EFFICIENT UTILIZATION OF 24-BIT AIRCRAFT ADDRESSES FOR AERODROME SURFACE VEHICLES USING ADS-B SURFACE SURVEILLANCE SYSTEMS

(Presented by Jordan/ Chairman.)

SUMMARY

This paper addresses the increasing use of ADS-B surveillance for aerodrome surface vehicles operating on runways, taxiways, aprons, and maneuvering areas.

The paper highlights the operational, technical, and regulatory challenges associated with assigning 24-bit ICAO aircraft addresses to non-aircraft surface vehicles, particularly regarding:

- address management and allocation responsibility;
- 1090 MHz frequency congestion;
- GNSS jamming and spoofing;
- surveillance system integrity and target correlation risks;
- interoperability with ATM automation systems.

The paper proposes regional harmonization to ensure safe, standardized, and sustainable implementation of ADS-B for airport vehicles.

REFERENCES

a)) ICAO Annex 10 — Aeronautical Telecommunications, Volume IV
b) ICAO Annex 10 — Volume III
c) ICAO Doc 9924 — Aeronautical Surveillance Manual
d) ICAO Doc 4444 — PANS-ATM
e) ICAO GANP and ASBU Framework
f) MID Region Surveillance Plan

1. INTRODUCTION

1.1 The deployment of Advanced Surface Movement Guidance and Control Systems (A-SMGCS), ADS-B, multilateration (MLAT), and integrated surveillance systems has significantly increased the need for real-time monitoring of aerodrome surface vehicles.

1.2 Airport vehicles such as the following, are increasingly required to be visible to Air Traffic Control (ATC) for runway safety enhancement.

- Follow-me vehicles
- Fire and rescue vehicles
- Maintenance vehicles
- Runway inspection vehicles
- Snow removal equipment
- Fuel and operations vehicles

1.3 ADS-B using 1090 MHz Extended Squitter (1090ES) is commonly used to provide surveillance visibility for these vehicles. However, assigning ICAO 24-bit aircraft addresses to non-airborne vehicles introduces several technical and operational challenges that require harmonized regional management.

2. DISCUSSION

2.2 ICAO Annex 10 permits the use of 24-bit aircraft addresses for aerodrome surface vehicles under specific conditions.

2.3 The State Civil Aviation Authority should remain the responsible authority for address assignment to ensure its uniqueness, traceability, compatibility with ATM systems, and coordination with aircraft registry databases.

2.4 The following entities should be included in the coordination process, it is recommended that a dedicated national registry be established for vehicle ADS-B addresses

- Civil Aviation Regulatory Authority
- Air Navigation Service Provider (ANSP)
- Airport Operator
- CNS Department
- Surveillance System Integrators

2.5 The 1090 MHz frequency is already heavily utilized by:

- Mode A/C/S transponders
- ADS-B OUT aircraft transmissions
- TCAS operations
- MLAT interrogations
- Surface vehicle ADS-B transmitters

2.6 Excessive use of ADS-B transmitters for vehicles may lead to RF congestion, garbling and message collisions, reduced probability of target detection, degradation of surveillance performance, and overload of ATM processing systems. This becomes particularly critical at major international airports with high traffic density. Therefore, uncontrolled large-scale deployment of vehicle ADS-B transmitters should be avoided.

2.7 ADS-B position reporting depends heavily on GNSS/GPS signals. In the MID Region, GNSS interference have become increasingly significant, which may result in false

vehicle position reports; complete loss of surveillance target; runway incursion risk; incorrect ATC situational awareness; and unsafe movement guidance decisions.

2.8 For safety-critical runway operations, sole dependency on GPS-based ADS-B may create unacceptable operational risk.

2.9 The following mitigation actions are recommended:

a) Hybrid Surveillance Approach

Use ADS-B together with Surface Movement Radar (SMR), MLAT, A-SMGCS, Independent surveillance validation systems, and avoid sole dependence on GPS-based ADS-B.

b) Controlled Address Allocation

Limit ADS-B use only for operationally critical vehicles.

c) GPS Interference Monitoring

Deploy GNSS monitoring systems for early detection of jamming/spoofing.

d) Safety Assessment

Conduct formal safety assessments before implementation.

e) Regional Coordination

Coordinate address usage among neighbouring FIRs and States.

2.10 ICAO Annex 10 allows the reuse of identical 24-bit addresses for surface vehicles when aerodromes are separated by more than 1,000 km. This provides efficient use of address space; reduced exhaustion of available addresses; simplified administration.

2.11 However, this must only be applied after ensuring:

- no surveillance overlap;
- no ATM correlation conflicts;
- no regional data fusion impact.

2.11 ADS-B implementation for aerodrome surface vehicles significantly improves runway safety and ATC situational awareness. However, improper management of 24-bit ICAO addresses, excessive use of 1090 MHz transmissions, and GNSS vulnerabilities may introduce serious operational and safety risks.

2.12 States should ensure that implementation is based on controlled allocation, regulatory oversight, surveillance redundancy, regional harmonization, formal safety assessment.

2.13 A balanced approach combining ADS-B, SMR, and MLAT provides the safest operational model.

3. ACTION BY THE MEETING

The meeting is invited to encourage MID States to:

a) share their experience on assigning ICAO 24-bit addresses to aerodrome surface vehicles;

b) assess the operational impact of increased ADS-B transmissions on the 1090 MHz frequency environment, particularly at high-density international airports, to avoid surveillance congestion, message collision, and degradation of ATM system performance;

c) develop harmonized regional guidance for MID Region implementation.

TECHNICAL EXAMPLES

Example 1 — Reuse of Surface Vehicle Addresses at Geographically Separated Aerodromes

- A State operating multiple international aerodromes may assign the same 24-bit aircraft address to aerodrome surface vehicles located at airports separated by more than 1 000 km, in accordance with ICAO Annex 10 provisions.
- For example:

Aerodrome	Surface Vehicle	Assigned 24-bit Address
Airport A	Follow-me Vehicle	ABC123
Airport B (more than 1 000 km away)	Maintenance Vehicle	ABC123

- Since the two aerodromes are separated by more than 1 000 km, the reuse of the same address would be permissible under Annex 10 Volume III provisions, provided operational risk assessments confirm no adverse impact on surveillance systems.

Example 2 — ADS-B Surface Surveillance Environment

- At aerodromes equipped with ADS-B surface surveillance systems, airport vehicles transmitting identical addresses within overlapping surveillance coverage areas could generate:

- duplicate target reports;
- target correlation errors;
- false track continuity;
- incorrect identification by ATM automation systems.

Therefore, reuse of addresses should only be implemented where sufficient geographical separation exists and where surveillance coverage overlap is not possible.

Example 3 — Cross-Border Surveillance Considerations

- In regions with extensive surveillance data sharing between neighboring FIRs, States should coordinate address allocation policies to avoid possible conflicts resulting from:

- shared surveillance networks;
- centralized ATM processing systems;
- regional ADS-B data fusion platforms.

Particular consideration should be given where long-range ADS-B or space-based ADS-B

surveillance data may be integrated into regional ATM systems.

Example 4 — Address Management Efficiency

- A State operating a large fleet of aerodrome vehicles across several remote airports may reduce consumption of reserved address blocks by reusing a limited pool of 24-bit addresses.
- Example:

Region	Aerodrome	Vehicle Fleet	Address Pool Used
Northern Region	Airport X	20 vehicles	20 addresses
Southern Region (>1000 km away)	Airport Y	20 vehicles	Same 20 addresses reused

This approach supports sustainable management of address resources while remaining compliant with ICAO provisions.