International Civil Aviation Organization

MIDANPIRG Communication, Navigation and Surveillance Sub-Group

Fourteenth Meeting (CNS SG/14)
(Abu Dhabi, UAE, 19 – 23 October 2025)

Agenda Item 6: ASBU Threads/ Elements related to CNS

DEPLOYMENT OF ADVANCED SURFACE MOVEMENT GUIDANCE AND CONTROL SYSTEM (A-SMGCS) AT RIYADH AND MADINAH AIRPORTS

(Presented by Saudi Arabia)

SUMMARY

This paper provides an overview of the deployment of the Advanced Surface Movement Guidance and Control System (A-SMGCS) – Level 2 at King Khalid International Airport (OERK) and Prince Mohammad Bin Abdulaziz International Airport (OEMA)Saudi Arabia. The system has been successfully commissioned and is currently in live operation, used by Riyadh and Madinah ATC TWR in managing the ground movements. It has undergone a full regulatory approval cycle and has received formal approval from General Authority of Civil Aviation (GACA). This initiative enhances surface movement surveillance, improves safety, and increases operational efficiency for managing ground movements, landing, and take-off aircraft movements and will allow the accommodate of additional traffic and increase of the declared runway capacity in particular during low-visibility operations.

Action by the meeting is at paragraph 6.

REFERENCES

- ICAO Annex 10 Vol Volume VI
- ICAO Doc 9924 Aeronautical Surveillance Manual
- ICAO Doc 4444, PANS-ATM
- ICAO Doc 9854, Global Air Traffic Management Operational Concept.
- ICAO Doc 9750, Global Air Navigation Plan
- ICAO Doc 9871, Technical Provisions for Mode S Services and Extended Squitter
- ICAO Doc 9830 AN/452, Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual
- MIDANPIRG/22 and RASG-MID/12 Report

1. INTRODUCTION

1.1 The continuous growth of air traffic and the increasing complexity of airport operations require the implementation of more advanced technologies to maintain safety, efficiency, and capacity during the management of ground movements.

1.2 The Advanced Surface Movement Guidance and Control System (A-SMGCS) is a system that provides routing, guidance, and surveillance for the safe, orderly, and efficient movement of aircraft and vehicles on the aerodrome surface during all weather conditions, within the aerodrome visibility operational level (AVOL). It integrates various technologies and procedures to ensure situational awareness for air traffic controllers, thereby enhancing the safe management of ground safety and reducing the risk of runway incursions and other surface incidents.

1.3 In line with Saudi National Air Navigation Plan (SNAP) adopted by General Authority of Civil Aviation (GACA), Saudi Air Navigation Services (SANS) has deployed A-SMGCS Level 2 at King Khalid International Airport (OERK) and Prince Mohammad Bin Abdulaziz International Airport (OEMA). The system is composed of multilateration (MLAT) and surface movement radar (SMR), including integration with tower ATM systems to support safe and efficient management of aircraft and vehicle movements on the airport surface under all weather conditions.

2. DISCUSSION

2.1 The A-SMGCS deployed at King Khalid International Airport (OERK) and Prince Mohammad bin Abdulaziz International Airport (OEMA), aims to enhance efficiency and operational reliability by adding a surveillance layer for safe aerodrome ground movement under all weather conditions. It is composed of **MLAT Transmitter (TX) and Receiver (RX)** ground station, and **SMR** system to ensure that the system has the full capability to detect the cooperative and non-cooperative ground movement object.

2.2 The first phase of the deployment of A-SMGCS covers the installation of and integration of the system with local Aeronautical Telecommunication infrastructure. The integration was conducted using the ATM simulator system to validate all operation functions. This phase was successfully completed.

2.3 The commissioning of A-SMGCS was subject to extensive operational trials to assess and validate the performance of the system and ensure that ATCOs are familiar with all features and functions.

2.4 AIP SUP has been issued in advance to notify the airspace user of all requirements and procedures related to the operation of the A-SMGCS system deployed at (OERK) & (OEMA).

2.5 The system is fully operational and has been approved by GACA following satisfactory operational trials that shows that the system is supporting the safety management of ground movements, and its performance assessment is meeting the requirements.

2.6 Following the approval of A-SMGCS, the Operational ATS surveillance coverage and separation have been updated to reflect the capabilities of A-SMGCS, ensuring long-term viability and effectiveness in meeting GACA requirements and airspace user needs.

2.7 With respect to features and functions supported, the A-SMGCS system provides:

A- Real-time tracking of aircraft and vehicles using MLAT and SMR.

B- Integration with ATC systems for enhanced situational awareness.

C- Runway incursion alerting and conflict detection capabilities.

D- Support for low visibility operations (LVO).

E- Reduction in taxi times and improved operational efficiency.

2.7 The aeronautical information related to the A-SMGCS for (OERK) & (OEMA) are described under KSA AIP under AD 2.22 FLIGHT PROCEDURES which can be accessed using the following link:
https://aimss.sans.com.sa/assets/FileManagerFiles/AIRAC%20AIP%20AMDT%2011_25_2025_10_30/index.html

2.8 The coverage of each system is provided in Appendix A to this paper.

3. SYSTEM DESIGN AND OPERATIONAL PERFORMANCE:

3.1 The A-SMGCS key System performance features can be summarized as follows:

- Full coverage of all movement area (runways, taxiways, aprons) is achieved using SMR, mini-SMRs, and MLAT/ADS-B ground stations.
- The system provides comprehensive situational awareness for ATCOs under all visibility conditions.
- The A-SMGCS coverage is maintained even in the event of a single MLAT station failure, as the system is designed with (N-1 redundancy), and the coverage will be degraded only if two or more MLAT stations are completely lost.
- The system supports both cooperative (MLAT/ADS-B) and non-cooperative (SMR) target detection and identification, ensuring tracking of aircraft and vehicles with or without transponders.
- The system is integrated with the ATM system and remains available on dedicated A-SMGCS displays on ATC TWR CWPs even if the ATM system fails.

3.2 The system architecture includes:

- Redundant A-SMGCS Control & Monitoring System (CMS) workstations, multiple controllers working positions, and backup displays.
- Redundant Surveillance Data System (SDS) servers, Data Recording Facility (DRF) servers, NTP time servers, and Communication Gateway Processing (CGP) servers.
- All equipment is connected via dual-bonded LANs and the existing OPC network.

4. TECHNICAL PERFORMANCE

4.1 The A-SMGCS key technical performance parameters are set as follows:

A- SMR (Surface Movement Radar):
1- X-Band radar, update rate of 1 second (60 RPM), range around ~5 NM.
2- Detects non-cooperative targets (vehicles/objects non equipped with transponders).

B- Mini SMR (Gap Filler)
1- Rotation rate 60 RPM [1 Sec update rate]
2- Transmitter 80 W, solid state
3- Operational range 1250 m
4- Compliant with EURCAE ED-116 Specifications

C- MLAT (Multilateration):
1- The ground stations are composed of (RX, RXTX, RXTR), distributed for optimal coverage and redundancy.
2- Receives SSR, Mode-S, and ADS-B; uses TDOA for position calculation.
3- Designed with N-1 redundancy: Loss of any single MLAT station does not impact the coverage.

D- Accuracy and Update Rate:
1- Position accuracy: Better than 25 meters for cooperative targets (MLAT/ADS-B).
2- Update rate: 1 second or less for all surveillance data.
3- Latency: End-to-end system latency maintained below 2 seconds.

E- System Redundancy:
1- Multiple sensors and processing units ensure continuous operation.
2- Redundant power supplies, servers, and network connections.

5. CONCLUSION:

5.1 The deployment of the Advanced Surface Movement Guidance and Control System (A-SMGCS) in Saudi Arabia represents a transformative milestone in modernizing ground movement operations at King Khalid International Airport (OERK) and Prince Mohammad bin Abdulaziz International Airport (OEMA) and maintaining safe aircraft ground movements during all weather conditions. By integrating advanced surface movement surveillance technologies, A-SMGCS significantly improves the safety, efficiency, and capacity of airport surface movements, especially under low-visibility conditions.

5.2 This system enables real-time monitoring and coordination of aircraft and vehicle traffic on the ground, reducing the risk of runway incursions, ground conflicts, and enhancing situational awareness for air traffic controllers.

6. ACTION BY THE MEETING:

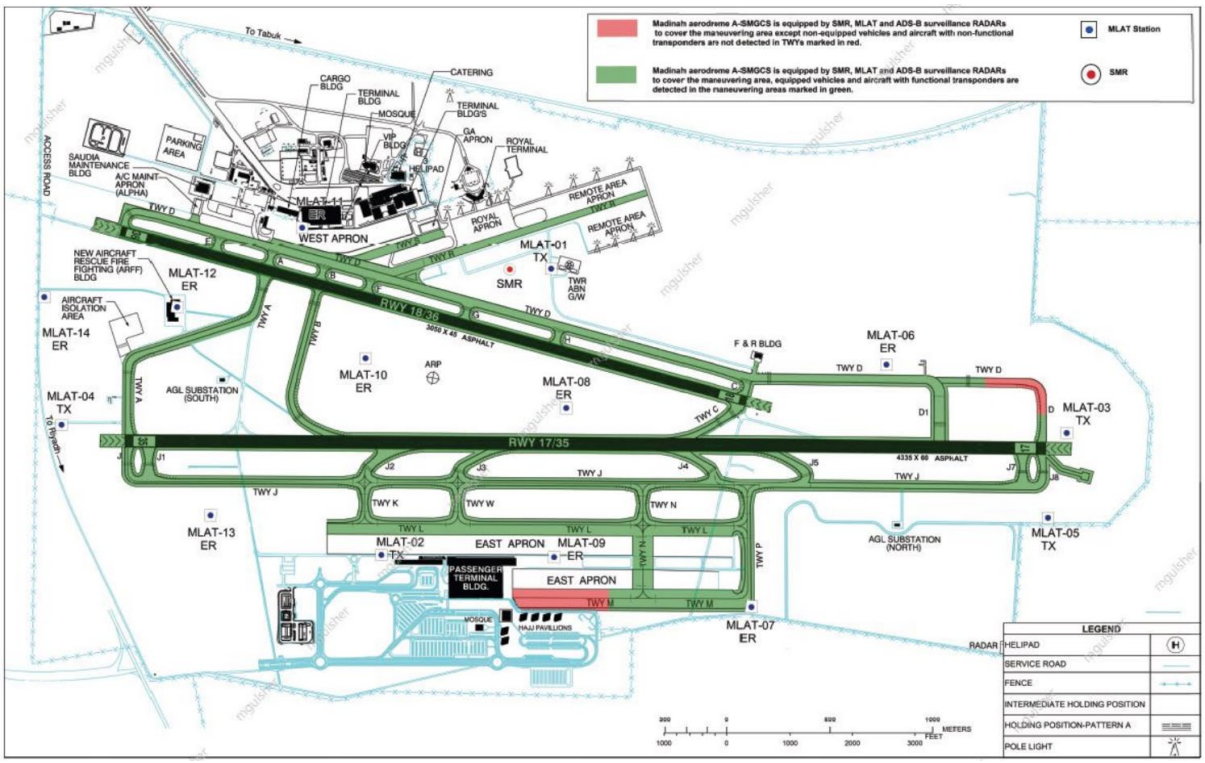
6.1 The meeting is invited to:

a) take note of the information in this Working Paper and the successful commissioning and regulatory approval of A-SMGCS at King Khalid International Airport (OERK) and Prince Mohammad bin Abdulaziz International Airport (OEMA);

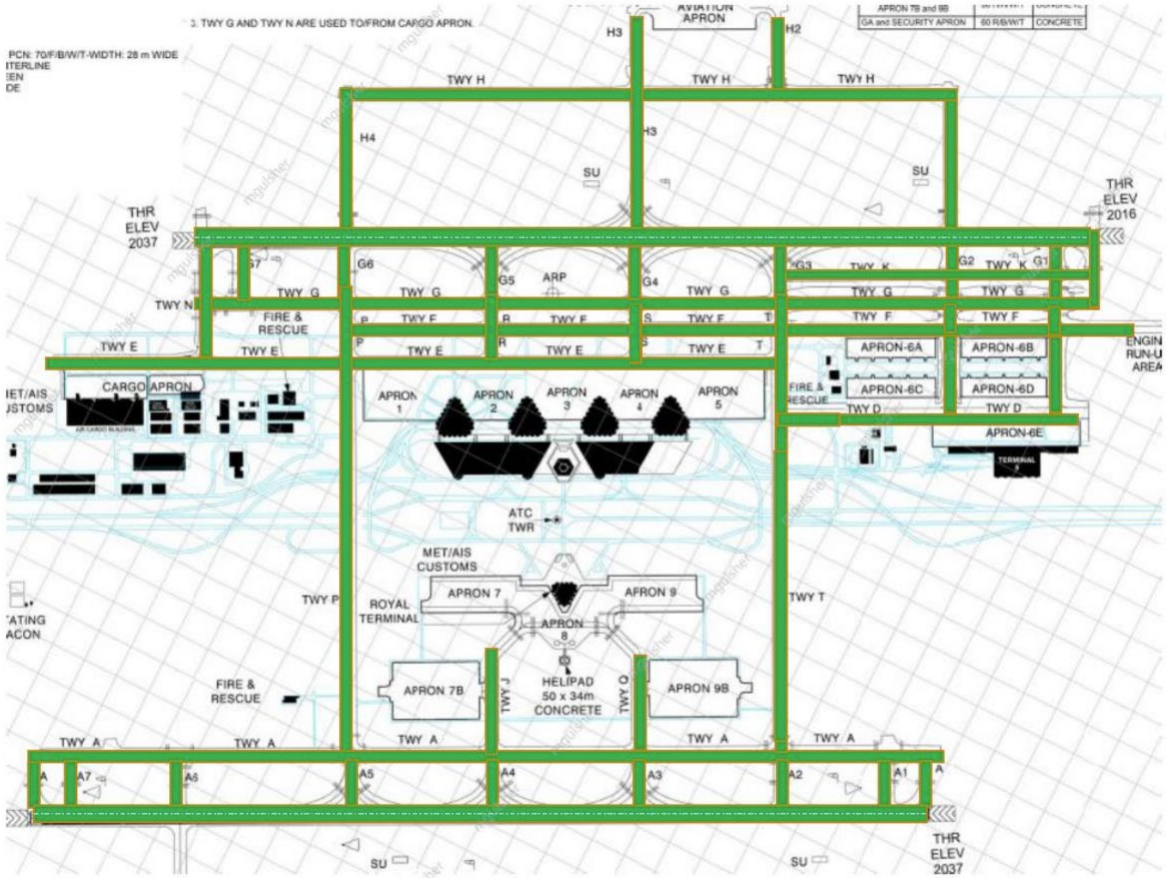
b) encourage -the deployment of A-SMGCS as a key step toward enhancing surface movement surveillance and operational safety under all weather conditions;

c) encourage collaboration and knowledge sharing among MID States for similar implementation; and

d) invite the ICAO Secretariat to include the deployment of A-SMGCS in the Mid-Air Navigation Report for 2025.



Prince Mohammad Bin Abdulaziz International Airport (OEMA)



King Khalid International Airport (OERK)

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