*International Civil Aviation Organization*

**Ninth Meeting of the Surveillance Implementation Coordination Group (SURICG/9)**

*Bangkok, Thailand, 07 - 10 May 2024*

Agenda Item 7: Update on surveillance activities and explore potential cooperation opportunity

a) States/Administrations

# ENHANCING SURVEILLANCE PROVISIONS FOR SAFE AND RELIABLE SERVICES FROM AERODROME CONTROL TOWERS AND APRON CONTROL CENTRES IN THE HONG KONG INTERNATIONAL AIRPORT

(Presented by Hong Kong, China)

**SUMMARY**

This paper provides information on enhanced surveillance provisions for providing safe and reliable services from aerodrome control towers and apron control centres in the Hong Kong International Airport, including Advanced Surface Movement Guidance and Control System (A-SMGCS), Digital Apron and Tower Management System (DATMS) and Automatic Foreign Object Debris Detection System (AFODDS).

## 1. INTRODUCTION

1.1 Since 1996, the Hong Kong International Airport (HKIA) has been ranked the world's busiest cargo airport, which handled 4.3 million tonnes of cargo in 2023. In the HKIA, air traffic control (ATC) services for landing and departing flights as well as their ground movements are provided by ATC Officers (ATCOs) at the aerodrome control towers. To provide safe and reliable ATC services, ATCOs rely on various essential information, such as flight information and surveillance data, etc., provided by various ATC systems, particularly under challenging conditions, such as low visibility and adverse weather scenarios (e.g. foggy weather, rainstorm, thunderstorm, tropical cyclone).

1.2 Advanced Surface Movement Guidance and Control System (A-SMGCS) has been used in providing enhanced surveillance and safety alert functions for aircraft and vehicle movements at the HKIA since 2005. A new A-SMGCS with enhanced resilience and additional sensors has been deployed since July 2022, which covers the South and North Runways and associated taxiways / taxilanes. The system is being expanded to cover the Three-runway System (3RS) at the HKIA with target for commissioning in end 2024.

1.3 Digital Apron and Tower Management System (DATMS) is a new application deployed at the HKIA since July 2022 to enhance the ATCOs' and apron controllers' visual capabilities by providing out-of-window views in a panoramic manner through stitching the digitized views from ultra-high definition cameras, augmented with essential aircraft/vehicle information on the digitized videos. Similar to A-SMGCS, the first phase of DATMS has been commissioned since July 2022 and is being expanded to cover the 3RS.

1.4 Automatic Foreign Object Debris Detection System (AFODDS) has been deployed at the HKIA since 2018 to enhance runway safety. The system can automatically detect FOD on runways

in a real-time and round-the-clock manner. The FOD alerts generated by the system serve as a complement to the runway inspection regime for safeguarding aircraft during take-off and landing.

1.5 This paper highlights the latest technologies adopted by the HKIA for implementation of A-SMGCS, DATMS and AFODDS to cope with the air traffic growth and operational needs.

## 2. DISCUSSION

Advanced Surface Movement Guidance and Control System (A-SMGCS)

2.1 A-SMGCS has integrated with data available from multilateration (MLAT), Automatic Dependent Surveillance-Broadcast (ADS-B), Surface Movement Radars (SMR) and airfield ground lighting (AGL) system for enhanced surveillance of aircraft and vehicle movements in the airfield, and provision of both visual and audio alarms for meeting pre-defined criteria for pre-alert and alert conditions upon detecting potential conflicts and runway incursion situations for enhanced flight safety and efficiency. The accurate surface movement information provided by A-SMGCS enables the ATCOs to maintain situational awareness at all times under various visibility conditions.

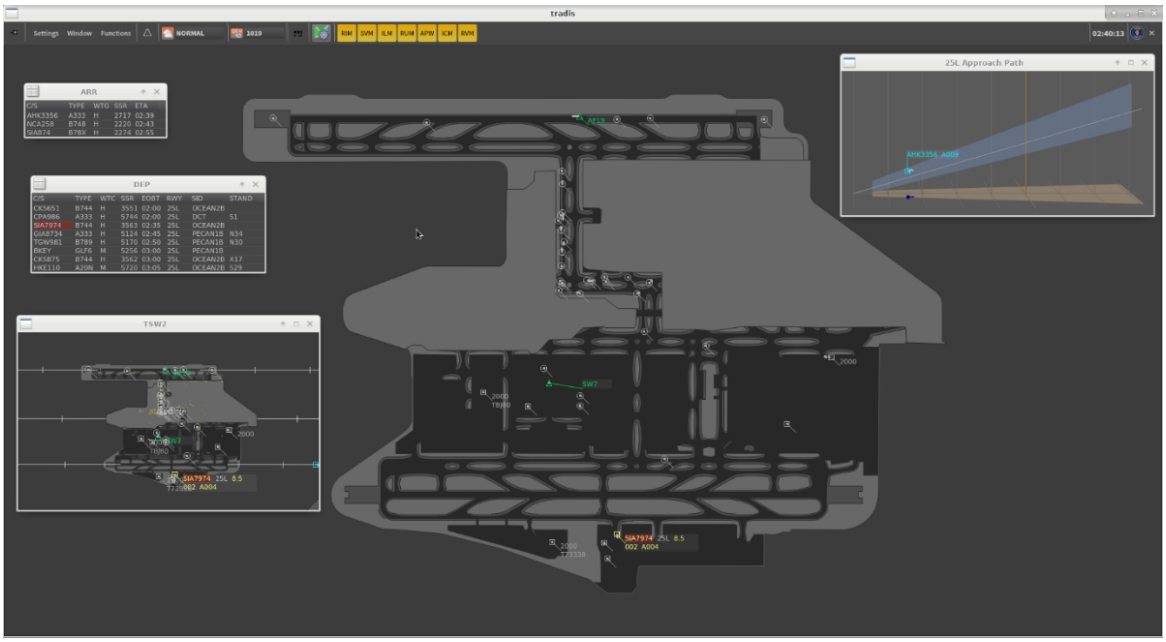

*Figure 1. Human-machine Interface of A-SMGCS at the HKIA*

Digital Apron and Tower Management System (DATMS)

2.2 DATMS leverages the cameras installed at strategic locations and stitching of individual camera outputs to generate panoramic views. Camera views under DATMS provide enhanced visualization of air and ground movements at the airport. A total of 240 cameras at various strategic locations at the HKIA have been installed. DATMS utilizes real-time digitized video outputs, augmented with flight information and surveillance data, to provide users with integrated visualization of activities at the airport.

*Figure 2. Panoramic view of South Runway (07R/25L) from DATMS*

2.3 With ultra-high resolution panoramic views, digital video technology, predictive intrusion alerts and flight information tagged to aircraft and vehicles on runways and taxiways, DATMS provides augmented visual presentation that significantly improves operators' experience and appreciation of activities on the airfield, enhancing the efficiency and safety of ATC and airport operations. They provide the below operational benefits:

(a) increased visibility under low light or low visibility conditions, such as night time conditions or during adverse weather;

(b) pan-tilt-zoom capabilities at strategically located cameras to cover locations far away or out-of-sight from aerodrome control towers / apron control centres; and

(c) real-time predictive alerts of conflicting situations, or intrusion into runway and airfield-restricted areas, based on artificial intelligence algorithms.

2.4 In sum, DATMS integrates various essential flight information and real-time operational data, such as surveillance data, flight information, parking stand information, etc., to provide real-time flight/vehicle information overlaid onto display screens. The overplayed information is user-configurable data to suit operational needs and users' preferences. Each camera array is also equipped with a pan-tilt-zoom camera to provide aircraft tracking features for tracking aircraft movements on runways and taxiways.

Automatic Foreign Object Debris Detection System (AFODDS)

2.5 AFODDS relies on sensors installed near each of the runways to provide round-the-clock monitoring of stray items. Equipped with electro-optical sensors and image analytics capability, the AFODDS can detect items as small as a golf ball under all weather conditions. If foreign objects are found on the runways, AFODDS will alert the apron control centres and aerodrome control towers.

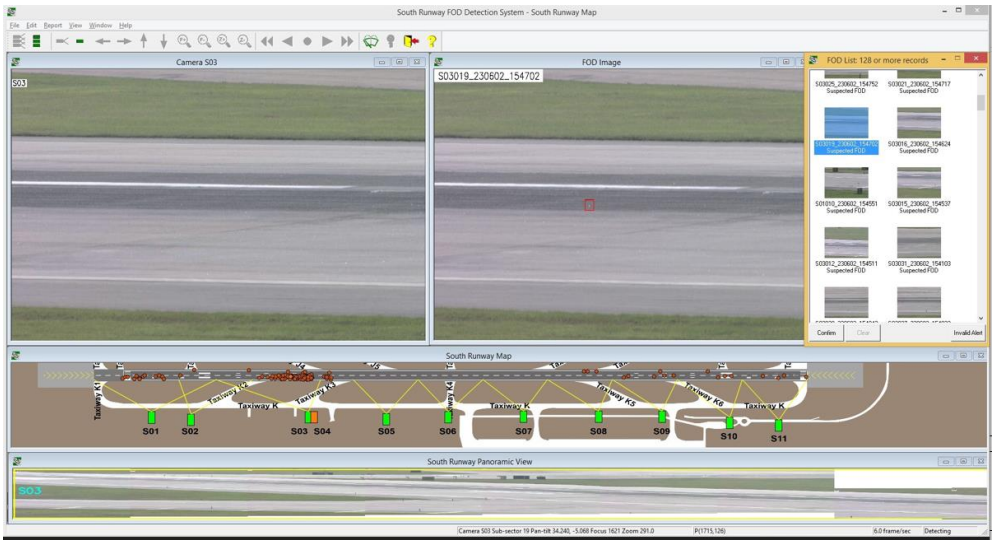


*Figure 3. Graphic User Interface from AFODDS*

**CONCLUSION**

2.6 In the HKIA, A-SMGCS, DATMS and AFODDS have enhanced surveillance capabilities and real-time situational awareness for aerodrome control towers and airport apron control centres, fostering closer collaborations with quick decision-making, all of which are conducive to further improving safety and efficiency of the overall aerodrome tower control and apron operations.

The application of advanced digital/smart technologies in the HKIA has provided an example for further enhancing the safety and efficiency of busy airports.

2.7 States/Administrations are invited to consider the implementation of relevant technologies, based on the ICAO Global Air Navigation Plan / Aviation System Block upgrades (GANP / ASBU) framework, if deemed necessary and operationally justified, to enhance surveillance provisions for safe and reliable services from aerodrome control towers and apron control centres at busy airports.

## 3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) consider the implementation of relevant technologies, based on the ICAO Global Air Navigation Plan / Aviation System Block upgrades (GANP / ASBU) framework, if deemed necessary and operationally justified, to enhance surveillance provisions for safe and reliable services from aerodrome control towers and apron control centres at busy airports; and

b) discuss any relevant matter as appropriate.

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