International Civil Aviation Organization

Twenty Sixth Meeting of the Communications/ Navigation and Surveillance Sub-group (CNS SG/26) of APANPIRG

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Agenda Item 13 **Discuss and share experience and application of new technologies, including big data analysis, artificial intelligence, Digital Tower, counter UAS detection and identification system, UTM, etc.**

PROVISION OF A DIGITAL TOWER AND APRON MANAGEMENT SYSTEM TO SUPPORT SAFE AND EFFICIENT OPERATION OF THE HONG KONG INTERNATIONAL AIRPORT AND ITS EXPANSION

(Presented by Hong Kong, China)

SUMMARY

To support expansion of the Hong Kong International Airport (HKIA) into Three Runway System, Hong Kong Civil Aviation Department (CAD) has partnered with Airport Authority Hong Kong (AAHK) to implement a Digital Tower and Apron Management System under roadmap of the ICAO Global Air Navigation Plan. The system has further enhanced situation awareness of air traffic controllers and apron controllers and increased safety and operational efficiency for the HKIA and its expansion. States/Administrations are encouraged to share their experience in use of advanced technologies in busy airports to support safe and efficient provisions of air navigation service which is of particular importance for air traffic recovery.

1. INTRODUCTION

1.1 Air Traffic Control (ATC) services for arriving flights, departing flights and ground movements at an airport are provided by Air Traffic Control Officers (ATCOs) stationed at an aerodrome control tower, which is typically a tall and windowed infrastructure overseeing the whole airfield. To maintain situation awareness of on-airport aircraft/vehicle movements, ATCOs rely on various essential information such as flight information, surveillance, scheduling etc. provided by ATC systems. Capitalizing on the latest digital video technology and in line with the roadmap stipulated in ICAO Global Air Navigation Plan (GANP), Remote Tower (RT), Digital Tower (DT) and Digital Apron (DA) have emerged as applications to overcome physical visual constraints by supplementing the tower's out-of-window view with ultra-high definition camera views on displays overlayed with essential aircraft information to substantially enhance ATCOs' visual surveillance.

1.2 To propel the HKIA towards a Smart Airport City, a digital transformation roadmap was formulated, which encompasses a broad scope of digitization initiatives and comprehensive business strategies, through the adoption of proven and modern-day technologies and innovations to

achieve deepened and widened operational integration of stakeholders in the aviation community such as ANSP, airport operator, air operators. Through use of multi-faceted and collaborative applications to exchange or share data/imagery, ATC and airport operations are expected to benefit. Such digital transformation will increase predictability and unleash latent capacity which are the core to ATC and airport operations in general.

1.3 A prominent application is the Digital Apron and Tower Management System (DATMS) jointly developed by CAD and AAHK to support operations of the HKIA and its expansion into Three Runway System. The first phase of DATMS has been commissioned since July 2022. This paper highlights the technologies adopted by the DATMS and its operational benefits.

2. DISCUSSION

2.1 The DATMS comprises two systems, namely Digital Tower Facilities (DTF) and Digital Apron Management System (DAMS). Both DTF and DAMS leverage on cameras installed at strategic locations and "stitching" of individual camera outputs to generate panoramic views. Camera views under DTF provide enhanced visuals of air and ground movements or supplement out-of-sight for ATC purposes whereas views under DAMS generally cater for airport operation. A total of 240 cameras spreading across the HKIA are deployed. DTF and DAMS mutually share real-time video outputs, flight information and surveillance data to enable users of either system to have the necessary and integrated visualization of activities at the airport. In addition to real-time video capturing, essential flight information tagged to aircraft in view to augment situation awareness of system users.

2.2 With ultra-high resolution views, smart digital video technology, predictive intrusion alerts, panoramic views of the airfield with 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. Other benefits include:

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

(b) Zoomed and strategically located cameras provide out-of-sight or out-of-direct-line of sight views; and

(c) Real-time predictive alerts of conflicting situation or intrusion into runway and airfield restricted areas.

<u>Digital Tower Facilities (DTF)</u>

2.3 DTF integrates various essential flight information and real-time operational data, such as ground surveillance data, flight data, parking stand information, etc, to provide real-time flight/vehicle information overlayed onto the display for ATCOs. The overlayed information is user-configurable data to suit operational needs and users' preference. Each camera array is also equipped with a pan-tilt-zoom camera to provide the aircraft tracking features for tracking aircraft movements of interest on runways and taxiways.

2.4 Artificial intelligence combined with digitized video provides additional safety alerts, such as early detection of conflicting situation or intrusion into airfield restricted areas. Customized functionalities under development include displaying occupancy for runway and parking stands to enhance ATCOs' situation awareness.

2.5 These ATC related operational data are shared in real-time with all authorized HKIA operational personnel to improve situation awareness of all stakeholders concerned without increasing their workload in addition to radio/landline communication.

Digital Apron Management System (DAMS)

2.6 To support airport transformation and large-scale expansion plans at HKIA, DAMS serves to provide aerodrome surveillance and anomaly detection functionalities. The solution provides airport operational personnel in the new Integrated Airport Centre (IAC) with brand new automated digital experience and increase their situation awareness on both apron and critical aircraft maneuvering area, and hence facilitate safety assessment and operational planning.

2.7 Customized functionalities under development include:

(a) Through data integration with various platforms and operational databases, DAMS would provide a wide array of rule-based automated alerts to monitor performance and operational readiness status of facilities around-the-clock; and

(b) With use of ground surveillance and video analytics for aircraft position tracking and route prediction, apron traffic safety and efficiency will be enhanced by automated control of back-of-stand roads vehicle stop signs, which stop apron vehicles before aircraft enters into parking stands.

3. CONCLUSION

3.1 The implementation of DATMS has enhanced information exchange and real-time situation awareness between ATCOs and airport operational personnel, foster closer collaborations and facilitate decision-making, all of which are conducive to further improving safety and efficiency of the overall ATC and airport operations. The application of advanced digital technology in the HKIA sets a good example on further enhancing safety and efficiency of busy airports, especially during period of air traffic recovery. A harmonized approach with common standards and guidance materials is recommended to facilitate implementation of Digital Tower and Digital Apron technologies worldwide.

4. ACTION BY THE MEETING

4.1 The meeting is invited to:

a) note the efforts by Hong Kong, China in enhancing the ATC and airport operational safety and efficiency through the application of advanced Digital Tower and Digital Apron technologies;

b) note a harmonized approach with common standards and guidance materials is recommended to ensure the harmonization and implementation of advanced Digital Tower and Digital Apron technologies worldwide; and

c) encourage States/Administrations to continue with regional collaboration and the sharing of experiences in the use of advanced technologies for the safe, efficient and sustainable development of aviation.

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