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**Agenda Item 3: Performance Framework for Regional Air Navigation Planning and
Implementation**

3.1: AOP

**TECHNOLOGY-ENABLED WORKFORCE IN SUPPORTING POST-COVID-19
AIR TRAFFIC RECOVERY AT HONG KONG INTERNATIONAL AIRPORT**

(Presented by Hong Kong, China)

SUMMARY

In coordination with the Hong Kong Civil Aviation Department, the Airport Authority Hong Kong has continued to proceed full steam ahead on a Digital Transformation Roadmap under the Smart Airport vision. This paper presents the experience on three key airport technology deployments including the implementation of (1) Driverless Technology, (2) Digital Apron and Tower Management Systems and (3) Smart Marshalling for the purpose of developing a technology-enabled workforce to enhance resilience and sustainability across the Hong Kong International Airport in the path of post-COVID-19 air traffic recovery.

1. INTRODUCTION

1.1 Mindful of the need to nurture airport-centric technology advancement and development, since 2015 the Airport Authority Hong Kong (AA) has organized an annual Technovation Conference and Exhibition. By leveraging leading airport technologies under the Smart Airport vision, the Hong Kong International Airport (HKIA) has continued to serve as an incubating platform for the airport technology industry to explore and experiment innovative solutions in aviation. In recent years, in coordination with the Hong Kong Civil Aviation Department (CAD) throughout the airport technology development and assessment processes, AA has enjoyed, and benefitted from, the fruit of leading airport technologies. In particular, the impact to airport workforce due to the COVID-19 pandemic has necessitated the increased utilization of airport technologies at HKIA to maintain a high standard of airport safety and security in the path of post-COVID-19 air traffic recovery.

1.2 This paper presents the experience on three key airport technology deployments targeting to develop a technology-enabled workforce to enhance resilience and sustainability across HKIA in the path of post-COVID-19 air traffic recovery.

2. DISCUSSION

2.1 **Driverless Technology for Security Patrol, Baggage, Cargo and Staff Conveyance.** HKIA is constantly in pursuit of innovative solutions for safe and efficient airport operations. Noting the impact to airport workforce due to the COVID-19 pandemic and the time required to rebuild the workforce in preparation for air traffic recovery, the need to enhance the resilience and sustainability across HKIA is considered imminent. HKIA has therefore been exploring the use of autonomous vehicle since 2019, and is taking a progressive approach in adopting such technology for airside transportation under all weather conditions. Each autonomous vehicle has been equipped with Light Detection and Ranging (LIDAR), high-definition cameras and Differential GPS technologies with fine-tuned traffic/obstacle detection and collision avoidance, and geo-fencing functions. After being the first airport in the world to deploy Autonomous Electric Tractors (AETs) into live operations for baggage conveyance, HKIA has expanded the adoption of autonomous vehicles into other applications, eventually developing an extensive network under the Airport Autonomous Transport System (AATS).

2.1.1 **Autonomous Electric Tractor for Baggage deployment (AET Baggage) in December 2019.** Baggage of passengers using the ferry transfer services to/from the Mainland China and Macao are currently being transported through a 2km airside road between the Baggage Hall at Terminal 1 and the SkyPier. Tractor drivers and airport security staff originally assigned to such baggage transfer tasks can be gainfully re-deployed to other duties.



Figure 1 - AET departing from Baggage Hall at SkyPier

2.1.2 **Autonomous Patrol Car (APC) deployment in September 2021.** Patrol duty along the airport perimeter is usually carried out by airport security officers at regular intervals. As HKIA is in the progress of expansion into a future Three-Runway System (3RS) with a major increase of operation footprint, similar driverless technology has been deployed to enhance the efficiency and effectiveness in perimeter patrolling. The deployment has been adopted with relevant aviation security surveillance functions with increased patrolling frequency thus reduced pressure on airport security officers' rostering in particular during adverse weather.



Figure 2 - APC on patrol

2.1.3 **Autonomous Electric Tractor for Cargo deployment (AET Cargo) in February 2022.** Similar to the deployment of AET Baggage, the driverless technology has ventured further out to handle cargo conveyance to address the future long distance towing (more than 7km) between cargo handling areas and future apron areas upon the commissioning of 3RS at HKIA. AET Cargo has commenced relevant safety data collection on road portions with different operation features including tunnel, roundabout, lane merging, traffic/obstacle detection and collision avoidance, etc. It is anticipated that the successful deployment of AET Cargo will significantly increase the cost effectiveness of future airport operations.



Figure 3 - AET for cargo conveyance

2.1.4 **Autonomous Electric Staff Bus planned for March 2023.** Apron buses are yet another planned application of driverless technology in the AATS. HKIA currently provides the airport community with a staff shuttle service travelling along apron roads. Adopting driverless technology will enable a more convenient service with greater flexibility in operating hours and frequencies.



Figure 4 - Preliminary testing of autonomous electric staff bus

2.1.5 All these electric transportation means are in line with the HKIA's initiative since 2012 to become World's Greenest Airport.

2.2 **Digital Apron and Tower Management Systems (DATMS).** To prepare HKIA in moving forward under the Smart Airport vision, digital transformation roadmap encompasses a wide scope of digitized activities and comprehensive business strategy. Multi-facet operations including airport operations, capacity management and stakeholder management can now leverage a diverse spectrum of mature technologies and innovations to enable increased operational integration in airport community. Against such background, DATMS is a project being developed jointly by CAD and AA with an aim to enhance the aerodrome safety and operational efficiency at airfield, apron and tower. DATMS comprise of two systems, namely (1) Digital Apron Management System (DAMS) and (2) Digital Tower Facilities (DTF).



Figure 5 - DAMS workstation

2.2.1 To support airport transformation and 3RS at HKIA, DAMS serves to provide aerodrome surveillance and anomaly detection functionalities. The solution will provide personnel in the new Integrated Airport Centre (IAC) not just with new infrastructure but with new automated digital experience of surveillance on apron area and critical aircraft maneuvering areas for situation assessment and operations planning.



Figure 6 - Panoramic view of apron areas on video wall panels of DAMS installed at IAC, HKIA

2.2.2 DTF overcomes the physical constraint of traditional air traffic control (ATC) tower and eliminates sight-obstructed apron/taxiway areas/runway ends under all weather and all day-light conditions. Panoramic view of the airfield with real-time situation of aircraft and vehicle movements on the runways and taxiways together with the essential aircraft information is provided to the air traffic control officers to facilitate the provision of ATC services through enhancement of situation awareness.



Figure 7 - Panoramic view of runway, taxiway and apron areas with essential flight data tagged on each aircraft

2.2.3 The implementation of DATMS has enhanced information exchange and real-time situation awareness between air traffic control officers and airport operational personnel, fostered closer collaborations and facilitated decision-making, all of which are conducive to further improving safety and efficiency of the overall ATC and airport operations. It will also enable further assessment on more effective deployment of manpower resources to support long term growth at HKIA.

2.3 **Smart Marshalling.** In view of increasing deployment of automated and digital surveillance and control systems in assisting airfield operations officers on aircraft docking monitoring, HKIA is exploring an enhancement in the concept of operations (CONOPS) leveraging the introduction of various advanced technology including enhanced Airport Docking Guidance System and 4K on-stand CCTV to achieve the following objectives:

- Utilize advanced technology including augmented image visualization to assist in operations and to enhance operational efficiency
- Co-locate operators in IAC to save travelling time and to increase flexibility in manpower deployment
- Enhance safety through advanced systems and re-engineered work processes
- Deploy manpower resources more effectively
- Handle equipment fault in advance to promote On-Time-Performance

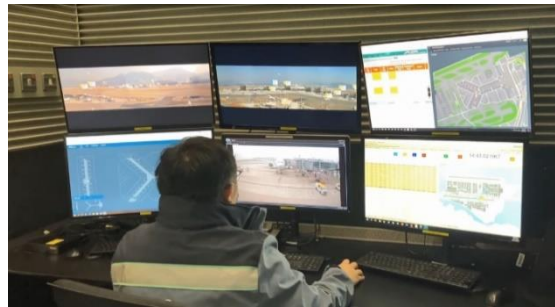


Figure 8 - Airfield operations officer trialling CONOPS under Smart Marshalling

2.3.1 More effective deployment of manpower resources is one of the key targets of AA, particularly upon the commissioning of future apron areas under 3RS at HKIA. The increase of operation footprint at HKIA will impose operational challenges on manpower deployment among all apron areas. The utilization of automation and assistive operations system will minimize human intervention and enable more flexible manpower deployment by reducing physical presence on site. Intensive safety data collection period for the concerned CONOPS implementation has been scheduled.

2.4 **Coordination between AA and CAD on Airport Technology Deployments**

2.4.1 Throughout the development of the above airport technologies under the Smart Airport vision, AA has endeavoured to enhance resilience and sustainability across HKIA in the path of post-COVID-19 air traffic recovery, while CAD has conducted thorough assessment on the implementation and test plans, observed trials of various operational modes and test scenarios, and vetted the standard operating procedures, contingency plans and test reports before the live operations. In particular, as the regulator of aerodrome safety and security for HKIA, CAD is committed to ensuring that the airport technology deployments will further strengthen the high standard of safety and security at HKIA.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) note the efforts made jointly by AA and CAD in enhancing the resilience and sustainability across HKIA in the path of post-COVID-19 air traffic recovery by the adoption of leading technologies to further strengthen the high standard of airport safety and security;
- b) share experience and lesson-learnt of planning and implementation for the application of technologies to an airport environment in enabling more effective and timely re-deployment of manpower resources to meet the manpower demands for air traffic recovery; and
- c) discuss any relevant matters as appropriate.

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