International Civil Aviation Organization

Eleventh Meeting of the Air Traffic Management Sub-Group (ATM/SG/11) of APANPIRG

Singapore, 2 – 6 October 2023

Agenda Item 5: ATM Systems (Modernization, Seamless ATM, CNS, ATFM)

IMPLEMENTATION OF DIGITAL TOWER FACILITIES AT HONG KONG INTERNATIONAL AIRPORT

(Presented by Hong Kong China)

SUMMARY

The Digital Tower Facilities (DTF) System at Hong Kong International Airport (HKIA) enhances the visual capacity of aerodrome controllers by providing comprehensive coverage of the aerodrome through multiple camera views. With features such as seamless stitching, pan-tilt-zoom views and overlay capabilities, controllers have access to a detailed and intuitive user interface to enhance their situation awareness. The system also ensures continuous operation through redundancy and failover mechanisms.

1. INTRODUCTION

1.1 DTF is a sub-system of the Digital Apron and Tower Management System (DATMS) jointly developed by the Civil Aviation Department (CAD) of Hong Kong and the Airport Authority Hong Kong (AAHK). Integrated with the Digital Apron Management System (DAMS) which focuses on the apron and stand areas, the DATMS is formed to provide full real-time visual coverage within HKIA coupled with essential ATC and airfield operational information.

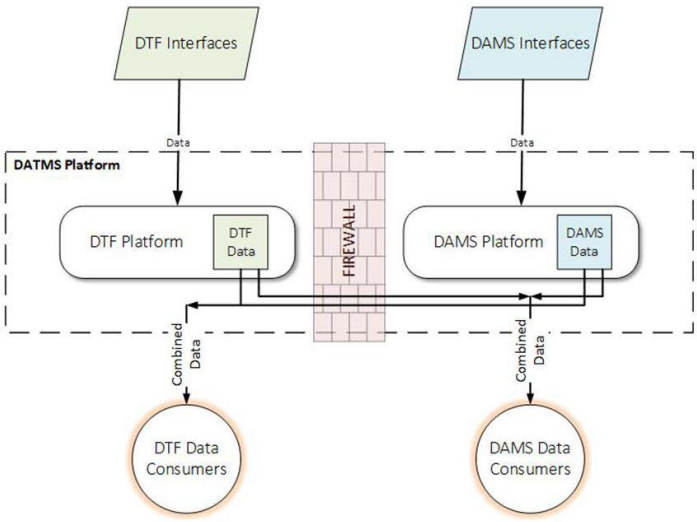

Figure 1 – High level Architecture of the DATMS

1.2 The DTF system is designed with multi-level system resilience to ensure reliable H24 operation in all weather conditions. Both the workstations and centralized servers have primary and secondary provision to ensure system availability. External data are connected to the DTF with resilient paths and secondary data sources.

1.3 Switching between the primary and secondary systems can be done seamlessly through the KVM toggle switch.

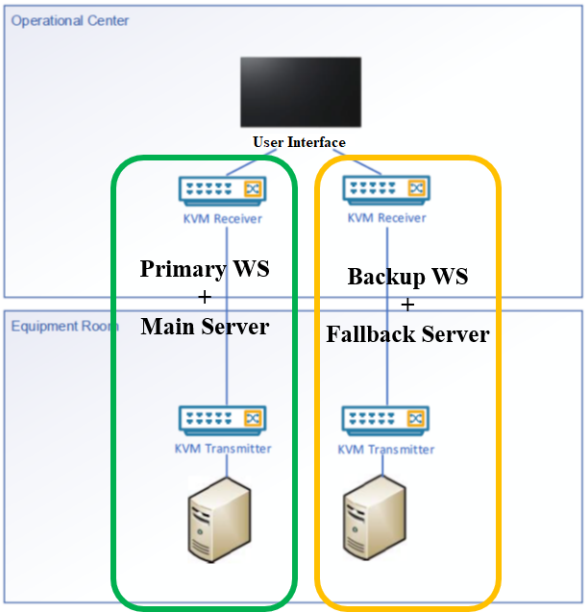

Figure 2 – DTF System Configuration

1.4 The DTF system is currently connected to some 180 ultra-high definition cameras, including fixed position cameras and cameras with pan-tilt-zoom capabilities. These cameras are strategically installed across 18 locations within HKIA.

2. DISCUSSION

Features in DTF

2.1 Video Views

2.1.1 The Panoramic View window contains a seamless stitch of real-time video feed with latency of not more than 1 second from multiple cameras at 25 frames per second.

2.1.2 The PTZ View window contains video streams fed directly from various PTZ cameras. The PTZ View allows controllers to zoom, pan, and tilt the camera to focus at specific area of interest with the capability of 30x optical zoom.

2.1.3 The Spot /Approach View window shows video streams extracted from panoramic camera arrays (Spot View) or Approach cameras. Approach View provides video feeds from designated Approach View cameras, covering a minimum of 2 NM final for each runway direction.

Figure 3 – DTF User Interface

2.2 Data Tags

2.2.1 Data Tags in the DTF display designated information sourced from other ATC systems. These tags are calibrated to appear close to and move along with the targets on the Panoramic View windows. There are five types of data tags available, differentiated by their content and border colour:

Type	**Content**	**Border Colour**
Arrival	ACID ACFT type | WTC | Stand	Blue
Departure	ACID ACFT type | SID	Yellow
Vehicle	ACID / SSR code if ACID N/A	Green
Local	ACID / SSR code if ACID N/A ACFT type (if available)	Pink
Tow	ACID / SSR code if ACID N/A	Purple

Table 1 – Data Tags Types

Figure 4 – Data Tags Samples

2.3 Landmark Overlays

2.3.1 To improve situational awareness, overlays are available in Panoramic and Approach Views. Different colours are used to depict different parts of the aerodrome in Contour Overlay:

Aerodrome Parts	**Colour**
Runway Contour	Solid yellow
Taxiway Contour	Solid blue
Holding Point	Dashed red

Table 2 – Contour Overlay Types

Figure 5 – **Contour Overlay Illustration**

2.3.2 Approach Path Overlay provides a visual reference of the distance to touchdown for aircraft on approach from approximately 6NM final to short final on the Approach View window.

Figure 6 – Approach Path Overlay Illustration

Enhancing Safety and Efficiency

2.4 The implementation of DTF with ultra-high-resolution views, smart digital video technology, panoramic views of the airfield with flight information tagged to aircraft and vehicles, and augmented visual presentation of the airfield has significantly enhanced the visual capacity and situation awareness of aerodrome controllers, and thus further enhancing safety and efficiency of ATC and airport operations. Other benefits include:

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

b) Providing real-time visual coverage of sight-obstructed areas and areas far from the ATC Towers.

Future Development

2.5 The following DTF features are being evaluated for future implementation:

a) Runway Occupancy Indication - provides information on runway usage;

b) Runway Incursion Alert - alerts controllers to potential runway incursions;

c) Apron Gate/Stand Occupancy Indication - monitors the occupancy of apron gates and stands; and

d) Identified Aircraft Highlight – locates and highlights specific aircraft selected from other ATC system (e.g. electronic flight strip) for improved visibility and tracking.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the experience of DTF implementation and operation in HKIA;

b) note the benefit of DTF in further enhancing safety and efficiency for ATC and airport operations; and

c) discuss any relevant matters as appropriate.

…….