International Civil Aviation Organization

Fourth Meeting of the Asia/Pacific Air Traffic Management Automation System Task Force (APAC ATMAS TF/4)

Bangkok, Thailand, 28 – 30 June 2023

Agenda Item 4: ATM Automation System Implementation Experience by States

4.3: Integration with External Systems

INTEGRATION OF METEOROLOGICAL DATA IN APPROACH SPACING MANAGEMENT SYSTEM

(Presented by Hong Kong China)

SUMMARY

Hong Kong China has implemented an Approach Spacing Management System (ASMS) to manage approaching aircraft spacing. Real-time meteorological data, including wind and weather radar data, have been integrated into ASMS to ensure safety and efficiency. This integration allows for the calculation of optimal spacing between aircraft and provides air traffic controllers with information to assess potential disruptions caused by weather conditions.

1. INTRODUCTION

1.1 Hong Kong China has implemented an Approach Spacing Management System (ASMS) for assisting the approach controllers in managing the spacing between aircraft during the final approach of Hong Kong International Airport. As weather conditions can have a significant impact on aircraft performance and affect the approach spacing, real-time meteorological data have been integrated into ASMS for calculation of optimal spacing and information display to the air traffic controllers to ensure safety and efficiency.

2. DISCUSSION

Wind Information for ASMS Calculation

2.1 As wind speed and direction could affect the ground speed of aircraft, the aircraft profile and calculation of corresponding spacing between aircraft pair is highly dependent on the wind condition. Therefore, the integration of meteorological information into ASMS must include accurate and up-to-date wind data. With the collaboration with the Hong Kong Observatory (HKO), two sets of wind data in customized GRIB format were integrated into ASMS, namely (a) “FIR Wind” covering the entire airspace of the Hong Kong FIR and (b) “TMA Wind” covering Approach/Terminal Area. The characteristics of the two sets of wind data are summarized as below:

	FIR Wind	**TMA Wind**
Update frequency	Every 6 hours	Every 10 minutes
Forecast valid time	At T+6hr, T+12hr, T+18hr, +24hr	At T+10 min, T+20 min, T+30 min
Horizontal coverage	Hong Kong FIR	Area of 150NM radius of Hong Kong International Airport
Horizontal resolution	1.25 x 1.25 degrees	0.05 x 0.05 degrees
Vertical resolution	9 layers (From 850 hPa to 100 hPa)	25 layers (From 995 hPa to 400 hPa)

2.2 The FIR Wind provides the wind information for the general trajectory calculation of aircraft. Comparing to the FIR Wind, the TMA Wind provides higher resolution and more up-to-date information on the wind conditions in the airspace surrounding HKIA. Such wind information is crucial for accurately calculating the optimal spacing between pairs of aircraft. To achieve the required level of precision, the HKO combines forecasted wind data with real-time observations from aircraft, including the Aircraft Meteorological Data Relay (AMDAR) and Mode S Downlinked Aircraft Parameters (DAPs).

Constant Altitude Plan Position Indicator (CAPPI)

2.3 To enhance situational awareness of controllers on potential disruptions to aircraft spacing caused by severe weather condition, the ASMS integrates the weather radar data from HKO in Constant Altitude Plan Position Indicator (CAPPI) format. This provides controllers with a visual representation of the intensity of convection overlaying on the air situational display, allowing them to assess the potential impact of significant convective weather along the route of aircraft and approach spacing. Both real-time and forecast CAPPI data can be displayed. The characteristics of the two sets of CAPPI Data are summarized as below for reference:

	CAPPI Data (Nowcast)	**CAPPI Data (Forecast)**
Update frequency	Every 6 minutes	
Forecast valid time	--	Forecast of 60 mins at 6-minute intervals
Horizontal coverage	256 km radius from Hong Kong International Airport	
Vertical resolution	20 layers (Approx. 1,500 - 30,000 feet)	1 layer (At approx. 10,000 feet)

2.4 The weather conditions are categorized into three levels, represented by the following color codes on the Air Situational Display:

a) Green: Light rain;
b) Yellow: Moderate rainfall;
c) Red: Intense rainfall.

An example of nowcast CAPPI weather data displayed on the air situational display is given in Figure 1.

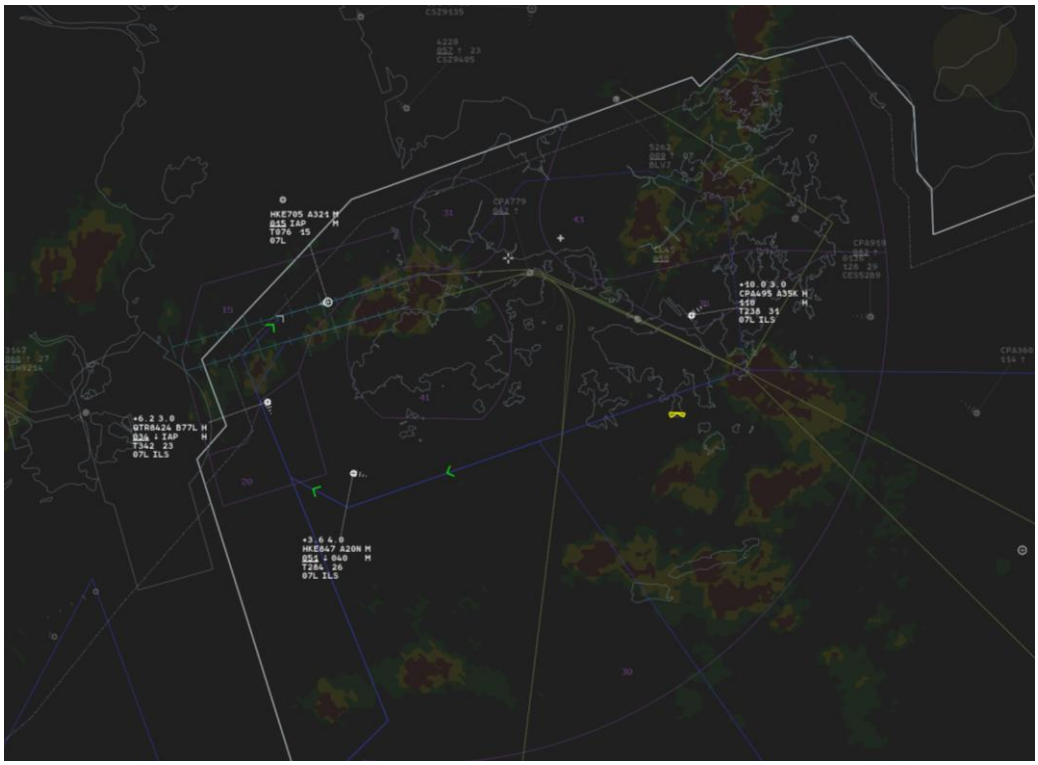

Figure 1 Nowcast CAPPI Weather Data on the Air Situational Display

2.5 Online customization of nowcast CAPPI data display is allowed via selection of the desired intensity and altitude range layers to be shown. In case of the selected altitude range covers multiple layers of CAPPI data, the ASMS will show the highest intensity pixel within the selected vertical column to indicate the most severe weather condition at that location. Figure 2 illustrates the Human Machine Interface for Weather Display Configuration.

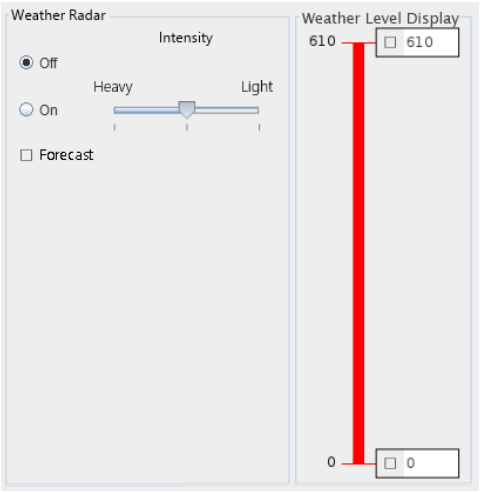

Figure 2 HMI of Weather Display Configuration

Conclusion

2.6 A close collaboration with meteorological office on the integration of accurate and real-time meteorological data for trajectory and optimal spacing calculation is essential for a successful implementation of ASMS. In addition, a visual integration of weather radar data into the air situational display can further enhance situational awareness of air traffic controllers allowing for an assessment of potential disruptions on aircraft spacing caused by severe weather.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the importance of accurate and up-to-date wind data for trajectory and optimal spacing calculation by ASMS;

b) note the benefit of CAPPI data display on the air situational display to enhance controllers' situational awareness for handling potential disruptions to aircraft spacing due to severe weather condition; and

c) discuss any relevant matter as appropriate.

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