Integration of MET Information into Approach Spacing Tool

Hong Kong, China

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Introduction

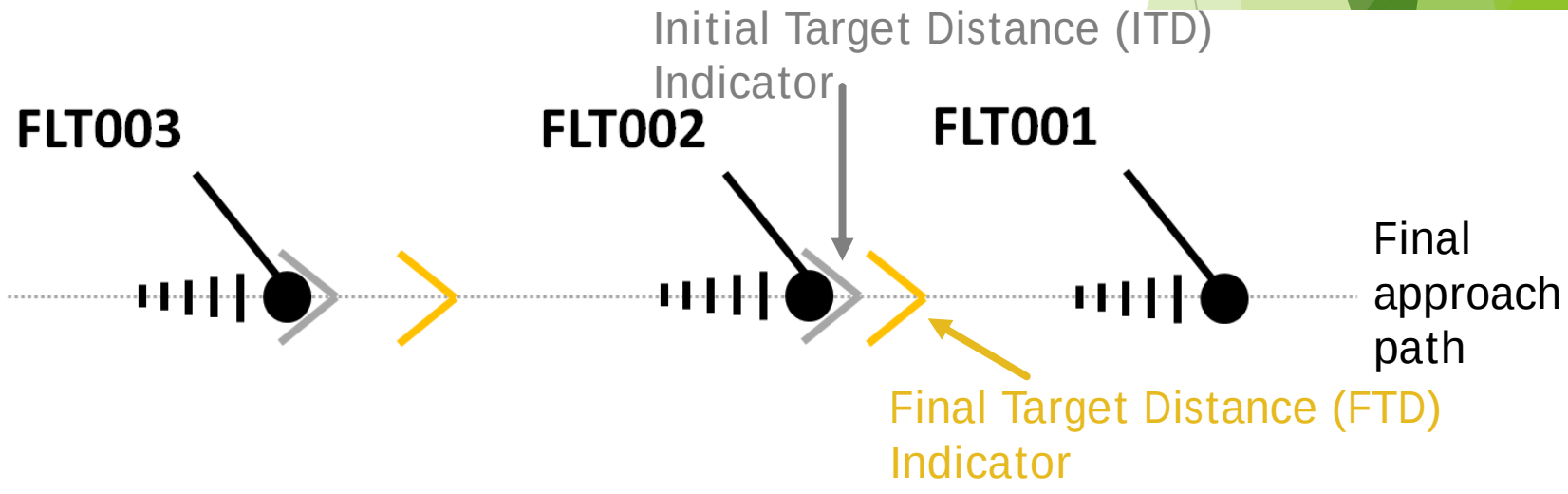
- Hong Kong, China is implementing an Approach Spacing Tool for assisting the approach controllers in improving the consistency in
  - delivering spacing between flights along the final approach path and
  - handling air traffic under the new "enhanced Wake Turbulence Separation" (eWTS) scheme, an alternative set of wake turbulence groups and associated wake turbulence separation minima by ICAO in Amendment 9 to PANS-ATM (Doc 4444).

Approach Spacing Tool

- a distance-based Approach Spacing Tool is being implemented at the Final Approach Director (FAD) position
  - To assist controllers in handling air traffic under eWTS
  - To improve controllers' consistency in delivering the traffic according to the intended runway capacity of HKIA
- determine the required spacing between aircraft along the approach sequence and
- provide advisories to indicate the optimal positions of aircraft along the final approach path

Initial Target Distance (ITD) and Final Target Distance (FTD) indicators

- Initial Target Distance (ITD) is the optimal distance for the following aircraft to be positioned behind a leading aircraft with the consideration of the required minimum spacing and the deceleration compression buffer.
- Final Target Distance (FTD) is the appropriate position for the following aircraft behind a leading aircraft at the required minimum spacing applied at the runway threshold. The follower shall always be behind its respective FTD indicator along the final approach path.
- ITD and FTD indicators were calculated based on
  - the wind information
  - flight profile
  - aircraft performance
  - spacing requirements
  - eWTS minima



Initial Target Distance (ITD) and Final Target Distance (FTD) indicators

- With introduction of the Approach Spacing Tool to the FAD operation, the spacing requirement for each aircraft pairs is presented visually to the controllers on the air situation display via the ITD and FTD graphical advisory indicators.
- Controllers can focus on positioning the aircraft at the ITD indicator, i.e. the optimal distance from the leader, and ensure the required spacing is delivered at the runway threshold using the FTD indicator.

Wind information for Approach Spacing Tool

- The calculation of predicted position of each aircraft is highly dependent on the near real-time wind condition, as wind speed and direction could affect the ground speed of aircraft.
- The Hong Kong Observatory (HKO) will prepare two sets of wind data in GRIB format for integration into Approach Spacing Tool of Hong Kong Civil Aviation Department (HKCAD)
  - wind covering Hong Kong FIR (FIR wind)
  - wind covering Terminal Area (TMA wind)

Wind information for Approach Spacing Tool

		FIR Wind		TMA Wind	
Update frequency		Every 6 hours (at 00, 06, 12, 18 UTC)		Every 10 minutes (shortly after 00, 10, 20, 30, 40 and 50 minutes of each hour)	
Forecast valid time		At T+6hr, T+12hr, T+18hr, T+24hr		At T+10 min, T+20 min, T+30 min	
Horizontal coverage		Hong Kong FIR		150NM from Hong Kong International Airport	
Horizontal resolution		1.25 x 1.25 degrees		0.05 x 0.05 degrees	
Vertical levels in pressure (hPa)	Vertical levels in altitude (ft) (approx.)	850, 700, 500, 400, 300, 250, 200, 150, 100	4800, 9900, 18300, 23600, 30100, 34000, 38700, 44600, 53100	995, 975, 950, 925, 900, 875, 850, 825, 800, 775, 750, 725, 700, 675, 650, 625, 600, 575, 550, 525, 500, 475, 450, 425, 400	500, 1100, 1800, 2500, 3200, 4000, 4800, 5600, 6400, 7200, 8100, 9000, 9900, 10800, 11800, 12800, 13800, 14900, 16000, 17100, 18300, 19500, 20800, 22200, 23600

0 - 5600 ft: 8 levels
5600 - 13000 ft: 8 levels
above 13000 ft: 9 levels

Wind information for Approach Spacing Tool

- TMA Wind dataset has finer spatial and temporal resolutions than FIR wind
  - to reflect the more detailed changes in the wind distribution in the approach area.
- To achieve the high-spatial and temporal resolution of TMA Wind, it is prepared by harmonizing forecast wind with real-time aircraft-based observations including
  - Aircraft Meteorological Data Relay (AMDAR),
  - those derived from Mode S Downlinked Aircraft Parameters (DAP), and
  - other data coming from ground-based sensors.

Coverage of TMA Wind in Hong Kong FIR

CAPPI weather radar data for Approach Spacing Tool

- Weather radar data in Constant Altitude Plan Position Indicator (CAPPI) is being generated by HKO for ingestion to the Approach Spacing Tool
  - to prepare for potential upsetting of minimum separation due to aircraft deviating from severe convection,
- The CAPPI radar image provides the controller with a colour picture of the convection intensity for overlaid on the air situational display of Approach Spacing Tool
  - for situational awareness regarding the possible impact of significant convective weather on the approach spacing.

CAPPI weather radar data for Approach Spacing Tool

- consists of 20 layers, 0.5 km to 10 km (approx. 1,500 to 30,000 ft)
- covering 256 km from HKIA
- updated every 6 minutes
- radar reflectivity categorized into three severities
  - light rain in green
  - moderate rain in yellow
  - intense rain in red

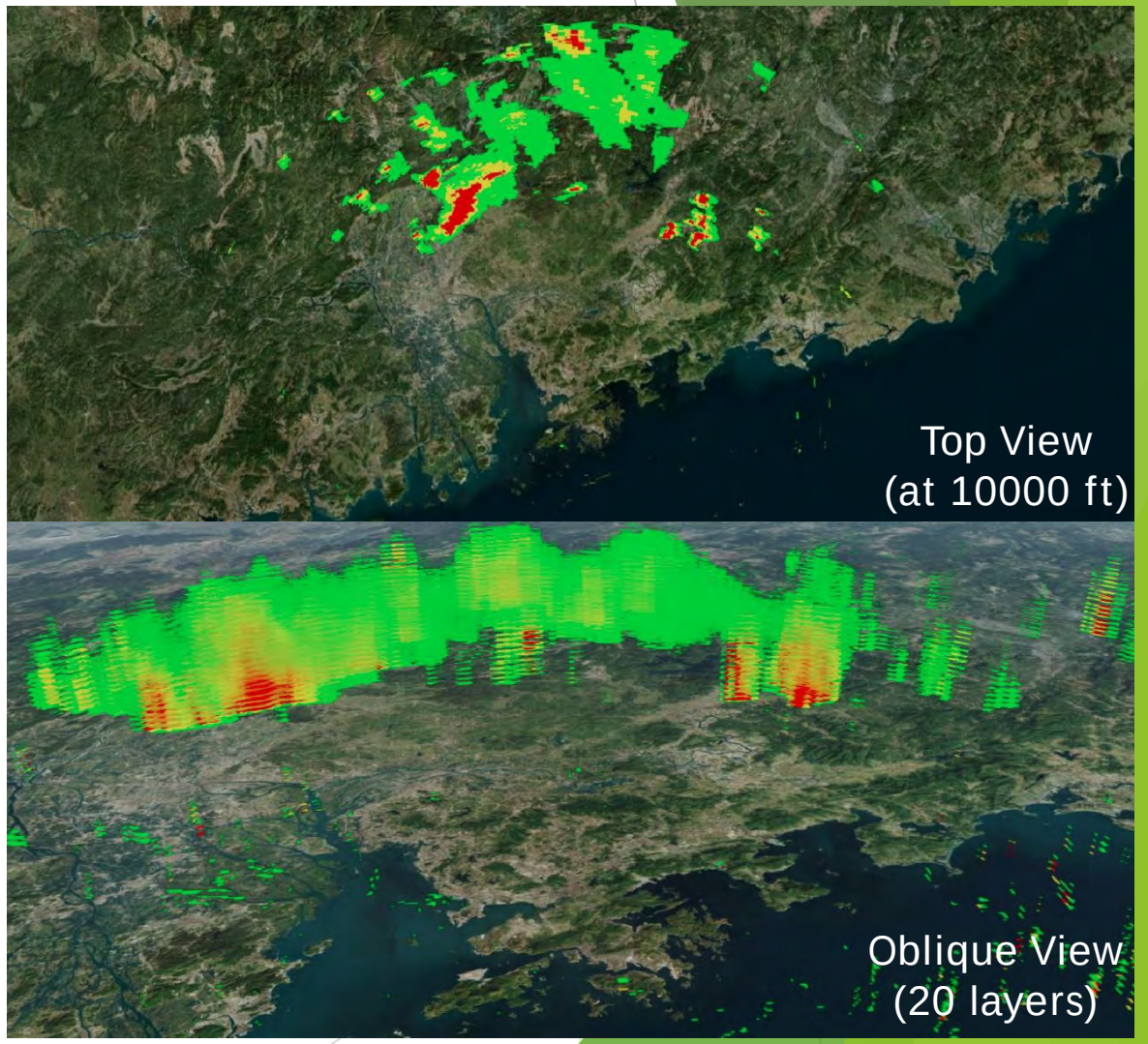
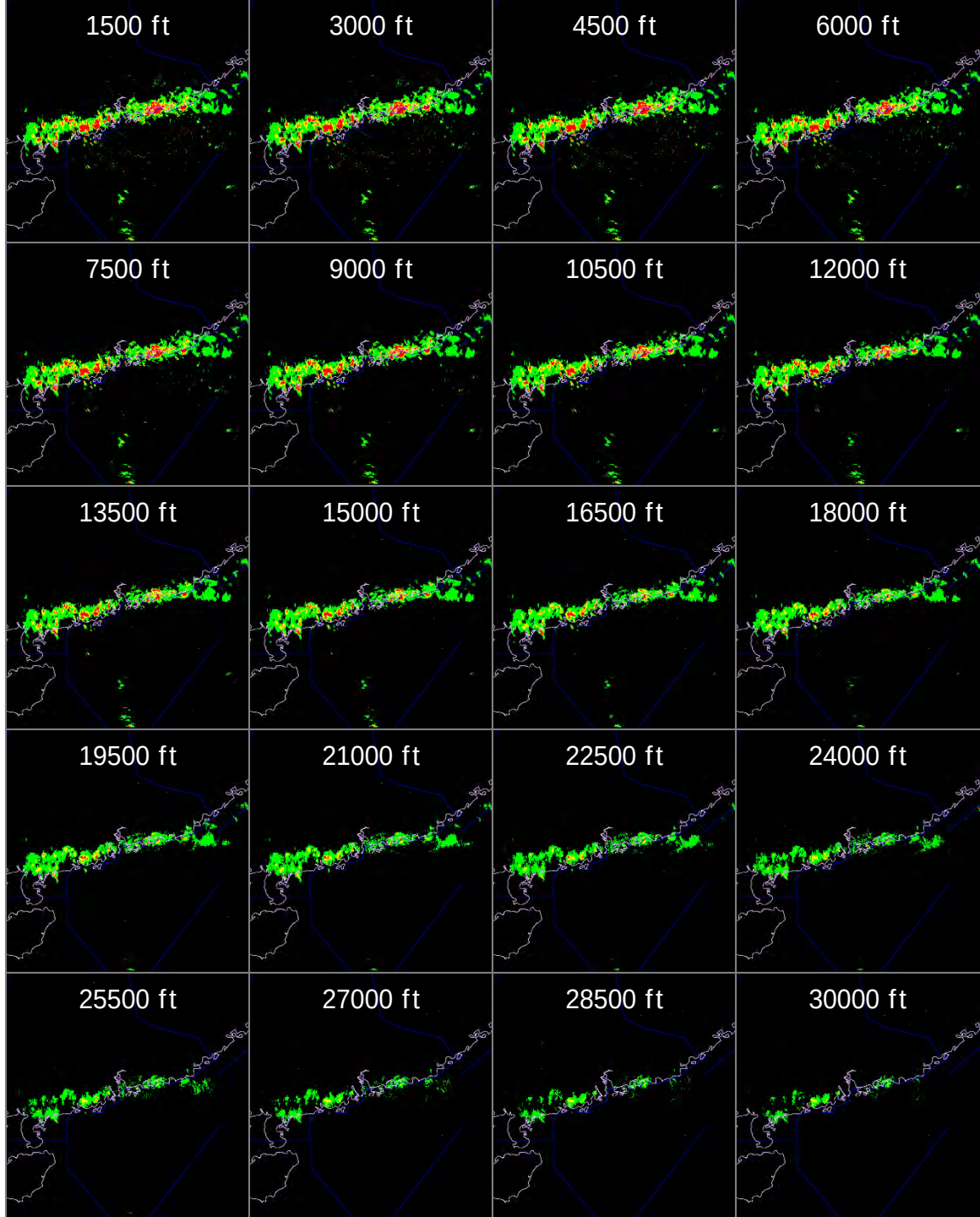


Illustration of Weather radar data in CAPPI of 20 layers

CAPPI weather radar data for Approach Spacing Tool

- Controllers can select multiple layers of CAPPI based on altitude range, and the Air Situation Display will show the maximum intensity in the selected vertical column for each pixel.
- forecast CAPPI data for Approach Spacing Tool to show the predicted movement of weather at approx. 10,000 ft
  - the following 60 mins at 6-min intervals



Next steps

- HKO will continue to collaborate with HKCAD
  - To test the ingestion of wind data and CAPPI weather data into the Approach Spacing Tool during acceptance tests
  - To evaluate the impact of TMA Wind accuracy on the calculation of optimal spacing using routine test data
- After controllers get familiar with the Approach Spacing Tool operation, it is expected that full benefits of implementing eWTS with enhanced runway capacity can be realized through the delivery of improved consistency and refined spacing on final approach.

Thank you for your attention!