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

4.1:   ATM Automation System Implementation Issues Sharing

OPTIMISATION OF APPROACH PATH MONITORING IN AIR TRAFFIC MANAGEMENT AUTOMATION SYSTEM

(Presented by Hong Kong China)

SUMMARY

This paper introduces the current design and implementation experience of Approach Path Monitoring (APM) at the Hong Kong International Airport (HKIA), and the future plan to enhance the architecture and performance of this safety net function.

1.   INTRODUCTION

1.1   Approach Path Monitoring (APM) is a ground-based safety net function intended to give prior warnings to controllers of the increased risk of controlled-flight-into-terrain (CFIT) incidents by generating, in a timely manner, alerts of unsafe aircraft flight path during final approach.

1.2   The existing APM function designed based on conventional ILS approach procedure may not be able to provide adequate monitoring of the intended approach portions for RNP and RNP AR approach procedures with multi-segments. Hong Kong China works closely with the ATM Automation System (ATMAS) supplier on the design and optimisation of APM to enhance the safety net performance for HKIA in this regard.

2.   DISCUSSION

2.1   Figure 1 and Figure 2 shown below are schematic diagrams showing the bird's eye view and the horizontal view respectively of the existing APM volume adaptation in the ATMAS used in Hong Kong China.
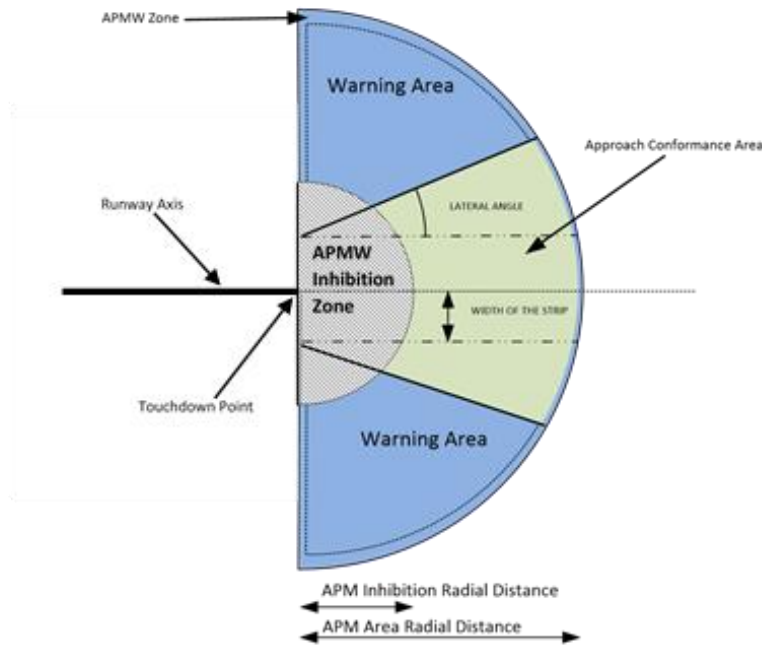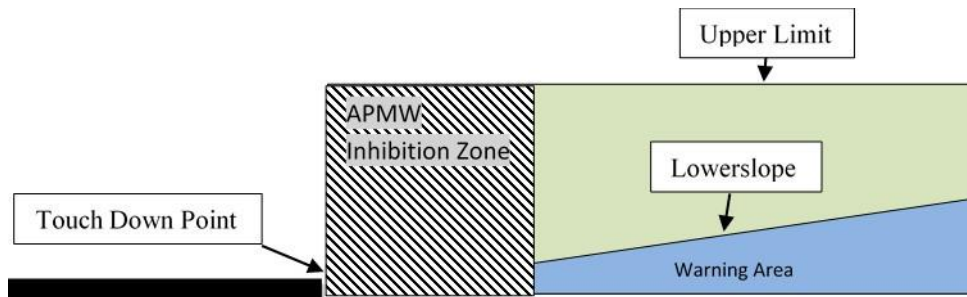
Figure 1 – APM Volume (Bird's Eye View)

Figure 2 – APM Volume (Horizontal View)

2.2   As illustrated in Figure 1 and 2, the APM design is based on conventional ILS approach procedure in which the approach path is defined by a single straight line with a constant glide slope and the lateral conformance monitoring area is defined by a fan-shape centered at the touchdown point. Only one APM volume can be adapted per each runway. The gradient of the lowerslope (in 0.1 degree increments) is therefore a compromise between different descent profiles of various approach procedures to a particular runway. The width and lateral angle of the Approach Conformance Area are adapted based on historical records of aircraft conducted approaches to that particular runway.

3.   **SHARING OF IMPLEMENTATION EXPERIENCE**

3.1   For HKIA, multiple approach procedures with different descent profiles are available for each runway. False APM alerts are experienced on occasions for step descent approaches as a result of the system limitation on a single lowerslope with constant gradient adapted for a particular runway.

3.2   The long finals of ILS approach procedures to Runway 25 direction necessitate a 14 NM monitoring volume, which leads to unintended APM alert being triggered by aircraft on base-leg of a short approach (e.g. RNP Y AR Approach) to Runway 25, as depicted in Figure 3.
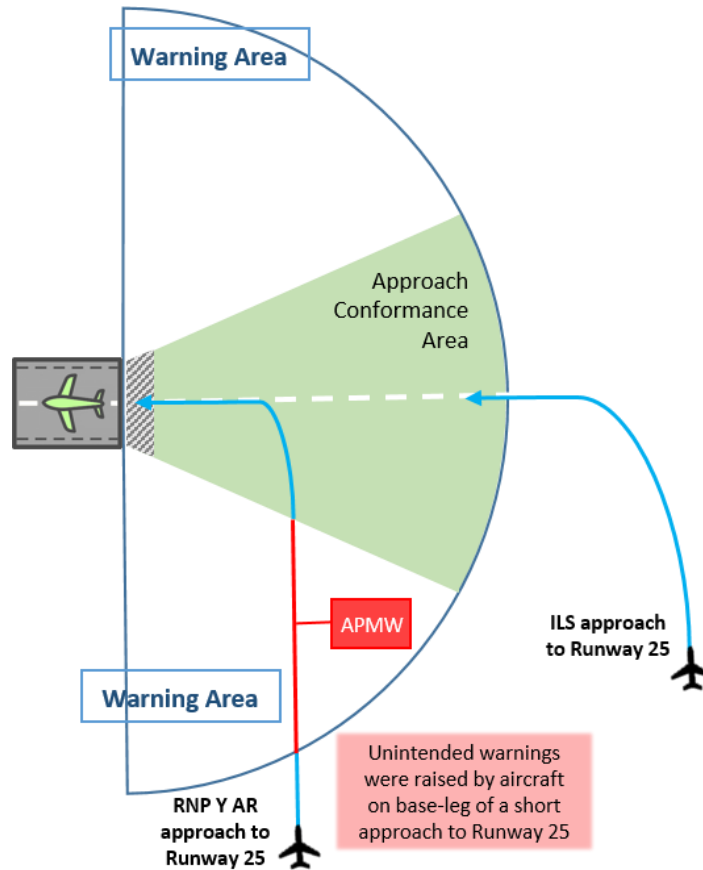
Figure 3 – Unintended APM Warning

3.3　　　　As a result, ATMAS software was updated to initiate APM for a particular aircraft only when that aircraft entered the approach conformance area of the nominated arrival runway. As such, no APM alert will be triggered when an aircraft enters the approach conformance area through the warning areas.

4.　　FUTURE ENHANCEMENTS

4.1　　　　To cater for the future development of RNP AR approaches that contain Radius-to-fix (RF) segments, Hong Kong China is working with the ATMAS supplier to enhance the existing APM design that can support approach paths composed of multiple segments.

4.2　　　　 Enhancements going to be made to the APM processing aim to allow users to customise approach path corridor volumes per runway, and in addition to the current design, per approach procedure.

4.3　　　　The concept of the enhanced APM design is shown in Figure 4. The APM processing will monitor the compliance of the approaching aircraft to the minimum safe altitude along the defined approach paths. The APM path will be composed of:

　　　　a)　A list of fixes (e.g. Point A to Point E) leading to the runway touch down threshold;
　　　　b)　A means to define the altitude slope not to infringe on each leg, for example, by setting an altitude per fix, or a slope gradient from each fix;
　　　　c)　The safe tolerance corridor width;
　　　　d)　The safe tolerance radius around fixes; and
　　　　e)　The radius of the APM inhibition area centered on the touch down threshold point.
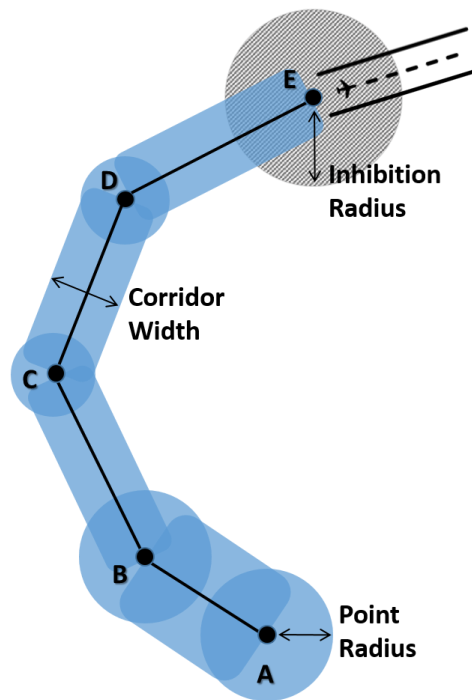
Figure 4 – APM Path Composed of Multiple Segments (Bird's Eye View)

4.4   The enhancement is to cater for monitoring flights on RNP AR approaches that contain multiple Radius-to-fix (RF) turns. Figure 5 below is an example of a potential RNP AR approach to HKIA that contains RNP 0.3 in intermediate and final segments.

Figure 5: RNP AR Approach with Multiple Radius-to-fix (RF)

4.5   The system supplier is also considering system adaptation enhancement on RF path terminator definition to better define curved flight path to enhance APM and route conformance monitoring, as well as route presentation in the controller's situation display.

5.   ACTION BY THE MEETING

5.1   The meeting is invited to:

   a)   note the information contained in this paper;

   b)   consider to include system enhancements in ATMAS to enable definition of curved flight path arising from implementation of RNP AR approaches for enhanced APM and route conformance monitoring; and

   c)   discuss any relevant matter as appropriate.

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