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)

PILOT IMPLEMENTATION OF POINT MERGE AT AREA CONTROL FOR ARRIVAL FLOWS TO GUANGZHOU BAIYUN AIRPORT

(Presented by China)

SUMMARY

This paper presents the progress on the preparation and pilot implementation of point merge at area control for arrival flows to Guangzhou Baiyun airport. The objective of the pilot implementation is to enhance queue management in the ACC for sequencing western arrival flows to Guangzhou airport.

1. INTRODUCTION

1.1 Point Merge is a systemized method, originally developed by EUROCONTROL, to merge arrival flows using lateral guidance by the FMS and enabling continuous descent even under high traffic load. It relies on a specific RNAV route structure consisting of a merge point and pre-defined sequencing legs equidistant from this point. These legs facilitate path stretching/shortening (Figure 1).

1.2 Point merge is utilized primarily in terminal areas, the Point Merge (PM) system is potentially valuable to apply in en-route control areas. With PM, aircraft approaches can be seamlessly merged based on logical sequencing, providing precise lateral guidance and continuous descent trajectories. Compared to traditional control methods, PM offers enhanced control over arrival aircraft's timing and flight paths, leading to improved efficiency and reduced delays. Expanding the use of PM to en-route control areas may have significant benefits.

1.3 The escalating flight traffic within the Great Bay Area (GBA) region has led to heightened congestion in specific sectors under Guangzhou's area control. This congestion has subsequently led to flight delays, elevated fuel consumption, and increased environmental pollution. There is an immediate need for efficient management of approach flight flows, all the while recognizing the challenges faced by air traffic controllers due to the rapid expansion of flight operations..

1.4 China is consistently working on efficiency enhancement initiatives to increase the capacity of the ATM system and minimize the use of ATFM measures. The ZGGGAR04 sector of the Guangzhou Area Control Center, extending westward in a fan shape with GYA as the handover point, serves as a busy arrival sector in the GBA region. Flight flows in the ZGGGAR04 sector are primarily distributed across four routes: B330, A599, R474, and H81, encompassing domestic and international flights to Guangzhou, Shenzhen, Zhuhai, Macao, Hong Kong, and overflights in the GBA region (Figure 2).

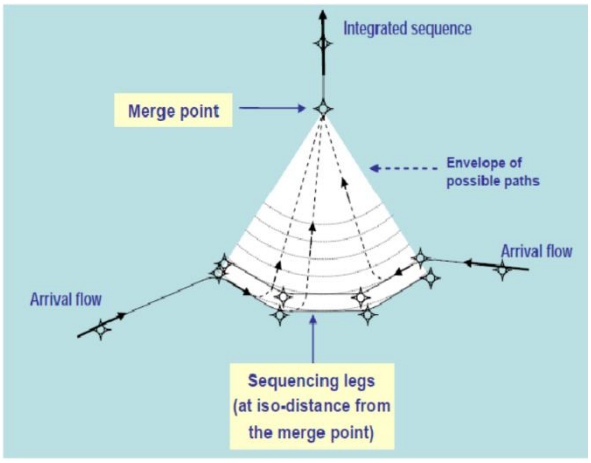


Figure 1 Example of Point Merge design with two entry points

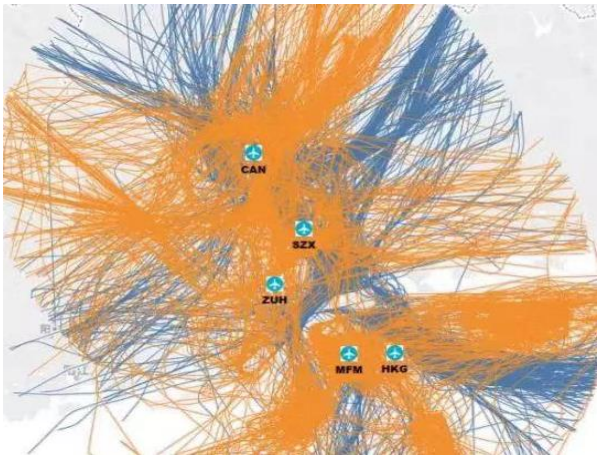


Figure 2 The GBA airspace and main flows

2. DISCUSSION

Modeling

2.1 Previous studies have demonstrated the applicability of Point Merge in ACC arrival sectors, showcasing its potential to improve safety and increase capacity without increasing distance flown. It is crucial to carefully consider the vertical aspects, including entry conditions.

2.2 Since 2019, Guangzhou ACC has been conducting a study and research on point merge (PM) procedures and methods in the ZGGGAR04 sector. The study aims to refine and validate the design, procedures, and working methods of PM, as well as perform an initial benefit assessment. It involved several rounds of model verification and updating (Figure 3), leading to the recent publication of the final PM route structure and working method (Figure 4).

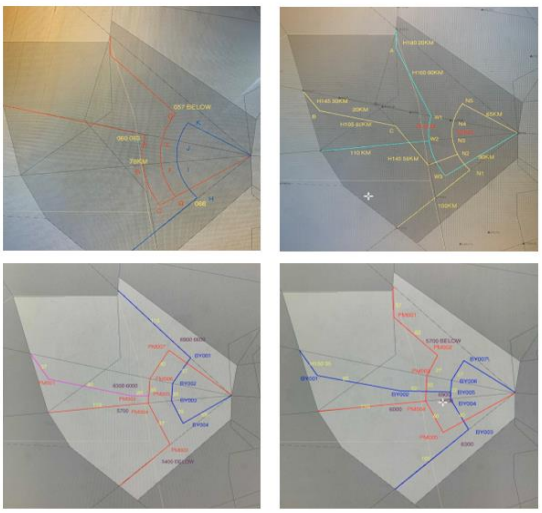


Figure 3 ZGGGAR04 PM model updating

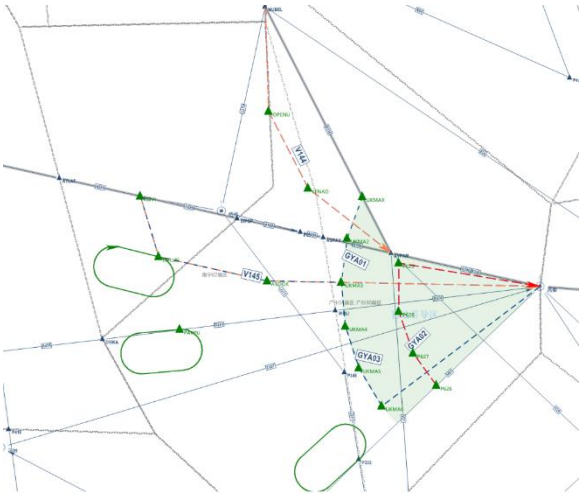


Figure 4 Published ZGGGAR04 PM procedure

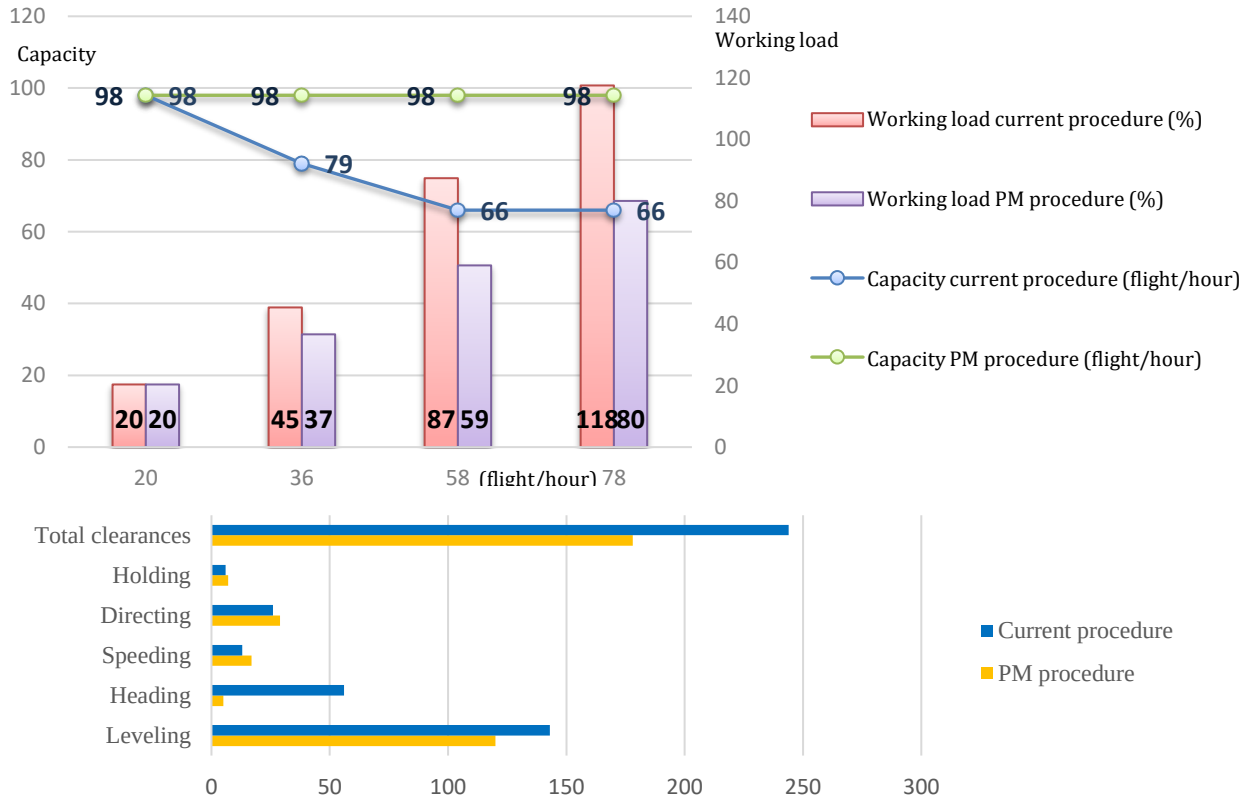
Simulation

2.3 Based on the EUROCAT simulator platform, Guangzhou ACC evaluated and analyzed the operation of the point merge program for arriving flights in Guangzhou. By analyzing the verification data from the simulator, different flow ratios and operational conditions were obtained. The study also compared the traditional procedure with the PM procedure in terms of arrival efficiency and controller workload, aiming to verify the feasibility and effectiveness of the point merge procedure and its impact on controller's workload.

2.4 The verification process involved conducting flight simulations with the help of pilots from the A320 fleet of China Southern Airlines on the A320 flight simulator. Fifteen different scenarios were evaluated, considering aircraft turning characteristics, descent performance, and the crew's ability to operate during joining and exiting the PM procedure. Various wind conditions and aircraft indicated airspeeds were taken into account.

Benefits

2.5 Flight simulations demonstrated that the PM procedure shows good operability, with aircraft performing well and meeting procedural requirements. Required turning points and crossing altitudes fall within the normal operating range of the aircraft. In strong tailwind conditions, speed brakes are necessary to maintain the required descent profile before reaching GYA at an expected altitude of 3300 meters.



2.6 At low traffic volume levels (20 movements/hour), the airspace capacity and controller workload are comparable for current procedures and PM procedures. As traffic volume increases, the difference in airspace capacity and controller workload between current procedures and PM procedures gradually widens. Under peak traffic volume levels (78 movements/hour), the largest difference in

workload is observed, with a capacity difference of 32 (98-66) and a workload difference of 37.52%. The workload under current procedures is 46% higher than that of the PM procedures.

2.7 Furthermore, Point Merge allows for a significant proportion of continuous descents (without level off) for ZGGG arrivals from 6900m to 3900m, resulting in major environmental and economic benefits such as reduced fuel burn, gaseous emissions, noise, and fuel costs.

2.8 The PMS program for ZGGGAR04 in Guangzhou is expected to be implemented by the end of 2023, and will be officially published in AIP at that time. At the same time, we are also preparing to circulate the relevant working procedures in advance, which are mainly aimed at pilots of major domestic airlines. It is suggested that IATA, IFALPA and other relevant parties can help us pass this information to foreign airlines and pilots who will fly through Guangzhou area.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;

b) relay information about the implementation plan of PMS to foreign airlines and pilots who will fly through Guangzhou area;

c) discuss any relevant matters as appropriate.

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