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ASSEMBLY — 40TH SESSION

TECHNICAL COMMISSION

Agenda Item 30: Other issues to be considered by the Technical Commission

MODELLING OF AIRSPACE OF GUANGDONG-HONG KONG-MACAO GREATER BAY AREA

(Presented by China)

REVISION NO. 1

EXECUTIVE SUMMARY

As one of the busiest areas of flight in Asia-Pacific Region and even in the world, the airspace of Guangdong-Hong Kong-Macao Greater Bay Area accommodates the flights of five major airports in Hong Kong, Macao, Guangzhou, Shenzhen and Zhuhai, as well as several feeder airports in China's Mainland. In 2018, the airport clusters of the area recorded traffic of 132 million passengers. With air traffic volume in this area surpassing world airport clusters of New York, London, and Tokyo, and becoming top one in the world, the problem of efficient utilization of airspace resources available has become increasingly urgent. In order to meet the needs of expansion and development of airport clusters and new airports in the area, ATMB of CAAC, the Hong Kong Civil Aviation Department and the Civil Aviation Authority of Macao (hereinafter referred to as the three parties) signed a memorandum of cooperation, which explicitly stated that based on the simulation platform established by ATMB of CAAC, three parties shall carry out airspace simulation of the Greater Bay Area and provide technical and theoretical support for the sustainable development of the airport clusters and the optimization of airspace in the Greater Bay Area.

Strategic Objectives:	This working paper relates to Strategic Objectives of Air Navigation Capability and Efficiency.
Financial implications:	N/A
References:	N/A

[1] English and Chinese versions provided by China.

1. INTRODUCTION

1.1 Over recent years, the traffic at five airport clusters of Greater Bay Area (Guangzhou Baiyuan Airport, Hong Kong Airport, Macao Airport, Shenzhen Airport and Zhuhai Airport) increased by a large margin. In order to realize common benefits and sustained and long-term development of ATMB, CAAC, the Hong Kong Civil Aviation Department and the Civil Aviation Authority of Macao (hereinafter referred to as the three parties) carried out evaluation of airspace optimization. In addition, theses airports are now actively pursuing expansion plans and the common management and coordination mechanism of regional airspace. Over the years, the three parties had several rounds of communication and coordination on the airspace over the airports, and organized in-depth analysis and study of this optimization program so as to achieve coordinated, common and mutual beneficial development of airport clusters in the Greater Bay Area.

1.2 In order to strengthen coordinated airspace development of the Greater Bay Area, the three parties held a high-level working conference in May 2016, and established and reinforced the tripartite cooperation and exchange mechanism. According to the guiding principles of the conference, tripartite seminars were held for multiple times and a memorandum of cooperation was signed in June 2017. The MOC decided to carry out airspace evaluation of the Greater Bay Area based on the simulation platform developed by ATMB of CAAC and by using international leading simulation software to conduct fast simulation, so as to provide technical support for airspace optimization in the expansion project of airport clusters in the Greater Bay Area.

1.3 In November 2017, the three parties held a management and technical group meeting, which determined the working plan for the airspace modelling project of the Guangdong-Hong Kong-Macau Greater Bay Area:

a) establishing baseline model of airspace and developing indicators for calibration and evaluation;

b) calibrating the simulation degree of the established baseline model;

c) establishing future airspace model using new optimization program; and

d) evaluating new optimization program.

1.3.1 After the meeting, the tripartite technical group for airspace management carried out technical preparations, and the modelling project was officially launched in December 2017.

2. TECHNICAL PROGRESS OF MODELLING

2.1 Since the start of the modelling project, the three parties have successively formulated detailed working plans of the technical work of modelling by convening leading group, technical group meetings, telephone conferences and e-mails:

Date of Modelling

2.1.1 In order to better simulate the actual operation of the airspace of Guangdong-Hong Kong-Macao Greater Bay Area, one day during the 2018 Chinese Spring Festival travel rush that met the requirements of heavy traffic with no complicated weather conditions or special activities was selected as

the sample, namely from UTC time (World Coordination Time) 16:00 February 8, 2018, to 23:59 February 9, altogether 32 hours.

Selection of Simulation Tools

2.1.2 The three parties decided to use the Total Airspace and Airport Modeller (TAAM) software from Jeppesen of US to carry out simulation modelling.

Content and Scope of the Model

2.1.3 The airspace modelling of Guangdong-Hong Kong-Macao Greater Bay Area covers the Hong Kong Flight Information Region and part of the Guangzhou Flight Information Region, including five airports in Hong Kong, Macao, Guangzhou, Zhuhai and Shenzhen. The modelling is divided into fast-time simulation and real-time simulation. Fast-time simulation is to input static data, such as airspace flight information region, ATC sectors, air routes, arrival and departure procedures of five airports and ATC handover rules, into TAAM software, and then input the flight plan of February 8, 2018. According to the data report generated by the operation results of TAAM software, data support will be provided for future airspace optimization program in the Greater Bay Area. Real-time simulation is an airspace simulation system consisting of air traffic control tower, approach, area control and Airbus A320 fixed simulator to display the actual operation of the airspace of Guangdong-Hong Kong-Macao Greater Bay Area in a more visual way.

Simulation Data Sharing Mechanism

2.1.4 The data-sharing platform built by ATMB of CAAC will be used by the three parties to transmit and share relevant data and evaluation results of simulation. The platform was built and completed in May 2018.

Division of Modelling

2.1.5 Fast-time simulation modelling: ATMB of CAAC is responsible for the modelling in the Guangzhou Flight Information Region, and Hong Kong Civil Aviation Department is responsible for the modelling in the Hong Kong Flight Information Region. ATMB of CAAC is responsible for the integration and calibration of the Guangzhou Flight Information Region model and the Hong Kong Flight Information Region model.

ATMB of CAAC is responsible for real-time simulation modelling.

Validation Standards

2.1.6 The validation standards are divided into expert observation and indicator statistics. For expert observation, the three parties assign front-line controllers to verify the baseline model base on the actual operation. For indicator statistics, the simulation degree of the model will be quantified by comparing the data generated by the baseline model with the actual operation data, so as to ensure the model can reach the necessary level of authenticity.

Time line

2.1.7 Baseline modelling and validation were completed on May 31, 2019, and the airspace modelling project of Guangdong-Hong Kong-Macao Greater Bay Area is planned to be completed by the end of 2019.

2.2 According to the working plan, technical personnel of modeling from the three parties have cooperated with each other and shared the modelling experience and achievements in a timely manner. The following achievements have been accomplished with high quality and efficiency by May 31, 2019:

Fast-time Simulation Modelling

2.2.1 Established and integrated the baseline model. The baseline model involves a total of 6378 flight plans, 167 arrival and departure procedures, 1744 flight routes (city pairs), 6400 ATC transfer rules, and 59 airport operation rules (see Figure 1 for detailed information).

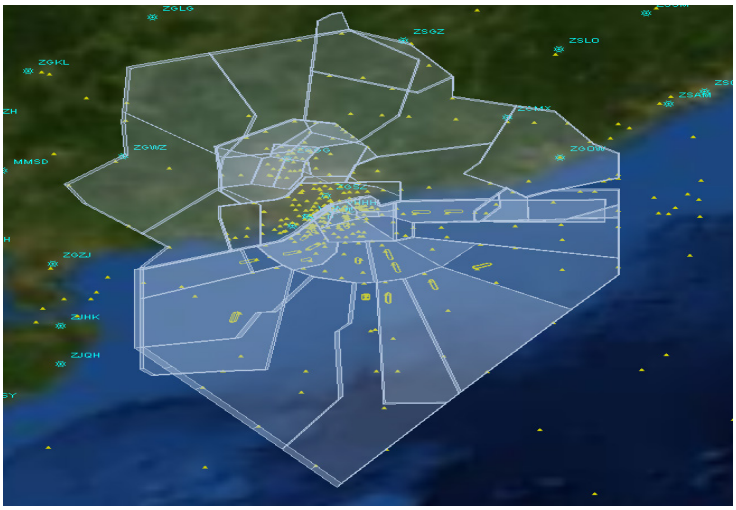

Figure 1. Illustration of TAAM baseline model

Real-time Simulation Modelling

2.2.2 ATMB of CAAC established a visual model displaying five airports in Hong Kong, Macau, Guangzhou, Shenzhen and Zhuhai in the tower, approach, area control simulator and Airbus A320 simulator (Figure 2 Visual snapshots of tower simulator and A320 simulator). With the opportunity of this tripartite cooperation, we have input relevant data of the Greater Bay Area into the real-time simulation platform to display the air-ground operation of the Bay Area in a more visual way. With the help of the A320 simulator, the platform can simulate not only the entire flying process of the aircraft from the take-off airport to the landing airport, but also the operation of all the towers, approaches and area control during the flight, so as to truly simulate the entire process of air-ground operation.

Figure 2. Visual snapshots of tower simulator and A320 simulator

Model Verification

2.2.3 The early stage of the modelling was based on the agreement submitted by each front-line air traffic control entities, while in the verification process, the main problem encountered was that the operation manual and related documents cannot fully reflect the daily operation habits of air traffic controllers. Therefore, with the joint efforts of technical personnel from the three sides, front-line air traffic control experts were invited to carry out on-site validation of the baseline model. And then, the results of the model were calibrated base on the statistical indicators jointly determined by the three parties, so as to establish a baseline model accepted by all.

3. FUTURE WORKING PLAN AND OUTLOOK OF AIRSPACE MODELLING PROJECT OF GUANGDONG-HONG KONG-MACUA GREATER BAY AREA

3.1 When the tripartite modelling technical group completed the baseline model, experts of airspace, air traffic control and flight procedure design from the three sides are revising the optimization program for airspace planning of the Greater Bay Area based on the results of the baseline model. The airspace modelling project in Guangdong-Hong Kong-Macao Greater Bay Area is planned to be completed by the end of 2019.

3.2 The airspace modelling project of Guangdong-Hong Kong-Macao Greater Bay Area involves a large amount of engineering, complicated data processing and evaluation, making it a typical example of China's creative airspace simulation in busy areas of China, which can provide valuable experience and lays a solid foundation for future simulation in China.

3.3 The airspace modelling of the Greater Bay Area strengthens high-level mutual visits of air traffic management, as well as exchanges and cooperation of technical personnel among the three sides. According to the concept of innovation, coordination, integration, and win-win, we will deepen cooperation to realize the goal of coordinated decision-making, control, and procedures. We will strengthen the joint planning of airspace and coordinated development of airport clusters of Guangdong-Hong Kong-Macao Greater Bay Area, so as to provide a reference for the reasonable planning of busy airspace for air traffic management departments of various countries.

4. ACTION

4.1 The Assembly is invited to take note of the information in this paper.

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