



ICAO

*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

**APPLICATION OF FLIGHT DATA INTERACTION BETWEEN ACC AND APP
ATMAS IN BUSY AIRSPACE**

(Presented by China)

SUMMARY

Taking Guangzhou ACC and APP as an example, this paper introduces the application of flight data exchange in busy and complex airspace based on the *MH/T4029.3*.

1. INTRODUCTION

1.1 At the first and second Working Group meetings of ATMAS in 2020 and 2021, China introduced the interactive application of flight data exchange in the ATM automation system based on MH/T4029.3. The paper [WP05_CHN AI.5.2 - Application of Flight Data Exchange in ATM Automation System](#) submitted to ATMAS TF1 took Lanzhou-Xining and Kunming-Xishuangbanna as examples. It introduced the application of FDECM (Flight Data Exchange Coordination Message between ATC centers), which plays a significant role in reducing coordination calls and improving ATC efficiency. Additionally, the paper [IP08_CHN AI.4.4 - Requirement and Implementation of Data Interaction](#) submitted to ATMAS TF2 presented the operation mode of Chengdu (One city, Two airports, Four sites), which achieves the synchronization and transfer of flight data between the ATMAS and the Tower ATMAS based on MH/T4029.3.

1.2 Being one of the busiest airspaces in the world, the operation mode of Guangzhou APP exhibits significant complexity and flexibility. Prior to the launch of the new terminal center of GZ APP, both GZ ACC and GZ APP operated on the same ATMAS and shared flight data processing module,, which posed a potential operational risk.

1.3 Based on further research, expansion and verification of MH/T4029.3, China has designed a solution in that ACC and APP use an independent ATMAS, which applies FDECM for flight transfer. In February 2023, the new GZ APP was successfully put into operation using an independent ATMAS, which achieve the smooth and easy electronic transfer between ACC and APP.

2. TECHNICAL SCHEME AND IMPLEMENTATION

system architecture design

2.1 The TCU mode presents several disadvantages, including a complex system structure, a large number of nodes, inconsistent calculation methods across different partitions, reliance on the main system server for flight processing, and complexity in partition degradation.

2.2 The new APP system incorporates independent flight data processing, surveillance tracking functions, warning and alert processing, AFTN interface, and multi-sensor data processing. Simultaneously, the software of the original ACC's ATM automation system will undergo upgrades and be separated from the original APP's data. An independent link will be established between ACC and APP to facilitate the exchange of FDECM messages..

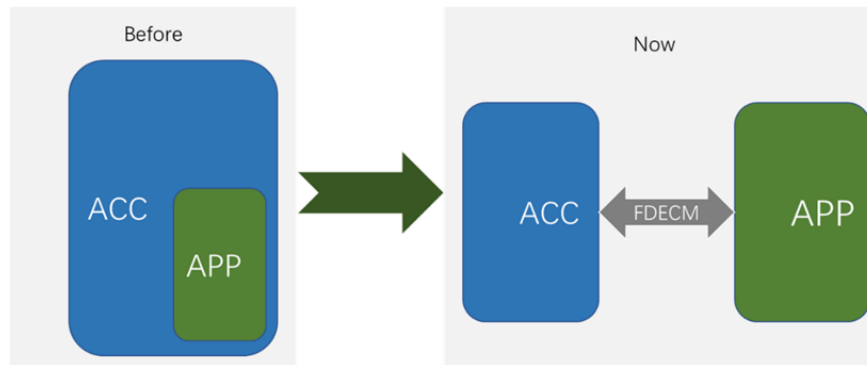


Figure1. TCU mode upgrade to independent mode

2.3 Both the ACC and APP ATMAS systems not only require seamless data exchange but also need to maintain independent processing boundaries. This places significant demands on data interaction and interoperability between the two systems. It also poses challenges and difficulties in implementing the independent system model.

System Interaction Implementation

2.3.1. To ensure the reliability of electronic handover, the new mode, based on MH/T4029.3, places emphasis on flight data synchronization and coordination between upstream and downstream systems.

- The CFPL messages synchronize the flight route, SSR code, cleared flight level, free text, and other important ATC information from the upstream to a downstream system in real time.
- The CLAM messages are used to confirm the coordination messages. If the coordination is rejected, there will be corresponding warning prompts for the responsible controller.
- Using CHRQ and CHRP messages to implement handover and accept, it is easy to cancel-transfer and re-transfer. Increase the message interaction in the coordination phase to achieve a high synchronization rate of flight information, and high reliability of coordination and un-coordination state.

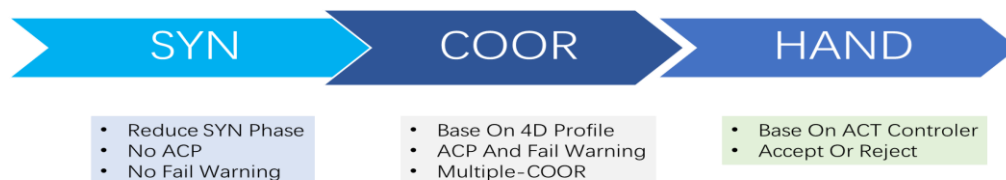


Figure2. FDECM transfer procedure

2.3.2. GZ APP serves airports including ZGGG (1200 daily departures and landings), ZGSZ (over 1000 daily departures and landings), ZGSD (over 250 daily departures and landings), and VMMC (over 100 daily departures and landings). Accurate exit and entry airspace calculation is vital in this busy airspace for smooth electronic transfer. The new APP's ATMAS employs offline parameters and 4D-profile calculations for efficient handling of fixed point and non-fixed point handover scenarios.

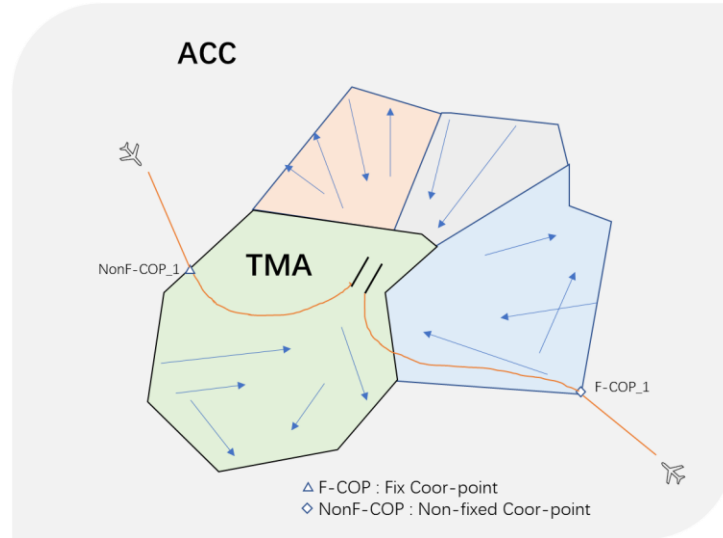


Figure3. Fixed point and Non-fixed point entry

2.3 The topology diagram illustrates the connection between the GZ ACC and the GZ APP. Both the ACC and APP ATMAS systems have implemented various network security measures and routing strategies in the FDECM interconnection. These measures are implemented to ensure the independence and security of the systems.

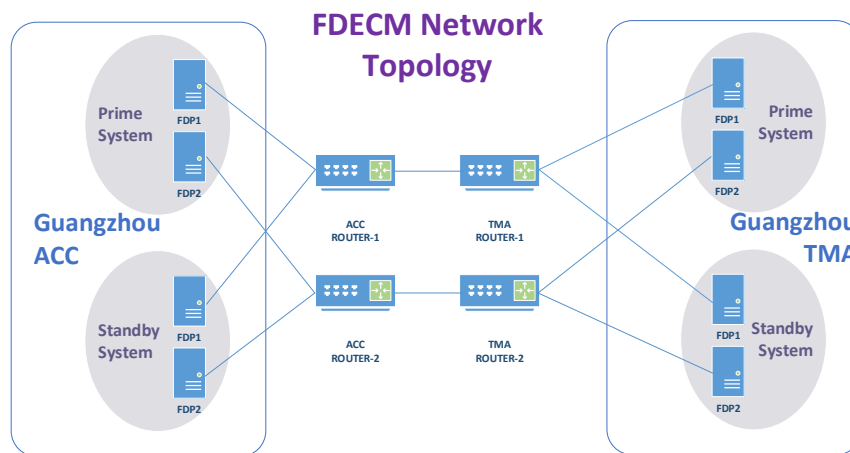


Figure4. FDECM network topology

Application effects and advantages

2.3.1 Based on the monthly statistical analysis of April 2023, the coordination and handover success rate of FDECM between GZ ACC and GZ APP exceeded 96%. On average, there were over 45,000 synchronized and coordinated messages per day using CFPL messages.

Additionally, more than 2,200 handover were successfully completed using CHRQ and CHRQ messages. These figures highlight the effective utilization and performance of the FDECM system in facilitating smooth coordination and handover between GZ ACC and GZ APP.

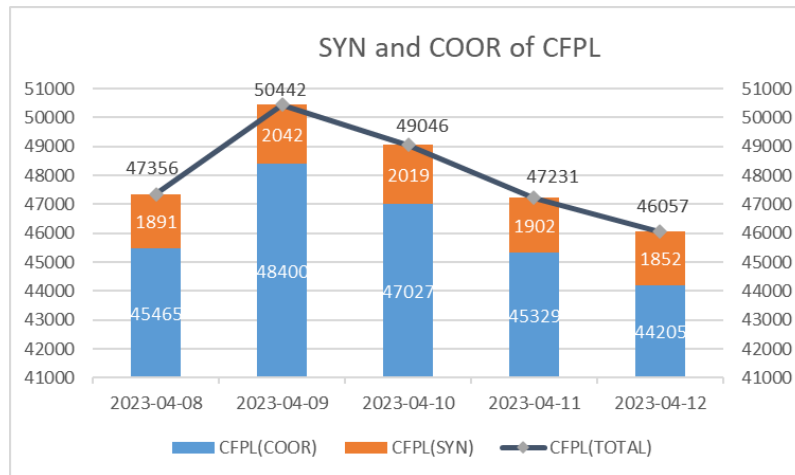


Figure5. SYN and COOR messages statistics

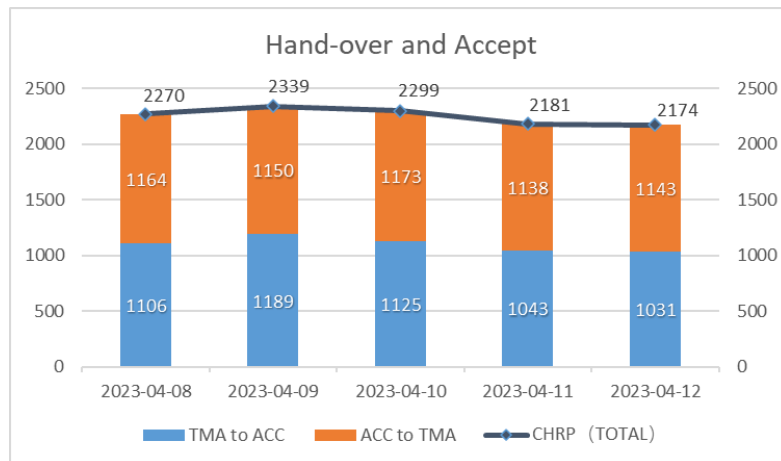


Figure6. Handover messages statistics

2.3.2 Through operational experience, the independent system mode has demonstrated the following advantages:

- **Independent system:** The size of each system has been significantly reduced. The ACC and APP can apply their own functional requirements and parameter configuration.
- **Security improvement:** No interference with each other, with network security boundaries.
- **Operational efficiency:** The handover efficiency has reached the level of the TCU mode, ensuring efficient transfer between systems. Additionally, there has been an improvement in the efficiency of parameter distribution and validation processes.
- **Redundancy improvement:** Independent flight data processing, surveillance processing, and alarm calculation.

3. DIRECTION OF IMPROVEMENT IN THE NEXT STAGE

3.1 The new APP's ATMAS needs to design a program to verify the flight route during the FDECM synchronization phase.

➤ Previously, when using the full-route-check mode, it is necessary for the relevant route parameters and the original flight plan route information to be consistent. However, there is a risk that the upstream system could modify the route information within the downstream system area.

➤ On the other hand, when utilizing the boundary-check mode, it is necessary for the boundary definition and boundary calculation model to be more accurate. However, implementing strict checks may potentially reduce the success rate of synchronization and coordination.

3.2 The new APP's ATMAS will further optimize the 4D-profile calculation of the route.

➤ Based on the coordination-case analysis conducted during on-site operations in GZ APP, several main reasons for unsuccessful coordination have been identified. These include inconsistencies in the flight plan 4D-profile between the upstream and downstream automation systems, disagreements in the determination of flown-over points between the two systems, and incorrect 4D-profile data that requires correction from the downstream system to the upstream.

4. ACTION BY THE MEETING

4.1 The meeting is invited to:

- a) note the information contained in this paper; and
- b) discuss any relevant matter as appropriate
