



ICAO

*International Civil Aviation Organization***Seventh Meeting of the Surveillance Implementation
Coordination Group (SURICG/7)**

Video Teleconference, 24 – 27 May 2022

- Agenda Item 8:** Update on surveillance activities and explore potential cooperation opportunities
- a) States/Administrations

**EXPLORATION AND PRACTICE OF ELECTRONIC HANDOVER IN COMPLEX
TRANSFER ENVIRONMENT BETWEEN ADJACENT ATC UNITS**

(Presented by China)

SUMMARY

This paper introduces the experimental operation of electronic handover in complex transfer environment between adjacent ATC units, gives and analyses the test verification results, puts forward the follow-up measures and plans.

1. INTRODUCTION

1.1 In order to solve the problem of data synchronization and interaction between ATM automation systems, CAAC and ATMB issued the industry standard "Civil Aviation Air Traffic Control Automation System - Part 3: Flight data exchange" in 2015 for the first time, which is called MH/T4029.3. And then CAAC released the revised edition and guidance manual in August 2020 on basis on summarizing previous verification operation experience.

1.2 MH/T 4029.3 Category C, defined as the flight data exchange coordination message between ATC centers (FDECM), is a data exchange message between two or more control units to achieve rapid handover, focusing on solving the problem that AIDC cannot be used as there is no fixed coordination point between ATC centers.

1.3 China introduced the verification and practical application of MH/T4029.3 screen handover at the SURICG/4 meeting in April 2019. This paper introduces the experimental operation of MH/T 4029.3 Category C in a complex transfer environment between adjacent ATC units.

2. PRELIMINARY WORK

2.1 Design of Technical Solution

2.1.1. In June 2021, at APA TF/7, China submitted an IP called "Application of electronic handover technology between high level and low level sectors", which introduces the complicated operational situation and requirements of horizontal and vertical handover in adjacent control areas, analyzes the difficulties of horizontal and vertical parallel implementation in adjacent control areas,

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gives a technical solution based on the application of MH/T 4029.3 Category C, to realize the vertical and horizontal electronic handover in the complex operational environment.

➤ [IP15_CHN AI. 3 - Research on technical solutions for electronic handover between upper and lower sectors](#)

2.2 Extension of MH/T 4029.3

2.2.1. MH/T 4029.3 standard on the strength of the actual operational needs of air traffic control in China, adopts a semi-structured and open messages defined method, which has the advantages of strong readability and scalability, open structure, good modifiability, and data combination on demand. It includes two stages: coordination and handover in a complex transfer environment between adjacent ATC units, the coordination message is extended based on the open structure and extensible characteristics of MH/T 4029.3, to facilitate the rapid feedback of control intention.

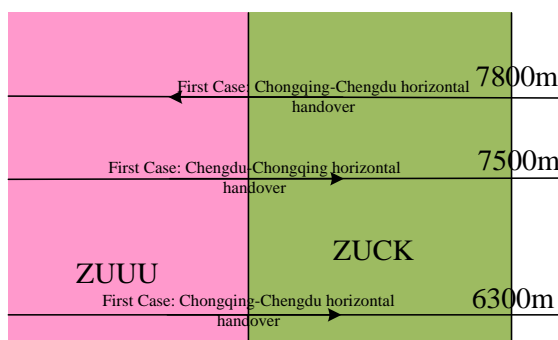
2.3 Safety Evaluation

2.3.1. According to the technical solution, Chongqing and Chengdu ATC with ATM Automation System manufacturers have completed the development and testing of software for Category C handover, and formulated the experimental operation plan. In December 2021, the safety evaluation of the experimental operation was conducted, the hazards include handover failure caused by link delay, timeout by manual operation delay, and unreasonable parameter settings. After identifying the effective control measures, From December 21, 2021, to February 14, 2022, Chengdu and Chongqing ATC carried out Category C handover experimental operation in each Automation system.

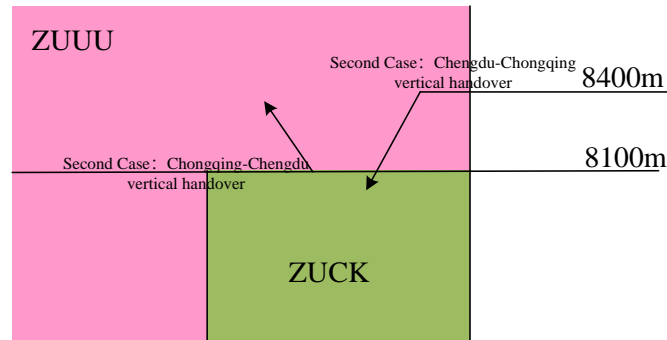
3. EXPERIMENTAL OPERATION AND DEVELOPMENT SITUATION

3.1 Scenes of Experimental Operation

3.1.1. Horizontal handover between Chongqing low sector and Chengdu low sector with coordination point.

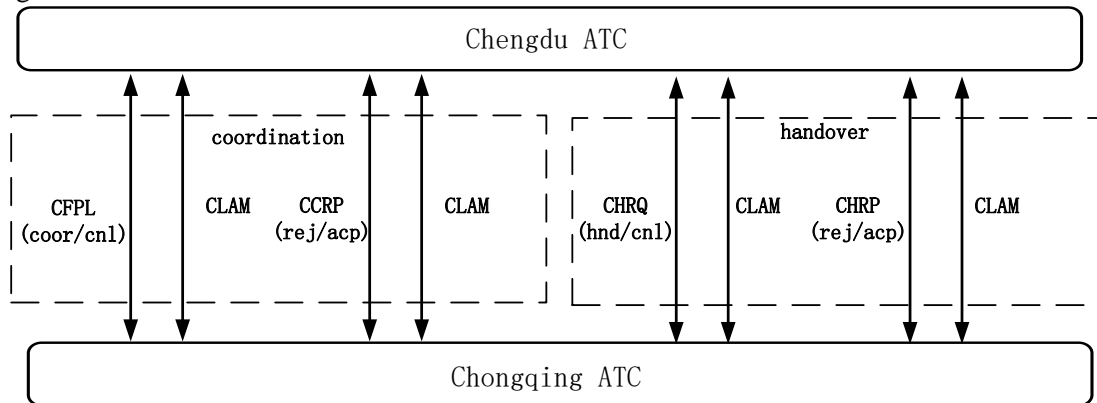


3.1.2. Vertical handover between Chongqing low sector and Chengdu high sector without coordination point.



3.2 Messages and Procedures in the Experiment Operation

3.2.1. During the experimental operation, Category C handover between Chengdu and Chongqing includes two phases: coordination and handover. The Category C messages which are used include CFPL, CCRP, CHRQ, and CHRP. A complete Category C data handover process is shown in the figure below:



3.3 The Transmission Link of Category C handover

3.3.1. Category C messages share the same transmission link with the AIDC messages, using the AFTN telegraph network to complete the storage and exchange of Category C messages between Chongqing and Chengdu ATC.

3.4 Statistics of Category C handover flight data during the experimental operation

3.4.1. Category C handover experiment operation involves two sets of automation systems, which are specifically divided into three stages:

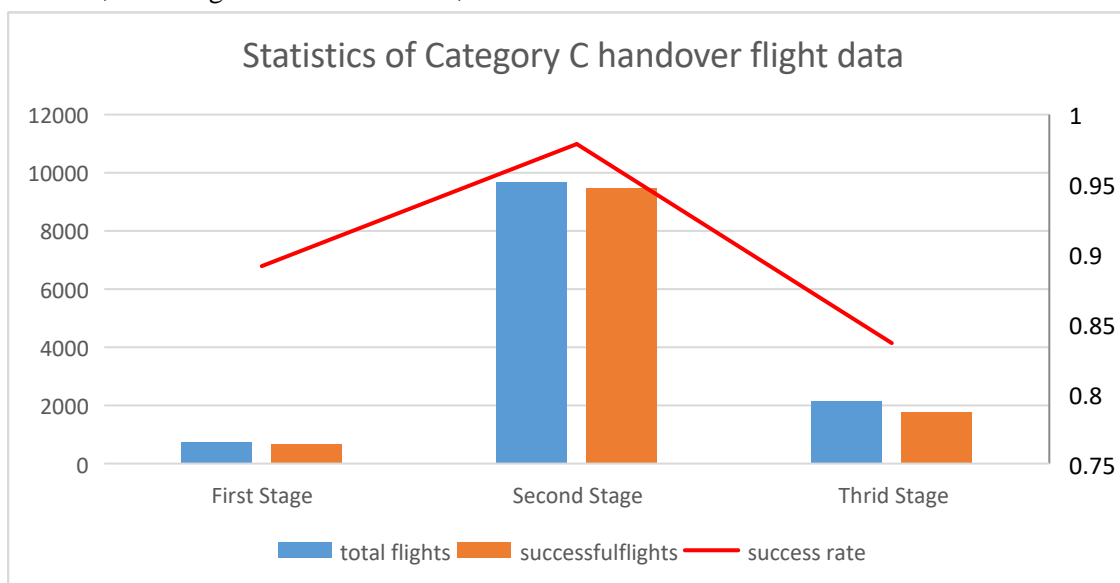
3.4.2. From December 21 to December 27, Chengdu and Chongqing used the same manufacturer platform for Category C handover at fixed periods per day. In this stage, the total time is 23.5 hours, 737 flights were handed over, 657 successful, and 80 failures.

3.4.3. From January 11 to January 24 in 2022, Chengdu and Chongqing used the same manufacturer platform for Category C handover all day. In this stage, the total time is 327 hours, 9,678 flights were transferred, 9,474 successfully and 204 failed.

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3.4.4. From January 25 to February 14, Chengdu and Chongqing used the different manufacturer platforms for Category C handover at fixed periods per day. In this stage, the total time is 42 hours, 2133 flights were transferred, 1783 were successful and 349 failed.



	Stage I	Stage II	Stage III
Total Flights	737	9678	2132
Successful Flights	657	9474	1783
Success rate	89%	98%	84%

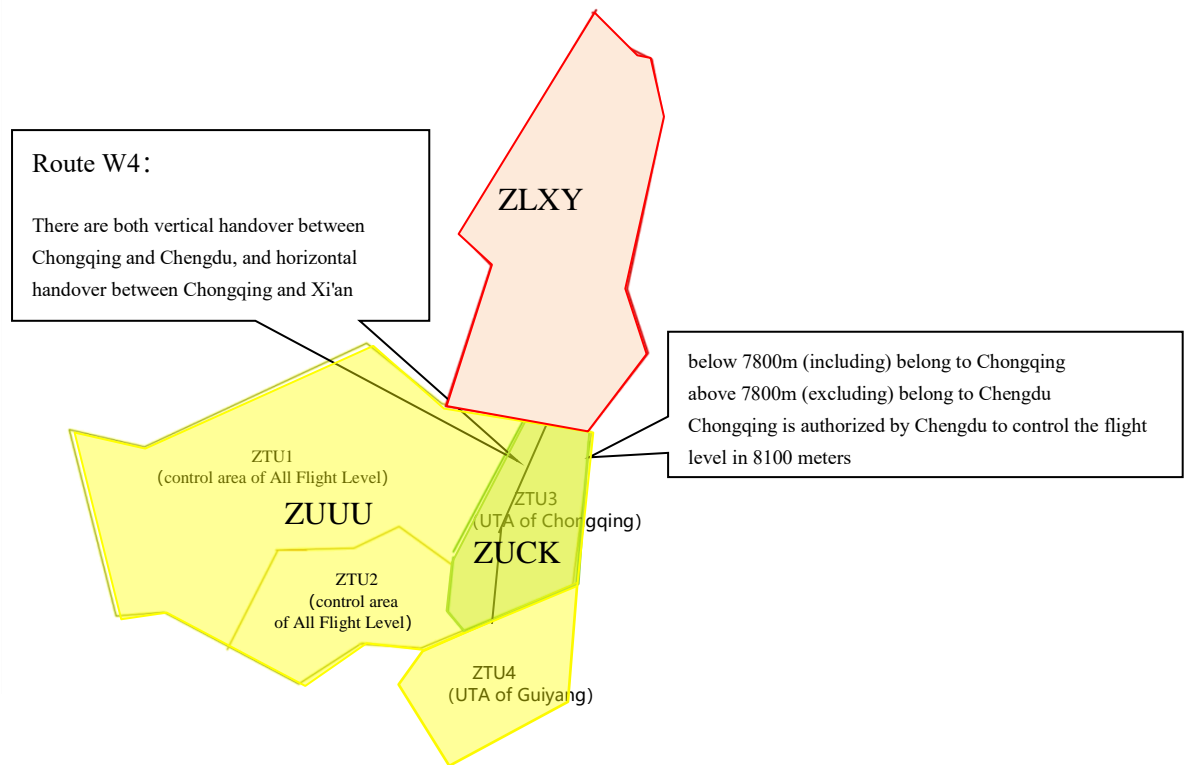
4. THE TEST VERIFICATION RESULTS

4.1 Realization

4.1.1. The electronic handover based on Category C can fully feedback the controller's intention and realize the horizontal and vertical handover.

4.1.2. AFTN link can be used to transmit Category C messages, so there is no need to update the ATM Automation System without dedicated line. The transmission rate used in the experimental operation is 9600bps, AIDC and Category C messages can be transmitted at the same time without message backlog. The sending and receiving reply time of Category C message is within 14 seconds.

4.1.3. Category C and AIDC handover can be parallel. In the W4 route below, there are both vertical handovers between upper and lower sectors through Category C and horizontal handovers through AIDC. The ATM Automation System confirms and sends Category C or AIDC messages to complete coordination by HMI operation, if it is necessary to change the coordination object, controllers are easy send a coordination to cancel message to the original coordination object, cancel previous Category C or AIDC coordination, and quickly initiate new coordination.



4.2 Problems and Measures

4.2.1. Analyze the reasons for Category C handover failure; the main problems are as follows:

i. The earlier parameters are unreasonable

4.2.2. At the beginning, Category C coordination response and handover response time were set as the same as AIDC, which are not applicable to Category C handover, as it requires the controller to reply the message manually. As a result, the controller had not completed the response, and the system had judged that the coordination or handover timeout by the parameters, and Category C handover failed. This problem mainly occurs in the first stage. After adjusting the response parameters, this kind of situation has been greatly reduced in the second stage.

ii. Only manual operation reply is not in time

4.2.3. Category C handover will fail when the messages reply delayed or the flight exceeds the handover zone, it's easy to happen in the case of large flight volume, when Category C messages are only triggered by controllers' manual operation. In fact, the logic of horizontal handover with a clear coordination point can be defined, so as the vertical handover in which landing in a fixed area with a fixed coordination flight level. By adding the automatic sending conditions of Category C messages in the automation system, the system can automatically trigger the message sending instead of manual operation, which can improve the efficiency of Category C handover.

iii. Controllers' operations are not familiar

4.2.4. The lack of skilled operation training resulted in missing or omission of Category C messages and failure of Category C handover. For this problem, the controllers would strengthen the training, and the automation system will also be further optimized in the HMI application of Category C.

5. FUTURE WORK PLAN

5.1 Optimize the automatic sending of Category C messages and the controller operational process in HMI of the automation system to further improve the efficiency of Category C handover.

5.2 Carry out the trial operation of Category C screen handover, and promote the parallel application of horizontal and vertical electronic handover in adjacent control areas.

6. ACTION BY THE MEETING

6.1 The meeting is invited to:

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