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 8: Review AIDC Implementation Issues Reported and Discuss Recommended Solutions

PRACTICE OF MULTIPLE ELECTRONIC TRANSFER PROTOCOLS IN ATMAS

(Presented by China)

SUMMARY

This paper introduces the application scenarios where ATMAS may use multiple electronic transfer protocols (such as AIDC, MH/T4029.3, and OLDI transfer protocols) with adjacent ATSU, as well as the corresponding problems and solutions.

1. INTRODUCTION

1.1 The electronic transfer protocols applied in China include AIDC, MH/T4029.3, and OLDI at present. AIDC is used for horizontal electronic transfer between ATSUs; MH/T4029.3 is mainly used for vertical electronic transfer between adjacent ATSUs, for example between terminal areas and upper area control center; OLDI is mainly used for electronic transfer with Russia's ATSU.

1.2 In some specific scenarios, the ATMAS needs to use multiple electronic transfer protocols simultaneously.

1.3 This paper introduces two scenarios where multiple electronic transfer protocols are used. Scenario 1 is that a flight needs to use different electronic transfer protocols for several consecutive transfers. Scenario 2 is that a flight may use different electronic transfer protocols in the next stage.

1.4 And This paper discusses the problems faced in these scenarios and shares the experience of solution

2. APPLICATION SCENARIOS

Scenario 1

2.1 As shown in Figures 1 and 2, when a flight departing from Airport A, which first approaches the airspace through the ATSU A, then transfers to the ATSU B through AIDC at point P1, returns to the ATSU A's airspace through MH/T4029.3 at point P2, and finally transfers to the ATSU C through OLDI.

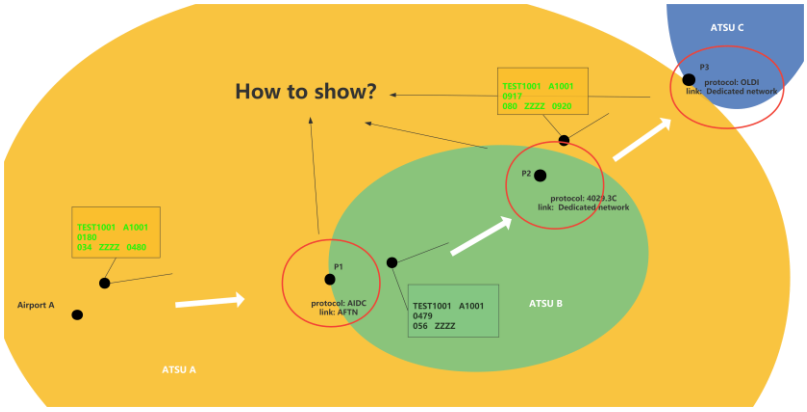

Figure 1 Adjacent ATSUs Transfer Scenario 1

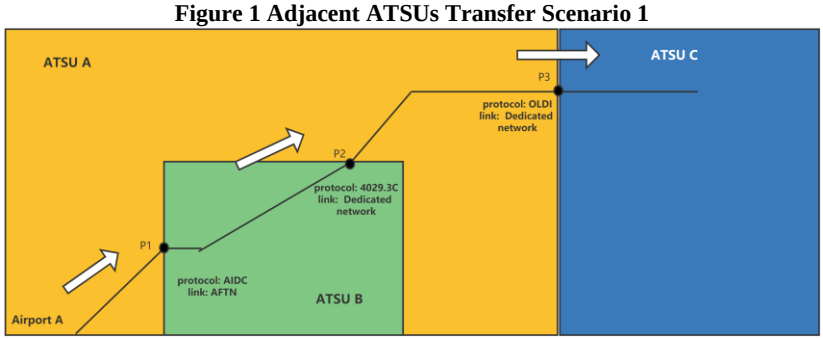

Figure 2 Cross section of Adjacent ATSUs Transfer Scenario 1

Scenario 2

2.2 As shown in Figures 3 and 4, flights departing from Airport D will pass through points P4 and P5 in sequence. Usually, flights climb to 6000 meters at point P4 and are transferred to the ATSU E through MH/T4029.3. If the flight cannot climb to 6000 meters at point P4 due to some restrictions, the ATSU D will maintain ATS authority and transfer to the ATSU F through AIDC at point P5.

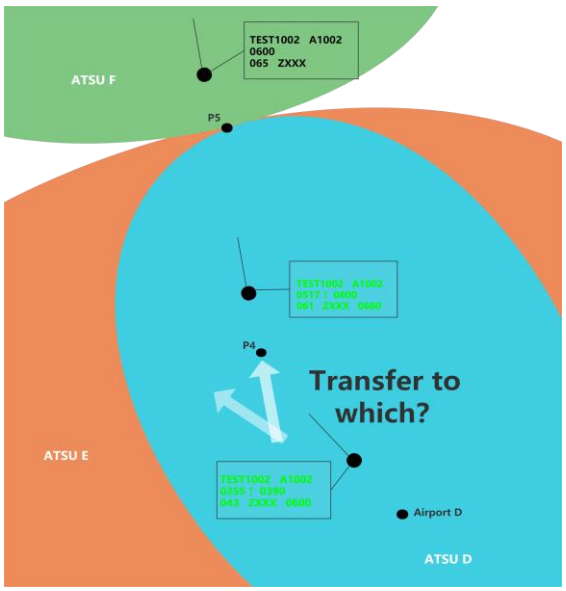

Figure 3 Adjacent ATSUs Transfer Scenario 2

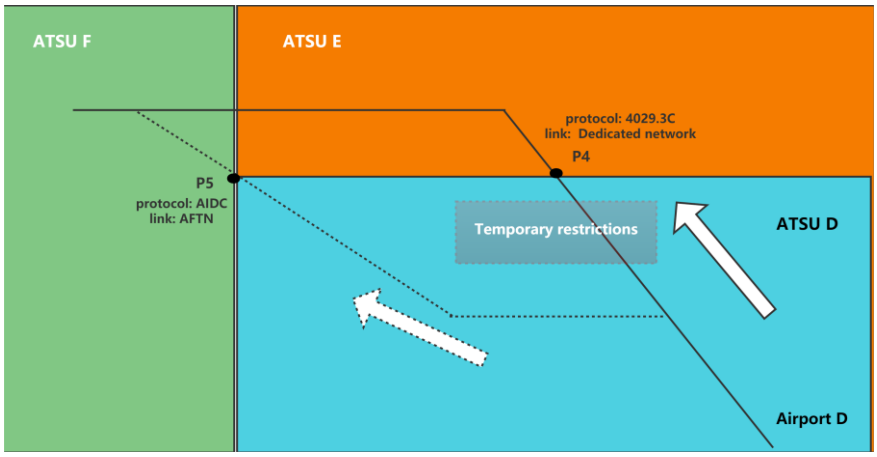

Figure 4 Cross section of Adjacent ATSUs Transfer Scenario 2

3. PROBLEMS

3.1 In the scenarios described in Section 2, attention should be paid to the following issues of ATMAS:

a) What are the characteristics of different transfer protocols?

b) Are there any significant differences in parameter configurations between different transfer protocols?

c) Are there any differences in the operational requirements for controllers between different transfer protocols? How the process of various transfer protocols should be displayed to reduce interference with the controller?

d) How to ensure that different transfer protocols of a flight do not affect each other?

4. SOLUTIONS

Unification of Transfer Process

4.1 Summarizing the existing electronic transfer methods for AIDC, MH/T4029.3, and OLDI protocols to simplify applications, most ATMAS adopts the basic process of the protocol. Figure 5 shows a comparison of the current status of various transfer protocol application processes.

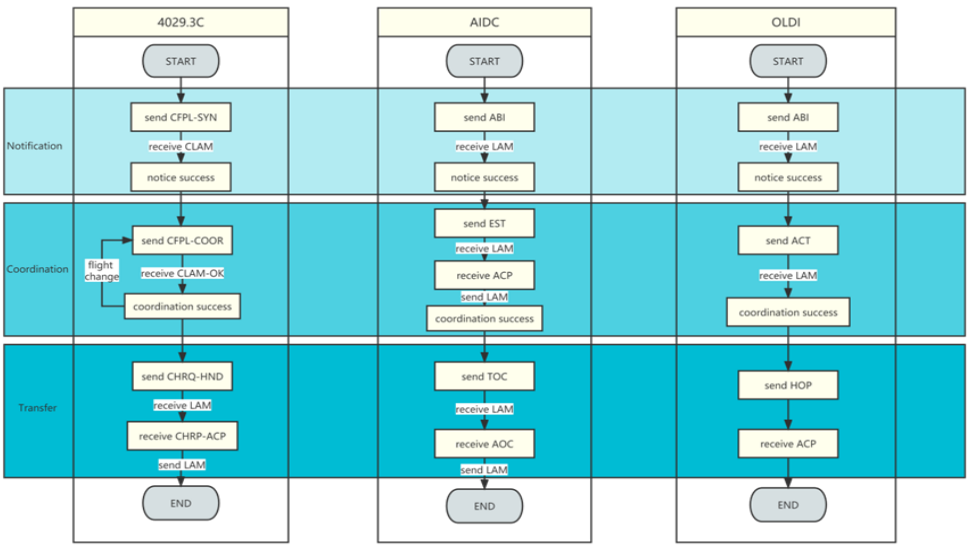

Figure 5 Comparison of Transfer Processes

4.2 By summarizing the above process, the basic process for transferring various protocols is similar. In ATMAS, the transfer process should be uniformly divided into three processing stages: notification stage, coordination stage, and transfer stage.

Unification of Parameter Configuration

4.3 To reduce the work of system maintenance personnel, by summarizing the similarities of various electronic transfer processes in Section 4.1, the parameter configurations for the three types of transfer protocol in ATMAS could be similar. The principles are as follows:

a) The timing parameters for transmitting messages are unified, and the distance or time parameter from the transfer point is set.

b) The acquisition method for coordination and transfer height is unified, with configurations obtained from XFL and CFL.

c) The timeout alarm parameters are unified and configured separately according to the transfer stage, such as coordination timeout parameters and transfer timeout parameters.

d) The communication link parameter configuration is unified, and the ATMAS should divide the message logic processing and transmission link into two functional modules. Each type of message can be transmitted using any message link. As shown in Figure 6.

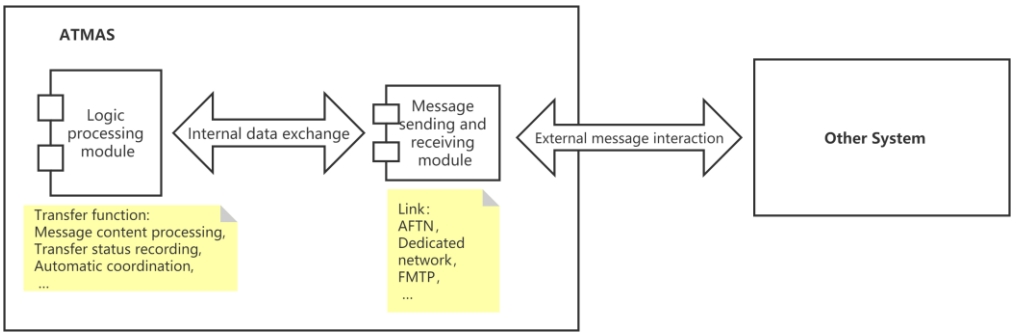

Figure 6 Transfer Processing in ATMAS Module Division

Unification of Interface Display

4.4 To reduce the impact of using multiple transfer protocols on the controller, the display and operation of various transfer interfaces of the ATMAS should be unified:

a) Unify prompt characters for various transfer statuses.

- When the notification phase is handed in, the sign of the flight prompts the character '<' (it is'>' when handing out);
- when the coordination of handing in is successful, the sign of the flight prompts the character 'O' (it is' C ' when handing out);
- during the transfer stage, 'H' is displayed;
- if there is a message processing failure, both transfer failure and coordination failure will display 'U'.

b) Unify the transfer methods for various types of protocols.

- Trigger coordination after setting the XFL; after successful coordination, the name of the adjacent ATSU that has been successfully coordinated will be displayed at the top of the transfer list for the controller to choose to initiate the transfer.

4.5 After unifying the interface display, it is applied to Scenario 1 (see Figure 7). When using different transfer protocols, the HMI displays have no differences in the transfer process and operation methods. Controllers only need to pay attention to the flight transfer and coordination process, and do not need to know which electronic transfer protocol is used.

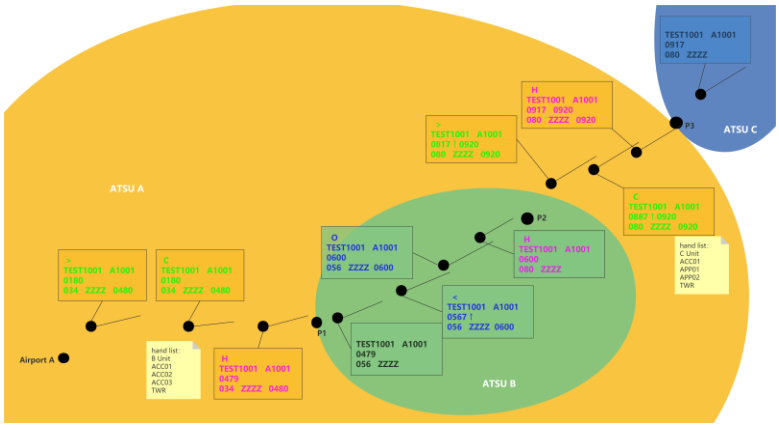

Figure 7 Unified Interface Display

Internal Independence of Transfer Status

4.6 To ensure that each type of transfer is carried out in a flight plan, the system background records each type of transfer status independently when processing messages, which is different from the unified display on the interface. The corresponding processing is as follows:

a) The system independently records the status of various transfers and determines the protocol transfers that can be made in the future based on the transfer status (as shown in Figure 8). Ensure that only one protocol transfer can be carried out for the same flight plan at the same time, and that the failure or termination of a certain type of protocol does not affect the triggering of other transfer protocols.

b) If the transfer point of a type of transfer protocol has already flown over, the transfer of the protocol shall be terminated (considered as completed), without affecting the transfer of other protocols.

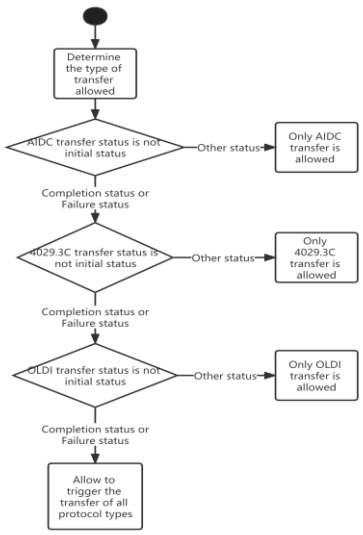

Figure 8 Flow Chart of Processing Multiple Electronic Transfer Protocols

4.7 In application scenario 2, the ATMAS can meet the requirements of coordinating different ATSUs using two transfer protocols without affecting each other. As shown in Figure 9, first use the MH/T4029.3 protocol to coordinate the transfer with the ATSU E. If the transfer has not been completed passing point P4, the transfer is considered as completed and the transfer status is cleared. At the same time, initiate coordination with the ATSU F using the AIDC protocol. After two

successful coordination attempts, different adjacent ATSUs will be prompted at the top of the transfer list, and the controller will freely choose an ATSU to be transferred based on the on-site situation.

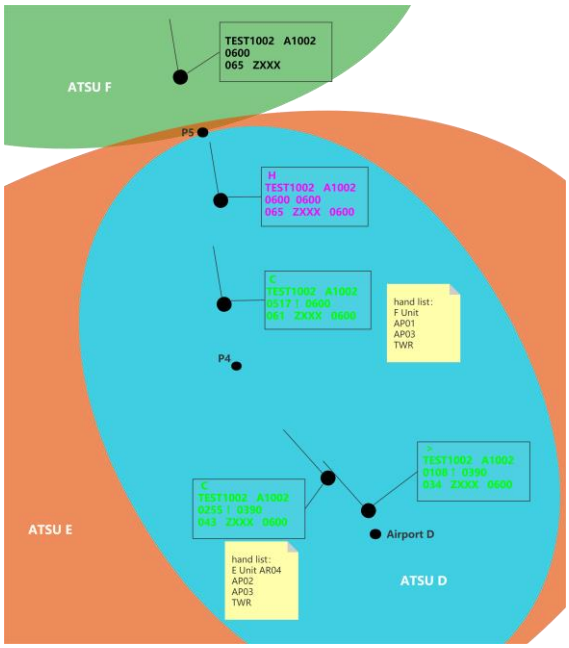

Figure 9 Coordination of Different ATSUs Twice for One Flight

5. SUMMARY AND OUTLOOK

5.1 Through feedback from the actual application of ATSU, there are also other complex scenarios, such as:

a) A flight shall be coordinated with two adjacent ATSUs at the same time, and the controller shall choose a transfer unit at his discretion.

b) The controlled airspace is relatively narrow, and when the flight has not yet been transferred, it is necessary to coordinate with other ATSUs for transfer.

5.2 On the premise of ensuring the normal processing of the electronic transfer protocol of the system, it is still necessary to continue practical exploration on how ATMAS can meet more diverse application scenarios while being more "humanized".

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

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