



ICAO

The Second Meeting of the Asia/Pacific Air Traffic Management Automation System Task Force (APAC ATMAS TF/2)

Video Tele-Conference, 14 - 16 September 2021

Agenda Item 4: ATM Automation System Implementation by States

4.4 Integration and Interoperability with External Systems

REQUIREMENT AND IMPLEMENTATION OF DATA INTERACTION BETWEEN THE TOWER ATM AUTOMATION SYSTEM AND THE ATM AUTOMATION SYSTEM

(Present by China)

SUMMARY

This paper presents requirements and solutions of air traffic control operation between the Tower ATM automation system and the terminal ATM automation system.

1. INTRODUCTION

1.1 The integrated Tower system is internationally recognized as an intelligent tower control Automation system adapted to the working characteristics and environment of the airport tower, which is integrated by hardware or software.

1.2 On the basis of learning from international technology on the concept of integrated Tower system, through scientific validation and project practice, Civil Aviation Administration of China (CAAC) has built an information system covers the whole process of tower controller's work, integrating various systems in the tower such as A-SMGCS, EFS, DCL, ATIS/D-ATIS, etc, providing tower controllers different and efficient integrated HMI display, supporting the operation of tower control. We named the system 'the Tower ATM automation system'.

1.3 In order to promote and standardize the construction and application of the Tower ATM automation system, in April 2021, Civil Aviation Administration of China and Air Traffic Management Bureau jointly issued the guidance for the construction and application of the Tower ATM automation system. The guidance clarifies the system roles, construction standards, equipment license, and maintenance regulations of the Tower ATM automation system. It also regulates the technical requirements and related configurations that must be met for the construction of the Tower ATM automation system.

1.4 Because the operation of tower control department is closely related to the terminal control department, the operation procedure is complicated. As an independent system, the Tower ATM automation system has multiple operation requirements with the terminal (approach) ATM automation system. This paper mainly presents the analysis of operation requirements of the Tower ATM automation system, data interaction method between the ATM automation system and the

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Tower ATM automation system, the data interaction method between main and backup Tower ATM automation systems.

2. REQUIREMENT ANALYSIS OF OPERATION

2.1 As an independent system, the Tower ATM automation system should keep data consistency, reliability and timeliness with ATM automation system, especially for flight plan data. Because both Tower ATM automation system and ATM automation system will modify the same flight plan, It must be ensured that every flight plan is reliably synchronized in two systems. Furthermore, using consistent flight plans can reduce the risk and safety hazards.

2.2 To guarantee the continuous, stable and reliable operation between the tower and terminal (approach), the Tower ATM automation system and ATM automation system need to use four types of data to implement interactive functions and to meet the requirements of controllers. The data includes flight plan data, control operation data, environmental data, and flight flow data.

- 1) Flight plan data includes Basic Flight Data, Terminate Flight Data
- 2) Control operation data includes Handover, SSR Request, SSR Allocation, Missed Approach information, etc.
- 3) Environmental data includes Runway state, Runway schedule, SIDs Availability, STARs Availability, Current Restricted Area Status, QNH, Automatic Terminal Information Services, etc.
- 4) Flight flow data includes Arrival Sequence Message, Departure Sequence Message, etc.

Both main and backup Tower ATM automation systems need to meet the following operational requirements to ensure the seamless emergency switch:

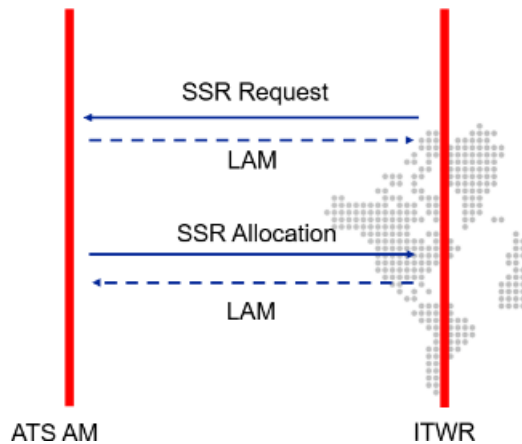
- 1) Consistency of flight plan data(flight plan synchronization, Electronic Flight Strips(EFS) status synchronization)
- 2) Environmental data includes Runway state, Runway schedule, SIDs Availability, STARs Availability, Current Restricted Area Status, QNH, Automatic Terminal Information Services, Sector Assignment, Controller Working Position (CWP) Setting, etc.

2.3 Technical Solutions of Data Interaction

2.3.1 Establishing a flight plan synchronization mechanism between the Tower ATM automation system and ATM automation system, is the key way to ensure consistency of flight plan in two systems. In normal working mode of the Tower ATM automation system, all flight plans only come from the ATM automation system. The flight plans created by the ATM automation system and their modifications should be synchronized to the Tower ATM automation system. Modifications of the flight plans by the Tower ATM automation system should also be synchronized to the ATM automation system. The flight data interactive message can implement the basic flight plan synchronization (creation/modification/cancellation) after the two systems are initially connected.

2.3.2 To establish a data interactive mechanism between the Tower ATM automation system and the ATM automation system, there are three types of operational data, including control operation data, environmental data, and flight flow data. Take a departure flight as an example to show the data interaction when the Secondary Surveillance Radar (SSR) codes request and allocate. The status change of departure flight plan is mainly based on the Tower ATM automation system.

First the Tower ATM automation system applies for the SSR code, and then the ATM automation system allocates SSR code. This message below shows the interactive content of the two systems:

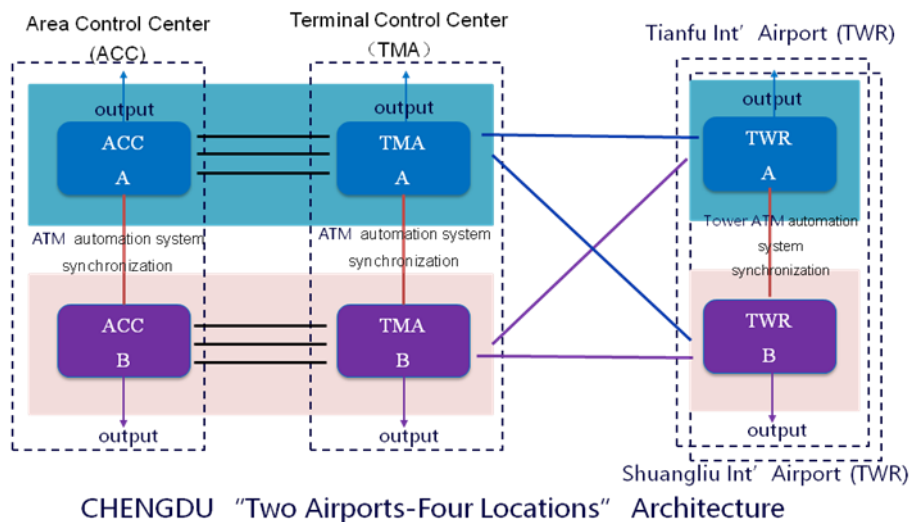


2.3.3 Implementation of data interaction in the Tower ATM automation system and ATM automation system. The data of flight plan creation, modification, and three types of operational interaction are all encapsulated in accordance with data structure of the ATM automation system Flight Data Exchange Standard (MH/T 4029.3), which is issued and widely used by CAAC. According to the requirements, different operation sites can select to use part or all of the messages or even expand the content of the messages. It will realize the flexible configuration of data interaction to achieve the best effect.

3. APPLICATION CASE AND EXPERIENCE

3.1 Application Case of Chengdu Tianfu Airport and Shuangliu Airport

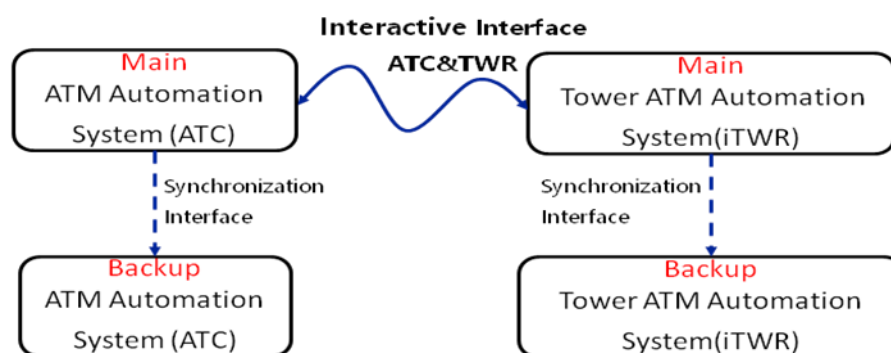
The Chengdu Terminal Air Traffic Control Center and Chengdu Tianfu International Airport were put into operation in April and June 2021. Chengdu has officially launched the joint operation mode of "One City, Two Airports" and "Two Airports, Four Locations" with the Chengdu Shuangliu International Airport, the Chengdu Tianfu International Airport, the Terminal Control Center, and the Area Control Center.



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Both the Main and backup Tower ATM automation systems were built in the towers of Chengdu Shuangliu and Tianfu International Airport. The Tower ATM automation system is interactive with the ATM automation system in Terminal Air Traffic Control Center, and the data interaction scheme is designed according to the above-mentioned operation requirements. The normal working mode is shown in the figure below.



3.2 Application and Benefit of Data Interaction

3.2.1 The flight plan and other data has high consistency in the Tower ATM automation system and the ATM automation system, and in the main and backup ATM automation system. Data consistency is the basic support for the safe and stable operation of control. Three types of data interaction (control operation data, environmental data, and flight flow data) are defined based on the actual operational requirements and further to ensure the safe operation and to improve operational efficiency.

3.2.2 The design of the data interaction interface follows the semi-structured and open-text definition of the Chinese civil aviation standard MH/T4029.3, and the general data of the message maintains the consistency with the general data of the Chinese civil aviation industry standard. The data interaction interface inherits the characteristics of readability, scalability, and on-demand combination in MH/T4029.3. The specification of data interaction interface has guiding significance and promotion prospects for the follow-up construction of China's new Tower ATM automation systems.

3.2.3 Based on the successful application of the data exchange between the Tower ATM automation system and the ATM automation system, CAAC will continue to study and standardize the data exchange standard between the Tower ATM automation system and the National Air Traffic Flow Management System.

4. ACTION BY THE MEETING

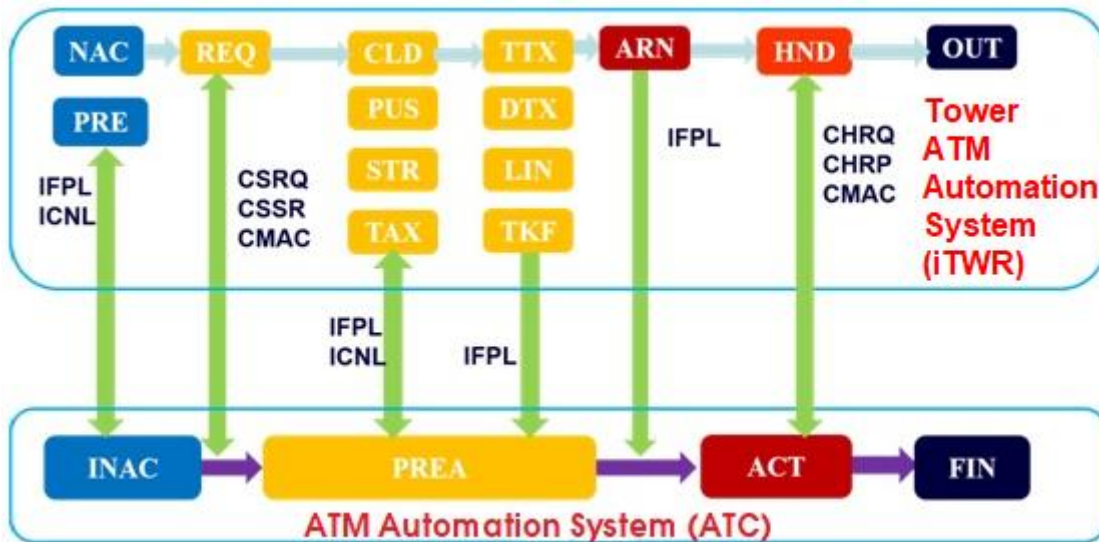
4.1 The meeting is invited to:

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

Attachment : Example of Arrival and departure flight data process

Departure flight data process

The flight plan data source is the ATM automation system, and the status changes are triggered by the Tower ATM automation system.



Arrival flight data process

The flight plan data source is the ATM automation system, and the status changes are triggered by the interaction of the ATM automation system and the Tower ATM automation system.

