International Civil Aviation Organization

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Agenda Item 5: ATM Systems (Modernization, Seamless ATM, CNS, ATFM)

TRIAL OPERATION OF DATA LINK ATC SERVICES IN MIDDLE-SOUTH REGIONAL AIR TRAFFIC MANAGEMENT BUREAU OF CAAC

(Presented by China)

SUMMARY

The air traffic operation in the middle-south region of China is characterized by high-density traffic. On one hand, frequent radio-telephony communications between controllers and pilots are necessary for routine operations, as a result, frequency congestion is unavoidable. On the other hand, extreme weather events, such as thunderstorms and typhoons, further complicate flight operations. Against this backdrop, according to the development strategy of Air Traffic Management Bureau (ATMB) of CAAC, The Middle-South Regional ATMB (MS-ATMB) is conducting the trial operation of data link ATC services, emerging as a vital solution to alleviate communication congestion and boost operational safety and efficiency. This paper outlines the trial operations, including objectives, phased rollout and outcomes, while also inviting discussion on addressing existing technological challenges.

1. INTRODUCTION

1.1 According to International Civil Aviation Organization's (ICAO) Global Air Navigation Plan (Doc 9750), data link ATC service is a core component in achieving Trajectory-Based Operation (TBO). In addition, enhancing the capabilities of data link is one of the principles of Asia/Pacific Seamless ANS Plan. The ATMB of CAAC is dedicated to developing and applying relevant technologies, and constantly enhancing ATC capabilities.

1.2 Given the high air traffic density, frequent adverse weather, and intensive radio-telephony communications, the air traffic operation in China's middle-south region is busy and complex. Data link ATC service is regarded as a crucial measure for enhancing operational safety and efficiency under these circumstances. MS-ATMB is exploring the use of data link ATC services to cut down repetitive air-ground communications and reduce frequency occupation, aiming to reduce controllers' and pilots' workload, alleviate communication congestion and boost operational safety and efficiency.

1.3 This paper analyzes the trial operation data of data link ATC services in MS-ATMB, assesses its benefits and challenges, and proposes subsequent action suggestions.

2. DISCUSSION

Trial Operations of Data link ATC services

2.1 Since 2019, MS-ATMB has been engaged in the application research and system development of data link ATC services. Successful trial operations have been conducted on various information services, including arrival procedures, landing runways, ground taxiing routes, stand assignments, turbulence information, expected frequency usage, and emergency alerts for communication failures. Routine trial operations have been launched in the Guangzhou and Zhengzhou control areas.

2.2 ***Landing Runway and Arrival Procedure Information:*** Guangzhou Baiyun International Airport, one of the largest airports in China, has four operational runways, with the fifth runway will soon be commissioned. The allocation and use of runways are key parts of Baiyun Airport's operations. Through air-ground data link, pilots can receive early notification of their landing runway and arrival procedures which reduces flight crews' workload significantly. MS-ATMB upgraded AMAN's functions to support data link ATC services. AMAN assigns the initial landing runway for each arrival flight 20 minutes before it enters the terminal area. After optimization at the AMAN position, the landing runway, arrival procedure, and sequence are locked in. AMAN personnel then push this information to flights via data link. As a result, pilots can receive landing and arrival information 5-10 minutes earlier than before, effectively reducing flight operational workload and enhancing safety.

2.3 ***Weather Deviation Information in Adverse Weather Conditions:*** During adverse weather conditions with massive deviation, the variation of deviation paths can lead to unexpected conflicts. Controllers must frequently coordinate with pilots to avoid conflicts. To alleviate frequency congestion, in June 2024, Zhengzhou ACC began to push four categories of information— "Deviation Suggestions" "Rerouting Path" "Airport Operations" and "Turbulence Information" to pilots via air-ground data link. Based on weather conditions and ATC operations, supervisors evaluate deviation plans and select key information from the system. The system can automatically filter out relevant flights and generate the message text. After verification by the supervisors, the message will be sent to the corresponding flights. This data link communication of weather diversion information helps build shared situational awareness between ground and air, significantly improves frequency congestion, and reduces the workload of both controllers and pilots. It is an effective measure to enhance operational safety and efficiency in adverse weather conditions.

Objectives of Trial Operation

2.4 The trial operation of data link ATC services aims to achieve four main goals:

a) ***Validate Technological Feasibility:*** By establishing a digital ATC service platform, verify the application feasibility of digital ATC technologies based on air-ground data link.

b) ***Develop Work Procedures and Standards:*** Through the trial operation of digital ATC, develop and summarize a series of practical digital ATC service working procedures and standards.

c) ***Explore Future Applications:*** Based on the trial operations, further explore future application requirements and scenarios to lay a foundation for realizing data link ATC services across all phases of flights.

d) ***Enhance Safety and Efficiency:*** Effectively enrich safety assurance measures, reduce controller workload, and improve operational efficiency and service quality through digital ATC service.

Phased Rollout of Trial Operations

2.5 The trial operations are typically rolled out in three phases, each corresponding to different work procedures to ensure the steady application of this new technology:

a) ***Phase 1:*** Data link ATC information/instruction is sent via data link, but controllers and crews must continue to issue and acknowledge voice instructions, with voice instructions taking precedence.

b) ***Phase 2:*** Data link ATC information/instruction is sent via data link. After receiving instructions, pilots must verbally acknowledge the digital instructions. Controllers will correct any inaccurate acknowledgments, with voice instructions still taking precedence.

c) ***Phase 3:*** Data link ATC information/instruction is sent via data link. After receiving instructions, pilots are not required to verbally acknowledge the digital instructions. Both controllers and crews will rely on the digital instructions, gradually replacing voice instructions with digital ones.

Outcomes of Trial Operations

2.6 The MS-ATMB research and trial operations in air-ground data link data link ATC services have been well-received by airlines, demonstrating good application outcomes and exemplary effects. According to data statistics, since the pilot launch:

a) In the Zhengzhou control area, over 300,000 data link messages have been sent, with a success rate of 97.14%.

b) In the Guangzhou control area, over 150,000 data link messages have been sent, with a success rate of 96.37%.

c) Assuming each message saves 10 seconds of communication time, a total of over 70,000 minutes of voice communication time has been saved, significantly reducing the occupancy rate of communication frequencies.

Conclusion

2.7 “Setting Once” and “Sending by One-Click” help supervisors effectively achieving a “one-to-many” information sending model, saving repetitive communications across multiple positions. This significantly reduces the workload of controllers and pilots, increases safety margins, and enhances situational awareness and operational efficiency.

Challenges and Optimization Suggestions

a) ***Latency Issues:*** Currently, air-ground data link technology still suffers from latency, which is too high for issuing ATC instructions in busy areas. Therefore, in the current trial operation, the majority of the content is informational rather than instructional. To extend the application of digital ATC service, stakeholders should take efforts to reduce the latency, additional investments of relevant facilities should be considered.

b) ***Limited Adoption of Next-Generation Communication Technologies:*** Currently, the number of aircraft supporting next-generation communication technologies such as CPDLC is limited, limiting comprehensive implementation. It is recommended that stakeholders share information and explore solutions in areas such as airborne systems, ATC systems, and communication transmission.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;

b) encourage the continued exploration and expansion of data link ATC services;

c) discuss potential solutions to address the latency issues in ground-to-air data link technology and the limited adoption of next-generation communication technologies like CPDLC;

d) support collaboration among relevant States/Administrations to share experiences and jointly advance the development of air-ground data link in the region; and

e) discuss any relevant matters as appropriate.

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