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AGENDA ITEM 4: AIR NAVIGATION

STATUS AND ROADMAP OF THE DEVELOPMENT OF AIR TRAFFIC FLOW MANAGEMENT IN CHINA

(Presented by the People's Republic of China)

SUMMARY

The paper provides an update on the development of air traffic flow management (ATFM) in China, including a description of the operational concepts of ATFM in China and an overview of the National Traffic Flow Management System (NTFM). It also describes the concept of One CTOT Solution (OCS), which aims to resolve the conflictions between multiple simultaneous ATFM measures, and aspects of cross-border ATFM collaboration. The overarching goal is to collaborate with all stakeholders to collectively advance the development of regional ATFM.

STATUS AND ROADMAP OF THE DEVELOPMENT OF AIR TRAFFIC FLOW MANAGEMENT IN CHINA

1. INTRODUCTION

1.1 The ATFM Command Center of Operations Management Center (OMC) under Air Traffic Management Bureau (ATMB) of CAAC has been in operation for four years. With over 86 stations in a 2000 square meter workspace, it organizes and implements both national and international civil aviation air traffic flow management. On May 20, 2021, the National Traffic Flow Management System (NTFM) was officially deployed across Chinese mainland, enabling nationwide integrated operation of the ATFM system and operating procedures.

1.2 The deployment of NTFM system in China has ushered in a new stage for civil aviation in China, characterized by common situational awareness and collaborative decision-making. As the System runs smoothly and cross-border ATFM collaboration being implemented, rapid simulations and human-in-the-loop (HITL) tests of cross-border ATFM have been carried out by ATFM units.

1.3 In operating the cross-border function of the NTFM System, we found that given the practical condition of the Asia & Pacific region, implementing GDP and other ATFM measures indiscriminately for domestic and international flights cannot effectively achieve information-sharing and cross-border collaboration. Therefore, China has sought to gradually promote the planning and implementation of the One CTOT Solution (OCS), Collaborative Multi-Constraint Conversion Program (CMCP), and ATFM Harmony Unit (AHU) in a holistic approach.

2. DISCUSSION

Operational Concepts

2.1 *Concept Development*: The ATFM operation system in China adopts a "decision-making on the first two levels and implementation on the third" model. Before 2020, China's ATFM operations was carried out primarily by the 7 regional ATMBs, each with their own ATFM system. The OMC back then monitored and coordinated the activities of the 7 bureaus, and the information-sharing across the country was achieved through the previous Air Traffic Operation Management (ATOM) system. After 2020, with the deployment of NTFM across Chinese mainland, a common situational awareness has been established, and the OMC assumes full responsibilities for nationwide ATFM operations.

2.2 *ATFM Progress*: Collaborative decision-making-based ATFM requires joint efforts of ATFM units at all levels to achieve optimal performance. Given the characteristics and development goals of civil aviation in China, one single ATFM measure is insufficient to address imbalanced demand and capacity. Instead, it is necessary to leverage the advantages of the entire ATFM system to deal with different scenarios. It is appropriate to make use of collaboration among stakeholders to develop a better-suited ATFM solution to accommodate the anticipated rapid growth of flight movements in China.

2.3 *Fundamental Concept of ATFM*: ATFM is a service established for the safe, orderly and flow of air traffic. It manages the temporal and spatial distribution of air traffic flows through monitoring, analysis, decision-making, implementation, and evaluation. This process maximizes the use of the ATM system capacity without overload, optimizes traffic flow distribution, maintains demand and capacity (DCB) through well-planned deployments, and aims to improve airspace utilization and reduce congestion and flight delays.

2.4 *Operational Concepts*: The Centralized Multi-Participant Collaborative ATFM Network (CMC) is the main ATFM operational concept in China. It encompasses a centralized ATFM network that provides ATFM services for domestic flights and connects with cross-border ATFM through nationally unified, advanced and integrated ATFM/CDM procedures and systems; multiple operational nodes where, after the national ATFM unit generates ATFM solutions based on collaborative decision-making, the 7 regional ATFM nodes in China facilitate the execution of the decisions made, and regional ATFM units can also make their own decisions in each region; and collaborative decision-making (CDM) with stakeholders, which enables a common situational awareness among all stakeholders to carry out multi-party collaborative decision-making, thereby providing a more feasible ATFM solution.

National Traffic Flow Management System (NTFM)

2.5 The National Traffic Flow Management (NTFM) is a unified ATFM system developed based on the concept of ATFM in China. It is deployed in the Operations Management Center (OMC), the 7 regional ATFM units, and 36 ATM sub-bureaus and stations, covering the entire ATM system in China. With the OMC as the hub, supported by regional ATFM units, and extended by the ATFM units located in the ACC, APP, and TWR.NTFM has formed a collaborative ATFM system that covers all civil aviation entities in China and that could effectively connect with cross-border ATFM in the Asia & Pacific region.

2.6 The NTFM system collects flight plan information from the flight plan processing system, along with inputs from the aeronautical information service system (AIS), meteorological information system (MET), ATC automation system, tower electronic flight strips (EFS), surface movement radar (SMR), and other sources. In addition, the System is capable of interaction with A-CDM AMAN/DMAN, and other related systems. CTOTs for regulated flights are automatically released to airspace users, airport operators and ATFM stakeholders via EFS to achieve automatic information-sharing.

2.7 The NTFM system covers the strategic, pre-tactical, tactical, and post-operation analysis stages throughout the ATFM operation. It also provides calculated proposals for the ATM planning phase. The System provides automatic evaluation recommendations for operational capacity based on simulations and the measures issued on similar days, and are available on the cross-border ATFM cooperation platform. It also provides operational information system (OIS) services for areas where transmission between systems is impossible.

2.8 Thanks to the NTFM system, ATFM measures in China have transitioned from being separation-based to capacity-based. When it is impossible to increase capacity and there is a need to manage traffic flow, NTFM provides flow management positions (FMP) with a series of optional ATFM measures such as ground delay procedure (GDP), airspace flow procedure (AFP), ground stop (GS), Miles/Minutes In Trail (MIT), level capping plus MIT, and collaborative rerouting. ATFM personnel can simulate these measures and assess their possible impact. Then, one measure or a group of measures are selected to form a sole ATFM solution. It is worth mentioning that when a flight is subject to multiple ATFM measures or restrictions, the slot calculation function of the System could fully consider the requirements of each measure/restriction based on One CTOT Solution (OCS) to generate a CTOT that complies with multiple measures/restrictions.

2.9 While building the NTFM system, China also pays attention to the construction of the whole ATFM ecosystem. China has deployed A-CDM at airports with more than 10 million passenger throughput, strengthened the construction of AMAN and DMAN responding to a complete ATFM system, issued the Regulations on ATFM of Civil Aviation, Operation Rules of ATFM in China (trial implementation) and the Regulations on The Management of Civil Aviation Air Traffic Flow to standardize ATFM operations and gradually create an efficient ATFM collaborative operation environment.

ATFM Solutions

2.10 As civil aviation in the Asia & Pacific region gradually recovers since last year, traffic volume is transitioning from rapid recovery to a higher-level growth. The APAC region, with its complex operating environment and diversified demands for ATFM, will experience demand-capacity imbalance. The situation is further complicated by the distinctive characteristics and conditions of the States/Administrations in the region, each with their unique operational challenges and ATFM requirements.

2.11 Additionally, multiple ATFM measures may be simultaneously issued to the same traffic flow or to one single flight, leading to conflicting ATFM measures. This conflict is a hot topic in the field of ATFM and presents an emerging issue to be considered in the next stage of cross-border ATFM in the Asia & Pacific region. Some ANSPs have their own solutions to these problems, such as determining the most penalizing regulation (MPR) or issuing an ATFM measure based on regional coordination. These solutions, while innovative, highlight the need for a more unified approach to managing ATFM measures.

2.12 These methods only address conflicting ATFM measures to some extent, and there are still challenges due to the number of ATFM measures and complex operating environments. On one hand, there are difficulties in timely communication and coordination for ATFM measures, especially when these measures are issued by different ANSPs. On the other hand, even though a better-suited ATFM measure is selected, there still exists the problem that a great deal of flights is unable to execute all of the ATFM measures that need to be compiled at the same time. This highlights the need for a more comprehensive and flexible approach to ATFM measure selection and implementation.

2.13 The concept of One CTOT Solution (OCS) aims to resolve these conflicts. By upgrading the Collaborative MIT Conversion Program (CMCP) to the Collaborative Multi-constraint Conversion Program (CMCP+), CTOT for every flight can meet all constraints, without selecting or coordinating for different measures. This innovative approach represents a significant advancement in the field of ATFM, avoids unnecessary or excessive restrictions, and demonstrates China's commitment to improving air traffic management efficiency.

2.14 CTOT is calculated by CMCP, which is generally supported by the system and has high compatibility. ATFM units without computing capabilities can use conventional approaches. When ATFM units with computing capabilities face traffic flow constraints and need to issue AFTM measures, they can calculate the CTOT which meets all overlapping constraints on this traffic flow. Therefore, only one CTOT should be issued no matter how many ATFM measures are imposed on the same flight. This approach reflects a transition of ATFM measures from implementation coordination to a solution that satisfies all constraints, and a shift from "conflicting" ATFM measures to "synergic" ATFM measures.

ATFM Collaboration

2.15 ATFM is a key efficiency improvement method for air traffic management and plays a crucial role in the implementation of the plan. In recent years, ATFM development in China has not only focused on domestic ATFM but also emphasized the harmonized development between cross-border and domestic ATFM under the ICAO ATFM Framework in the Asia & Pacific region. China has been actively participating in cross-border ATFM collaboration and has been progressively carrying out cross-border ATFM projects and follow-up planning activities in a more pragmatic and systematic way.

2.16 The operating mode of ATFM in China has been designed based on ICAO's ATFM framework. There are both similarities and differences between China and other States and regions in terms of ATFM operational concepts, workflows, and ATFM measures. Therefore, strengthening the understanding of ATFM in China and seeking common ground while reserving differences is the basis for collaborative ATFM operation in the future.

2.17 The NTFM system itself is not severed from the rest of the world, and instead, it is a part of the Asia & Pacific ATFM network and a component of the global network. Therefore, China is willing to promote interconnection with ATFM information networks of all States and administrations in the region under the framework and standards of ICAO. With the further development of cross-border ATFM collaboration, the network of cross-border ATFM system can not only facilitate information interaction but also sharply promote operational efficiency. Thus, we welcome all stakeholders to carry out tests on interconnecting with China's NTFM system to enable information exchange.

3. ACTION BY THE CONFERENCE

3.1 The conference is invited to:

a) note the information contained in this paper;

b) support the development of cross-border ATFM in Asia& Pacific region; and

c) encourage all stakeholders to carry out tests on interconnection with China's ATFM system to enable information exchange.

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