*International Civil Aviation Organization*

**Eleventh Meeting of the Asia/Pacific Air Traffic Flow Management Steering Group (ATFM/SG/11)**

Video Teleconference, 02 – 06 August 2021

**Agenda Item 4: Review of Current CDM/ATFM Operations and Problem Areas**

# CROSS-BORDER ATFM PROCEDURE RESEARCH IN CHINA

(Presented by China)

**SUMMARY**

This paper presents the research of cross-border ATFM operation procedure in China. To make the balance between capacity and interval, Shanghai ATCC makes the trail of the XMAN (Cross-border Extended AMAN) operation in Shanghai FIR from October 2020. China will optimize the design on this basis to apply to the cross-border ATFM operation procedure for China, Japan and ROK after achieving data connection. The further discussion will be held on next NARAHG meeting.

## 1. INTRODUCTION

1.1 The optimal design of ATFM measures is the focus of research for busy airspace flow management units. Usually, MINIT is suitable for airway interval sequence, but under the condition of route convergence, the interval will be double or triple. GDP is suitable for convergence flow, but it only can be implemented in central ATFM system. Therefore, in the airspace that cannot be covered by the central ATFM system, it is of positive significance to design an efficient ATFM measure. To resolve this contradiction, XMAN (Extend Arrival Management) and TBFM (Time-based Flow management) were designed by Eurocontrol and FAA.

1.2 XMAN is a concept developed in the frame of the SESAR Program (Single European Sky ATM Research) to extend the conventional AMAN horizon up to 550 NM and provide an enhanced and more consistent arrival sequence. XAMAN refers to preparing further in advance the sequencing of air traffic destined for a given airport. The solution extends the arrival management coordination beyond the airport TMA to neighboring en-route airspace. This allows controllers upstream to give early instructions to pilots to adjust their speed and trajectory before initiating descent towards the destination airport, reducing the need for stacking and holding over the destination airport. XMAN offers a smart solution to alleviating congestion compared to the conventional AMAN horizon and is ready for implementation. The tangible benefits of XMAN based on live trials are a better predictability, noise and fuel reduction, better sequence planning and better adherence to the planned sequence. In regions like Europe where aircraft fly across several national airspaces during the flight, cross-border traffic management is a necessity to take full benefits from Queue Management concepts. Cross-border Extended AMAN (XMAN) is the first operational cross-border implementation of the Extended-AMAN concept. DSNA is highly involved in this concept implementation to operate effective cross-border traffic management with its neighboring ANSPs.

1.3 At Heathrow 65% of arrivals experience stack holding due to capacity constraints. The XMAN concept developed together by the FABEC and the UK-Ireland FAB introduces the ability for controllers to manager delays in the tactical phase of flight well before the top of descent.

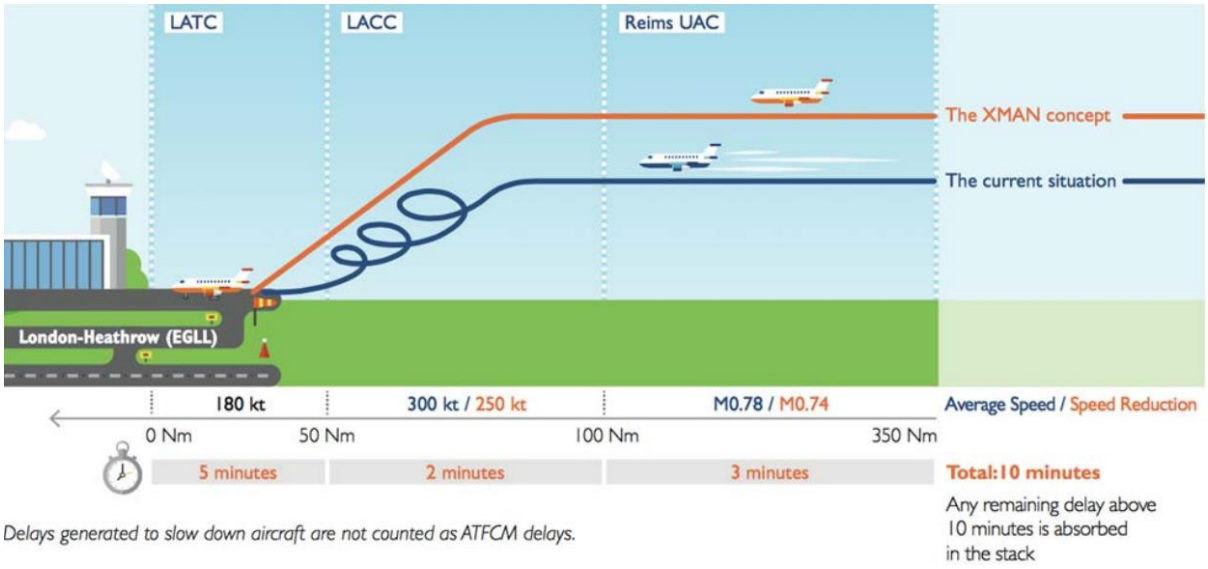


Figure 1: delay sharing between London Terminal, London ACC and Reims UAC

1.4 Time-based flow management (TBFM) is a foundational decision support tool (DST) for time-based management in the en-route and terminal environments in FAA. TBFM's core function is the ability to schedule aircraft within a stream of traffic to reach a defined constraint point (e.g., meter fix/meter arc) at specified times, creating a time-ordered sequence of traffic. The scheduled times allow for merging of traffic flows, while minimizing coordination, reducing the need for vectoring/holding, and efficiently utilizing airport and airspace capacity. The TBFM schedule is based on current aircraft estimated time of arrival at key defined constraint points based on wind forecasts, aircraft flight plan, the desired separation at the constraint point and other parameters. The schedule applies time-based spacing only when needed to maintain the desired interval at one or more constraint points.

1.5 The managing facility (ARTCC/TRACON) must:

- Determine appropriate TBFM settings and parameters and enter them into the TBFM system and coordinate as necessary.
- Determine TBFM activity timeframes and coordinate start/stop times with the ATCSCC and affected facilities.
- Communicate TBFM activity start/stop information to operational areas, operating positions, and supporting facilities, and log.
- Enable/disable sector meter list as coordinated.
- Monitor internal and upstream compliance and take appropriate action.
- Monitor TBFM airborne delays and initiate actions, as appropriate, when values exceed or are projected to exceed delays that can be absorbed by control sectors. Notify the OS or affected areas/sectors of actions taken and expected outcomes.
- Notify ATCSCC when unable to use TBFM capabilities, provide supporting justification, and log.

- Coordinate internally with affected areas and with supporting facilities before taking action when changes to the metering strategy or updates to the TBFM schedule are necessary.

1.6 In Shanghai TMA, the traffic flow via AND to ZSHC, ZSNB and ZSZS will convergence from 5 directions. The arrival traffic flow to ZSSS and ZSPD is also coming from the south of AND. So, the transfer flight level at AND is limited for these 4 directions. Therefore, Shanghai TMA usually issue 30 minutes separation for these 4 directions (Japan and ROK is exempted). In real operation, the extra holding still cannot be avoided in Shanghai TMA, because the MINIT cannot manage the overfly time at AND.

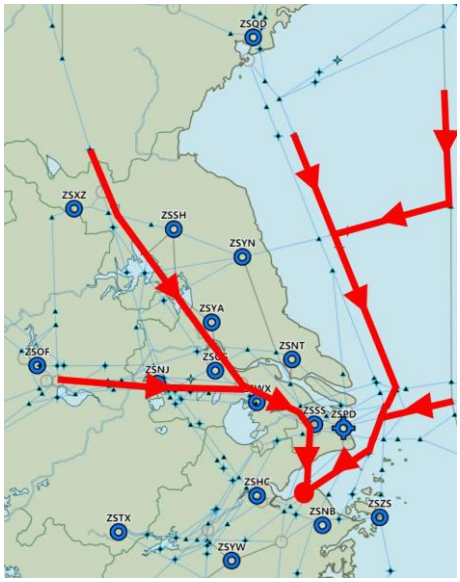


Figure 2: The convergence traffic flow at AND (red dot)

1.7 In October 2020, Shanghai ATCC decided to make an XMAN operation trial at AND. Shanghai ATFMD organize this test by ATFM system. Shanghai TMA set the FMP to monitor the inbound traffic flow overfly time list. In case of the separation is not enough, Shanghai TMA FMP will inform Shanghai ACC FMP to modify the overfly time for defined flight(s). The maneuvering instruction (Figure 3) or RTA modification (Figure 4) will be issued by ACC controller. The maximum coordination distance is enlarging to 325 miles in Shanghai FIR. By this way, the holding in the Shanghai TMA is decrease and the ATFM measure is reduced to 10 minutes for each direction.


Figure 3: The effect of accuracy adjustment at AND


Figure 4: The pilot input the RTA (Required Time Arrival) which issued by ACC controller.

1.8 By this XMAN test, we found that the estimated overfly time calculated by radar will have an error of 2-3 minutes sometimes. To get the accuracy overfly time, we plan to improve it through FMS via VHF. One TBO evaluation project was held in 2021 by CAAC, Shanghai ATCC and ADCC (Aviation Data Communication Corporation) jointly execute this project by XMAN operation. We upgrade the ATFM system to send the ETO request to ADCC, ADCC will send a check message to the cockpit by VHF data link. Then the reply from the cockpit will be sent in few seconds, this data will update the ETO in Shanghai ATFM system. The FPM in Shanghai TMA and ACC can make more accuracy modification than before. Experimental data shows that the error of one hour flight trip will be controlled within 30 seconds. The real test will be implemented in September 2021.

1.9 According to statistics, there were 276 flights in June 2021 instructed by Shanghai ACC to use the method of XMAN to avoid the holding in Shanghai TMA. The report from pilots were very positive, they can make more smoothly adjustment than before. The fuel consumption is also significantly lower than before. Shanghai ATCC plan to make more trail in Shanghai FIR to improve the ATFM measures and ATC methods.

## 2. DISCUSSION

2.1 The XMAN operation test in Shanghai ATCC is cooperated by TMA and ACC. ATFMD in charge of the ATFM system operation, ATFM measure and POA. Benefit from precise coordination, the ATFM measures on the relevant routes have been reduced. It can be called a triple win for all parts. It is similar the BTO operation between China, Japan and ROK after the real data connection. At that time, all the NARAHG FMPs can gather the accurate ETO shared by NARAHG members. By the cooperation like XMAN, some ATFM measures on convergence waypoints can be reduce or eliminated. To achieve this, NARAHG members cooperated to push the ATFM system data connection project from July 2020.

2.2 Capacity management is the major target of ATFM, but ATFM units always face the situation of convergence traffic flow. In the past, increase the MINIT to the different downstream is the only way to be implemented. XMAN or TBFM is a good selection for cross-border ATFM operation, even if almost all the coordination is implemented by controller, but each direction still needs ATFM to consider the suitable ATFM measure.

2.3 According to this XMAN test in Shanghai FIR, we found that the practice is a good way to research the new concept procedure. However, for more complex operation procedures, it is best to have a highly simulated platform for enough verification. Because NARAHG operation procedure will base on many new concepts and technical, simulation experiment as real as possible is needed. China will continue to do the research and practice on this topic.

## 3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper; and

b) discuss any relevant matters as appropriate.