



International Civil Aviation Organization

The Third Meeting of ICAO Asia/Pacific Air Traffic Flow Management Steering Group (ATFM/SG/3)

Singapore, 10 – 14 March 2014

Agenda Item 3: ATFM/CDM Global Update

CONCEPT OF OPERATION FOR A DISTRIBUTED MULTI-NODAL ATFM NETWORK FOR THE REGION

(Presented by Singapore)

SUMMARY

This paper presents a brief on the sub-regional distributed multi-nodal ATFM Concept of Operation which was developed through a collaborative research project performed by CAAS with support from an industry partner and active participation and operational inputs from key stakeholders such as ANSPs, Airspace Users, Airport Authorities and International organizations using a proven concept engineering methodology.

1. INTRODUCTION

1.1 Asia Pacific Region has experienced a robust increase in the demand of air traffic in the recent years with a strong growth of 5-6% year on year and is forecasted continue this trend. As most regional hubs were already operating near the limits of their current capacity, solutions to managing traffic flow efficiently were sought through various collaborative initiatives. As the existing centralized model of ATFM operations such as in Americas, Australia and South Africa were considered to be not suitable for the region ATFM/SG/2 agreed that the distributed multi-nodal network was perhaps the only viable solution to the ATFM needs of the region.

2. DISCUSSION

2.1 One such collaborative initiative was the ATFM/CDM proof of concept research project which aim to develop a multi-nodal regional ATFM/CDM concept that is viable for any state to adopt. CAAS had embarked on a 10 month ATFM/CDM proof of concept collaborative research project supported by an industry partner and key stakeholders. The concept development was based on a proven concept engineering process, which included several stakeholder sessions culminating to the human in the loop simulation. The research project received wide participation from ANSPs, Airspace Users, Airport Operators and International organization providing valuable operational inputs shaping the outcome of the concept. The tripartite member states Hong Kong China, Singapore and Thailand as well as Malaysia, airspace users such as Singapore Airlines, Silk Air, Tiger Airways, airport operators represented by Changi Airport Group and Airport Operator of Thailand and international organizations such as IATA and EU-AATIP had participated in the stakeholder sessions, Fast time simulation and Human in the Loop simulation providing essential operational inputs to the development of the concept. The research project has since concluded with the delivery of benefit analysis and the concept of operation. The outcomes of the research are as follows.

Concept Engineering Process

2.2 The concept engineering process involved Concept Analysis, Concept Exploration and Concept Development. The concept analysis phase focused on identifying key stakeholders, underlying problems in the air traffic flow and ATC operations, defining objectives for solution and developing storyboards through collection of operational data, questionnaires and surveys to stakeholders. The concept exploration phase continued with data collection, building and conducting Fast-time simulation and analysis, conduct benefit analysis through workshop participation. The concept development phase focused on concept experimentation and refinement of the ConOps through participation of stakeholders in workshops, training sessions and various exercise scenarios simulated on the Human In The Loop (HITL) test bed defining the functions, performance criteria, target architecture and system environment.

Concept Overview

2.3 The concept involves each ANSP operating an independent, virtual ATFM/CDM node supported by an interconnected information sharing framework. Where possible, Airport-CDM mechanisms, especially at busy airports, can aid the collaborative decision making process between the ANSPs. The flows of air traffic will then be managed effectively based on a common set of agreed principles among the participating ANSPs and airports. A node comprising an ANSP with associated airports will be able to manage the demand and capacity through adjustments in aircraft Calculated Landing Times (CLDT) which will in turn influence the issuance of Calculated Takeoff Times (CTOT) for aircraft at the participating airports.

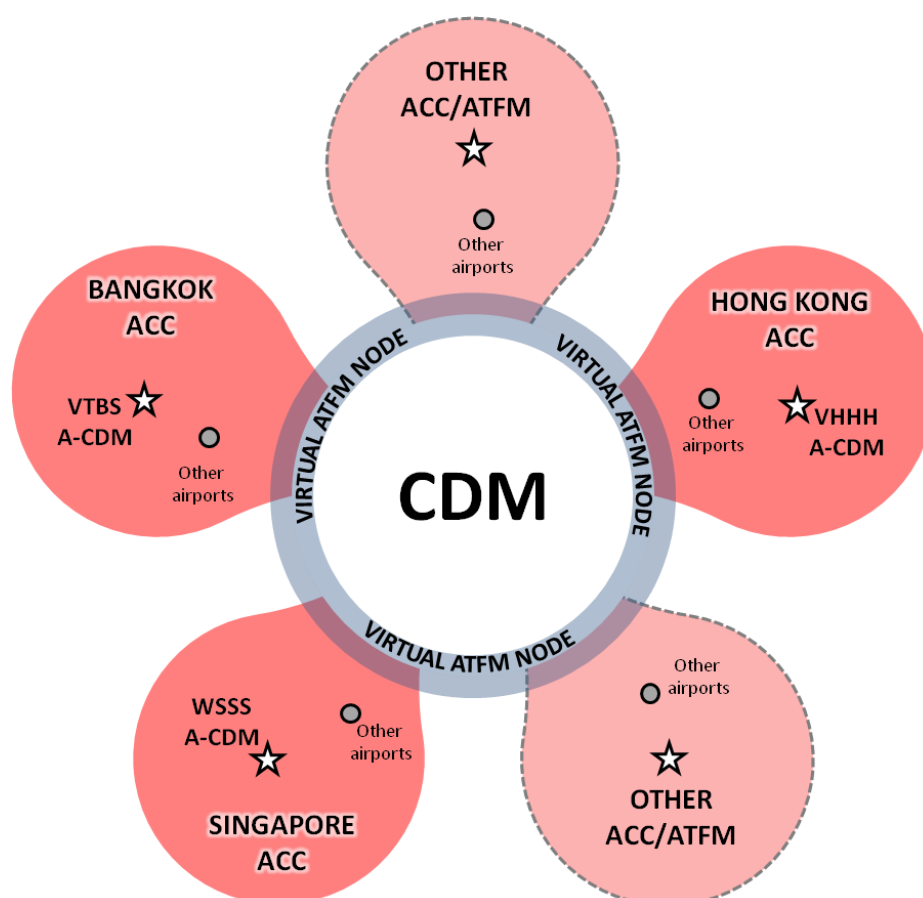


Figure 1. Distributed Multi-Nodal ATFM Network

2.4 Key components of the ATFM/CDM concept.

Regional Stakeholders interconnected via virtual communication framework

- Each ANSP has an independent FMP and ATFM System
- Each ANSP independently manages demand/capacity of its own Arrival Airport(s)
- Stakeholders/ANSPs communicate via existing Internet/Telecommunications networks
- Data from each ANSP is viewable by stakeholders via software web interfaces

Specify Capacity and Predict Demand

- Demand Prediction- Flight progress via manual input or automated data feed (e.g. FDP or AFTN)
- Capacity Management- Inputs from FMP and FOC via ATFM web based interface

Evaluate Alternatives, Initiate/Modify TMIs

- Aircraft Operators manage the TMI delay assigned to flights
- Aircraft Operators perform CDM with Airport Operators for ground/surface delay intent
- Slot assignments can be viewed via software web interface and notifications

Implementing TMIs – Stakeholder Roles

- Aircraft Operators
 - Provide delay absorption intent to ATFM System
 - Provide delay absorption intent to pilots
 - Monitor flight progress for compliance
 - Manage flight delay intent and substitute flights if necessary
- Pilots
 - Responsible for following ATC operational procedures in order to try and achieve compliance by meeting intended delay absorption.
- ATC
 - Departure - Potentially monitor compliance with intended Take Off Time
 - En route - Aware of TMIs but minimal interventions required
 - Arrival - Potentially monitor compliance with Calculated Time Over Fix
- Flow Management Unit (FMU)
 - Daily Airport and Airspace Capacity determination
 - Model Flow programs and set hourly capacity and arrival slots to ensure demand/capacity balance
 - Assess effects of imbalance to traffic beyond capacity impact range
 - Daily stakeholders CDM engagement to ensure demand/capacity balance
 - Daily post Operational Analysis
- Airport Operators
 - Departure – respect TMI affected departures and assist in meeting departure times based on Airport capacity.
 - Declare daily maximum allowable delay at gates.

2.5 These are the essential requirements for the success of a distributed multi-nodal ATFM concept.

- Acceptance of the Regional Concept by neighbouring ANSPs
- Agreement to common set of business rules for departure, destination and enroute ANSPs, Airport Operators and Aircraft Operators
- Participation level exceeding 70% of aircraft operated at any given airport to ensure effectiveness of flow measures
- Common agreement to share essential data for ATFM by stakeholders
- Participating ANSPs to initiate effort to build their individual capabilities and practice ATFM in accordance to ICAO guidance to provide ATFM service

2.6 The concept enables ANSPs to establish an ATFM framework to better manage air traffic flow for international and domestic traffic compositions. This concept accords greater flexibility to airspace users to manage delays through collaboration and negotiation with ANSPs and Airport Operators, thus bringing system wide efficiency, fuel savings and reduced emissions to ATFM operation.

2.7 ANSPs in the region could choose to adopt the concept to meet to their specific suitability and plan a structured ATFM implementation plan through internal capability building leading to interconnected participation in the virtual regional distributed multi-nodal ATFM network.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) Note the information contained in this paper
- b) Recognize this as a viable and adaptable concept for widespread adoption across the region;
- c) Consider the elements captured in this concept to be part of the regional ATFM Framework;
- d) Recognize that stakeholders' active involvement would be key to the success of a multi-nodal ATFM/CDM concept;
- e) Discuss any relevant matters as appropriate.

.....