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DISTRIBUTED MULTI-NODAL AIR TRAFFIC FLOW MANAGEMENT (ATFM) NETWORK IMPLEMENTATION IN THE ASIA-PACIFIC REGION

(Presented by Australia, China, Indonesia, Lao PDR, Malaysia, Philippines, Singapore, Thailand, CANSO and IATA)

REVISION NO. 2

EXECUTIVE SUMMARY

This paper presents the collaborative effort by a group of States and industry in the Asia Pacific Region to operationalise cross-border air traffic flow management (ATFM) based on the Distributed Multi-Nodal ATFM Network concept. Thus far, operational trials have been conducted to enhance operational efficiency and optimize capacity by providing greater predictability for stakeholders. The paper highlights the recent development in procedure validation and the introduction of the concept in operational environment, as well as inviting the Assembly to consider the adoption of the Distributed Multi-Nodal ATFM Network concept as one of the viable solutions to implement cross-border ATFM globally.

Action: The Assembly is invited to:

a) note the on-going collaboration between States in the Asia Pacific region to implement cross-border ATFM;
b) acknowledge the importance of advance flight planning and transmission of associated flight movement messages to ensure accurate demand predictions for ATFM operations;
c) acknowledge the importance of engaging the aeronautical meteorological (MET) community to develop tailored products to support ATFM; and
d) consider the Distributed Multi-Nodal ATFM concept as one of the solutions to implement cross-border ATFM for inclusion in the *Manual on Collaborative Air Traffic Flow Management* (Doc 9971) with a view to harmonise ATFM implementation.

Strategic Objectives:	This working paper relates to Strategic Objectives of safety, air navigation capacity and efficiency and environmental protection
Financial implications:	Not applicable
References:	Twelfth Air Navigation Conference (AN-Conf/12)– WP/95 Doc 9971, Manual of Collaborative Air Traffic Flow Management

1. INTRODUCTION

1.1 Over the past few years, States have acknowledged the rapid and sustained increase in air traffic demand globally with the trend continuing to grow in the foreseeable future. Furthermore, various air navigation service resources (airports and airspace) are operating at or near capacity. When situations such as adverse weather results in a reduction in capacity, traditional flow restrictions such as imposing larger longitudinal separation at transfer of control points are often used to regulate air traffic flow; though such measures have not been the most effective and often result in negative impact on stakeholders' operations. Within the Asia-Pacific region, it was recognised that there is a need for a viable means to collaboratively handle the large air traffic demand at various constrained resources while providing stakeholders with greater situational awareness and involvement in the decision-making process.

1.2 At the Twelfth Air Navigation Conference in November 2012, Hong Kong China, Singapore and Thailand presented a working paper (AN-Conf/12-WP/95) that seeded the idea of a networked collaborative decision making (CDM) framework that could eventually support the implementation of air traffic flow management (ATFM). This idea was further developed through research collaboration between States and industry. Since then, the idea has evolved into the Distributed Multi-Nodal ATFM Network concept which has also been endorsed by Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) as the foundation for a cross-border solution in Asia-Pacific.

1.3 Over the last two years, the involvement of States in the Asia Pacific region has grown to include Australia, Cambodia, China, Indonesia, Lao PDR, Malaysia, Philippines and Viet Nam. The group of States are pursuing to bring the concept into operations through the Distributed Multi-Nodal ATFM Operational Trial Project, which is also supported by CANSO and IATA. Since June 2015, operational trials have been conducted to further refine and validate the ATFM processes and procedures in live operational environment.

2. DISCUSSION

2.1 The Distributed Multi-Nodal ATFM Network Concept

2.1.1 The Distributed Multi-Nodal ATFM Network concept is based on a network of ANSPs leading independent ATFM operations within their domain and connected to other ANSPs and stakeholders through an effective information sharing mechanism. By establishing common ATFM guidelines and protocols and ensuring fully-interconnected information flow within the region, each ANSP, associated Airspace Users and Airport Operators – grouped together as an ATFM Node – can implement effective ATFM programmes involving both domestic and intra-regional international flights while creating a channel for stakeholders' participation in the Collaborative Decision Making (CDM) process. This network of ATFM Nodes forms the broader ATFM body to support the regulation of air traffic for the region when required.

2.1.2 Since June 2014, the Multi-Nodal ATFM Project members from the various States and International Organizations have met over 10 meetings to develop the ATFM processes and procedures, and plan the conduct of operational trials. The project group adopted a multi-tiered participation approach to cater for the varying capabilities and level of readiness of the ANSPs, airport operators and airspace users. The various tiers used in the project and the associated capabilities are summarised in Table 1.

Tiered Participation Level	Capabilities	Number of Members
Level 3 ATFM Nodes	Capable of generating, delivering, receiving, and complying with Calculated Take-Off Time(CTOT)[1]	4 ANSPs, 13 airports, 13 airlines
Level 2 ATFM Nodes	Capable of receiving and complying with CTOT	2 ANSP, 13 airports, 8 airlines
Level 1 ATFM Nodes	Observe and participate in the Trial Progress	4 ANSPs
Advisory ATFM Node	Provide advice to the Trial	1 ANSP

Table 1. *Tiered Participation Level for the Multi-Nodal ATFM Project and the associated capabilities*

2.1.3 The project also adopted a phased approach to carry out the ATFM operational trials to allow progress to be made through gradual levels of complexity. Phase 1 focuses on addressing air traffic Demand-Capacity Balancing at individual airports by regulating arriving flights through Ground Delay Program (GDP) at departure airports with the issuance of Calculated Take-Off Time (CTOT). Subsequently; Phase 2, planned for 2017 onward, aims to use the similar concept in addressing Demand-Capacity Balancing (DCB) within sectors and airspace managed by participating ANSPs and paving way toward inclusion of long-haul international flights.

2.1.4 Phase 1 has been ongoing since June 2015 which was further divided into 3 stages to allow the project to progressively mature alongside the development of processes and procedures. The various phases and stages adopted by the project group are shown in Table 2.

Phase 1 – DCB for Constrained Arrival Airports		
Stage 1	**Stage 2**	**Stage 3**
• Communication Linkage and Protocols • Information Dissemination	• Demand Prediction Validation • Local Table-Top Exercises • Cross-border Procedure Development and Validation through Demonstration Flights	• Limited-Scope Operational Service: Providing ATFM service for planned and ad-hoc events; introduction of Combined ATFM Measure
Phase 2 – DCB for Constrained Airspace		
To be developed		

Table 2. *Multi-Nodal ATFM Project Phases and Stages*

2.2 Communication Linkage and Establishment of Technical Sub-Group

[1] CTOT is a calculated period of time within which take-off has to take place

2.2.1 Phase 1 Stage 1 focused on setting up various communication channels (E-Mails, Phone, Facsimile, AFTN, Web-Conference, Web Interface) between stakeholders, effectively establishing ATFM information sharing platform that would ensure effective communication between different stakeholders and thus enabling appropriate actions when ATFM measures are put in place by participating ANSPs. Additionally, in this Stage, participating stakeholders had opportunities to interact with different ATFM support systems from the Level 3 ANSPs (China, Hong Kong China, Singapore and Thailand).

2.2.2 The work in Stage 1 highlighted differences in user experience among various ATFM support systems which have been developed or procured independently by different ANSPs. Without the system-to-system information linkage, a major airline with a number of flights originating from many places could be required to access different systems to obtain ATFM information on all their flights. Airspace Users recognize that this would pose a major roadblock to scaling the ATFM Network due to the high workload in accessing information. Airspace Users and other stakeholders agreed on the need for a 'single point' of information access which could be achieved through interface enabling system-to-system communication between various ATFM support systems. The acknowledgment of this need resulted in a formation of the **Technical Sub-Group** of the Distributed Multi-Nodal ATFM Project. The Technical Sub-Group is focusing on developing an Interface Control Document (ICD) that will define the ATFM system-to-system information linkage, keeping in view the requirement from airspace users and future development towards System-Wide Information Management (SWIM) framework.

2.3 Procedure Development and Validation through Demonstration Flights

2.3.1 Subsequent to the testing and development of communication linkage, the project focused the effort on the development of **Common Operating Procedure** for ATFM under the Distributed Multi-Nodal ATFM Network. This work was undertaken by Level 3 ANSPs through project meetings and engagement with local stakeholders, resulting in a starting set of procedure that formed the foundation of how cross-border measure should be disseminated and managed in various scenarios. In the current setting, the workflow encompasses planning and distribution of ATFM Daily Plan, CDM web-conference, CTOT implementation and distribution, and CTOT slot management in the case of delayed flights or departure ground congestion. Efficient communication between responsible Flow Management Positions (FMPs) and stakeholders' operational personnel are emphasized throughout the process.

2.3.2 To validate the procedures and to raise awareness among stakeholders' operational personnel, a series of **demonstration flights** with various airlines from different airports were conducted between March and June 2016. For these demonstration flights, fictitious scenarios involving capacity reduction at major airports were simulated and CTOTs were issued by responsible ANSPs to pre-selected flights. These were "zero-delay CTOT" so as not to cause any unnecessary delay to flights involved. The expectation was for airlines responsible for the flights to handle the information given appropriately as if ATFM measures were enforced, involving their operational personnel as far as practicable. The activities proved fruitful in assisting stakeholders to familiarize their operational personnel such as pilots, dispatchers, and FMPs with the concept and practice of cross-border ATFM as well as highlighting various challenges to be discussed and refined.

2.3.3 Limited-Scope Operational Service: First Application in the Operational Environment

2.3.4 With the development of Common Operating Procedure and successful process validation and awareness campaign through demonstration flights, the project is at a crucial juncture with the commencement of **Phase 1 Stage 3 – Limited-Scope Operational Service**. In this last stage of the first phase of the Operational Trial, ATFM measures will be applied and enforced under actual reduced-capacity situations. This is a key step in moving toward the implementation of cross-border ATFM to

achieve DCB at capacity-constrained arrival airports. This work commenced in July 2016 and will last through much of the remaining of 2016, albeit with meetings among participating stakeholders to review the work periodically. The project will progress incrementally through this implementation, beginning with planned situations chosen in advance on limited number of days to allow stakeholders proper preparation and familiarization before methodically widening the scope to eventually enable ATFM measures to be implemented on an ad-hoc basis when needed.

2.4 Advanced Demand Prediction and Capacity Assessment: Roles of Advanced Flight Planning and Meteorological (MET) Collaboration

2.4.1 Throughout the progress of the Operational Trial, the project has recognized the importance of having accurate air traffic demand prediction in advance of the actual operations. This enables ANSPs to assess the situation at their resources and implement ATFM program effectively while minimizing negative effects on stakeholders through improved pre-operation situational awareness. An important role Airspace Users play in enabling accurate demand prediction is through advanced flight planning. Best practices in ATFM elsewhere in the world have shown that requiring flight plans to be submitted at least 3 hours prior to the Estimated Off-Block Time (EOBT) and associated flight movement messages (DLA, CHG, CNL, DEP) to be submitted in a timely manner prove effective in allowing ANSPs to determine the DCB situation in advance and implement pre-tactical ATFM program accordingly. The project has thus put in a suggestion at various contributory bodies of APANPIRG to consider implementing this advance flight planning and associated messages requirement in the Asia-Pacific region.

2.4.2 On the other side of the DCB equation, accurate capacity assessment based on forecast situations also plays a key role in the implementation of effective ATFM program. The ability of ATFM Units at ANSPs to put in place ATFM measure hinges on the information that is available for the decision-making process, and adverse / inclement weather is one of the common critical factors for capacity reduction in Asia-Pacific. Close collaboration between ANSPs and their MET service providers to ensure accurate weather forecast and appropriately-tailored weather product is thus fundamental to ATFM operations. It is important that ATFM community actively engage with the MET service providers to explore ideas, share experiences, and collaboratively develop tailored MET products to enhance ATFM operations.

2.5 Way Forward toward Harmonization of ATFM

2.5.1 Since June 2015, the Distributed Multi-Nodal ATFM Project has made significant progress to develop and validate the concept that has been endorsed as a viable foundation to the Asia-Pacific regional cross-border implementation. The project is now at a crucial juncture where the concept and procedure are being tested in operational environments. While the road ahead will be challenging, project members are committed and will continue to work collaboratively to ensure the success of this project; thus paving the way towards harmonized and efficient air traffic operations in the region.

2.5.2 The Distributed Multi-Nodal ATFM Network concept, when fully implemented, can be a viable solution toward the harmonization of ATFM standards, processes and procedures globally. In today’s globally interconnected air traffic network, a harmonized ATFM is one critical area in the pursuit of ATM Modernization laid out in the Aviation System Block Upgrade (ASBU) Methodology of the Global Air Navigation Plan (GANP). The inclusion of the Distributed Multi-Nodal ATFM Network concept along with the processes and procedures into the ICAO Manual on Collaborative ATFM (Doc 9971) can help guide States in their ATFM implementation, taking into consideration the linkage with regional and global ATFM operations as suggested in the ASBU Methodology.

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