

Asia/Pacific Framework for Collaborative ATFM

INTERNATIONAL CIVIL AVIATION ORGANIZATION



**ASIA/PACIFIC FRAMEWORK
FOR
COLLABORATIVE AIR TRAFFIC FLOW MANAGEMENT**

Version 3.0 August 2017

This Plan was developed by the Asia/Pacific Air Traffic Flow Management Steering Group (ATFM/SG)

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SCOPE OF THE FRAMEWORK

Regional Air Traffic Flow Management

1.1 The 24th Meeting of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/24), held in June 2013, considered that with the strong growth of air traffic in the Asia Pacific Region there was a need to effectively manage demand and capacity, particularly at major international air hubs and in the associated major traffic flows (MTF).

1.2 The airspace of the Asia/Pacific Region, particularly that of South East Asia, is characterized by relatively small FIRs with corresponding low flight transit times. Any demand management process applied unilaterally in one FIR had a knock-on effect in multiple ‘downstream’ FIRs, and procedures applied are therefore structured around the lowest capability along any particular route/flow. ‘Flow Management’ in the region has tended to be limited to rudimentary traffic spacing measures imposed by individual FIRs, rather taking a wider network view that optimizes available capacity and manages demand, only when necessary, on a sub-regional basis.

1.3 The Asia/Pacific Seamless ATM Plan provides a blueprint for coordinated Regional development, including capability improvements described in the ICAO Aviation System Block Upgrades (ASBU) roadmap. Air Traffic Flow Management (ATFM) taking a network view, is a key module in ASBU Block Zero. **B0-NOPS – Improved Flow Performance through Planning based on a Network-Wide view** has since been identified by APANPIRG as one of ten priorities for the Asia/Pacific Region.

1.4 While the concept of a single ATFM entity to serve a region works well in Europe and North America, a centralized ATFM Unit (ATFMU) approach is not yet practicable for the Asia/Pacific region. The need for a regional ATFM framework focusing on sub-regional, multi-State implementation, rather than individual FIR-based programs, was recognized by APANPIRG/24 in its adoption of the following Conclusion:

Conclusion 24/15: Asia/Pacific ATFM Steering Group

That, States participate in, and support the Asia/Pacific ATFM Steering Group to develop a common Regional ATFM framework, which addresses ATFM implementation and ATFM operational issues in the Asia/Pacific region.

1.5 This document, the *Asia/Pacific Region Framework for Collaborative ATFM* (the Framework) is intended to provide a common Regional framework that addresses ATFM implementation and ATFM operational issues in the Asia/Pacific region. Further discussed in later sections, a core concept of the Framework is the *distributed multi-nodal ATFM network*, envisaged as interconnected States and/or sub-Regional groups operating in an ATFM network without the need for any central, physical facility providing the network management function. The concept, untried elsewhere, originated in the *Regional ATFM Concept of Operations*, developed as a collaborative effort between Singapore and industry partners, later expanded to involve Hong Kong China, Malaysia and Thailand. The Framework will, in its future versions, be expanded and adjusted where necessary as the concept matures and experience is gained from operational implementation of cross-border, network-based ATFM and its supporting technology.

1.6 Doc 9971 states that *in its initial application, ATFM need not involve complicated processes, procedures or tools. The goal is to collaborate with system stakeholders and to communicate operational information to airspace users, air navigation service providers, and to other stakeholders in a timely manner.* Version 1.0 of the Framework includes near to medium term performance objectives to prepare and guide States in the implementation of collaborative, cross-border ATFM, providing for regionally harmonized ATFM concepts, communications and practices.

Framework Structure

1.7 The Framework, developed by the Asia/Pacific ATFM Steering Group (ATFM/SG), forms part of a suite of global and regional air navigation planning documents relevant to the Asia/Pacific Region.

1.8 Global vision and strategy perspectives are provided by the *Global ATM Operational Concept* (Doc 9854), *Global Air Navigation Plan* (GANP, Doc 9750), and *Global Aviation Safety Plan* (GASP, Doc 10004). The GANP includes the Aviation System Block Upgrade (ASBU) framework, its Modules and its associated technology Roadmaps.

1.9 Beneath this level is regional planning primarily provided by the *Asia/Pacific Basic Air Navigation Plan* (BANP, Doc 9673) and the *Asia/Pacific Seamless ATM Plan* which, together with its contributory documents, including this Framework, define goals and the means of meeting State planning objectives.

1.10 Now incorporated within the Seamless ATM Plan are the earlier *Asia/Pacific ATFM Concept of Operations* and *Air Navigation Concept of Operations*. The Framework draws upon and aligns with the guidance and recommendations of ICAO Doc 9971 *Manual on Collaborative ATFM*, and with the regional performance improvement expectations of the Seamless ATM Plan.

1.11 The Framework includes analysis of the current situation, a performance improvement plan, and considerations for research and future development.

1.12 The performance objectives of the Framework are expected to be implemented in phases aligned, where practicable, with those of the Seamless ATM Plan. Having considered the short time frame between the endorsement of the Framework by APANPIRG and the Phase I expectations of the Seamless Plan, Regional ATFM Capability is expected to be implemented in the following phases:

- Phase IA, expected implementation by 12 November 2015;
 - *(aligned with Seamless ATM Plan Phase I)*
- Phase IB, expected implementation by 25 May 2017; and
- Phase II, expected implementation by 08 November 2018.
 - *(aligned with Seamless ATM Plan Phase II.)*

1.13 None of the above phases or any element of the Framework is binding on any State, and they should be considered as a planning framework. It is important to note that, like the Seamless ATM Plan, the Framework's Phase commencement dates are planning targets. They should not be treated as a 'hard' date such as the example of Reduced Vertical Separation Minimum (RVSM) implementation. In that case there was a potential major regional problem if all States did not implement at the same time by the specific agreed date, which is clearly not the case for the start of the Framework Phases.

1.14 In that regard, although it would be ideal if all States achieved capability on day one of Phase I, this is probably not realistic. States should, however, consider the impact on stakeholders and on the needed improvements in cross-border ATFM and the ATM system overall that would result from not achieving target implementation dates. The Seamless ATM Plan Phase dates, and hence the Framework dates, were chosen as being an achievable target for the majority of States. However the dates were not designed to accommodate the least capable State, otherwise the region as a whole would fall behind the necessary urgent ATM improvements required by the Directors General of Civil Aviation and APANPIRG.

Document Review

1.15 The Framework is intended, as a minimum, to be first reviewed coincident with the first planned review of the Seamless ATM Plan in 2016 and thereafter each three years, also coincident with the regular review of the Seamless ATM Plan. Earlier or more frequent review and amendment will be conducted as recommended by ATFM/SG and agreed by APANPIRG, through its Air Traffic Management (ATM) Sub-Group (ATM/SG).

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DEVELOPMENT AND OBJECTIVES OF THE FRAMEWORK

Framework Development

2.1 The Asia Pacific Region Air Traffic Flow Management Steering Group (ATFM/SG) was formed by the Asia/Pacific Region Air Navigation Planning and Implementation Regional Group (APANPIRG) to *inter alia*, develop a common Regional ATFM framework which addresses ATFM implementation and ATFM operational issues in the Asia/Pacific Region.

2.2 The Framework was developed over four meetings of the ATFM/SG, supported by offline work by a team of specialists drawn from within the Steering Group. The Framework was endorsed by the 26th Meeting of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/26, Bangkok, Thailand, 7 to 10 September 2015).

2.3 The Framework draws on relevant experience gained in Asia/Pacific States, and in other Regions. Key concepts used or adapted in the Framework include:

- A distributed multi-nodal cross-border ATFM network rather than a regionally centralized facility;
- An agreed model for ATFM information exchange;
- An agreed suite of ATFM terminologies for use in ATFM systems and processes, and in interfaces with other complementary systems;
- Meteorological forecasting information tailored for ATFM purposes;
- *Delay absorption intent*, allowing aircraft operators to flexibly distribute their total ATFM delay across various phases of flight.

2.4 The performance objectives of the Framework are, wherever practicable, aligned with the ATFM-related objectives and implementation timelines of the Asia/Pacific Seamless ATM Plan. The

2.5 Further development of the Framework beyond this version will be guided by the concepts discussed in its Research and Future Development section, and by the experience gained in operational implementation and the maturing distributed multi-nodal ATFM network concept.

ATFM Framework Objective

2.6 Having considered relevant documents such as the Global Air Navigation Plan (Doc 9750), the Asia/Pacific Region Seamless ATM Plan and the Manual on Collaborative Air Traffic Flow Management (Doc 9971), the objective of the Framework is to provide a regionally agreed framework for the harmonized implementation of networked, interoperable, multi-FIR, multi-State, cross-boundary collaborative ATFM capability.

2.7 The Framework provides information, guidance and performance objectives including:

- ATFM principles;
- ATFM-related Aviation System Block Upgrades (ASBU), and relevant performance objectives from the Asia/Pacific Seamless ATM Plan;
- ATFM-related performance objectives of the Asia/Pacific Seamless ATM Plan;
- Collaborative decision-making (CDM);
- ATFM phases;
- Airspace and airport capacity improvement, planning, assessment and declaration;
- ATFM daily plan;
- ATFM terminology, communications and information distribution;
- Meteorological information for ATFM;
- Distributed multi-nodal ATFM network concept;
- Training and competencies for ATFM personnel;
- Analysis of current ATFM capability in the Region
- A performance improvement plan; and
- considerations for research and future development.

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EXECUTIVE SUMMARY

The Need for a Regional Framework for Collaborative ATFM

3.1 The Asia-Pacific (APAC) region is the world's largest market for air transport. In 2012 it accounted for 33% of the global air transport market¹. This was expected to grow to 37% by 2017. Three of the top ten airports (passenger movements) and four of the top ten (air cargo tonnage) in 2013 were in the Asia/Pacific Region².

3.2 While recognizing that the first response to increased demand should always be an increase in capacity, the growing demand/capacity imbalance in the Region has resulted in increasing congestion, delays, costs and potential safety risks.

3.3 The need for a regional, network-based response to the challenges of increasing demand was recognized by APANPIRG/24 (June 2013) in its adoption of **Conclusion 24/15: Asia/Pacific ATFM Steering Group**, re-convening the ATFM/SG to develop a common Regional ATFM framework addressing ATFM implementation and ATFM operational issues in the Asia/Pacific Region. It was further recognized in the inclusion of the ASBU module **B0-NOPS – Improved Flow Performance through Planning based on a Network-Wide View** among the ten priorities and targets for the Asia/Pacific Region³.

3.4 The scope of work of the ATFM/SG was further expanded by new terms-of-reference, endorsed by APANPIRG/25 (September 2014), which require the Steering Group to research and recommend appropriate ATFM guidance, and maintain an overview and review the effectiveness of Asia/Pacific CDM/ATFM programs.

Distributed Multi-Nodal ATFM Network Concept

3.5 Of central importance to Framework is the concept of cross-border ATFM utilizing a distributed multi-nodal ATFM network. Previously untried, the concept as detailed in this document will develop further with experience gained, particularly in the ongoing multi-partite trial program, with operational trials planned to commence in June 2015. This program, with the active participation of 8 Asia/Pacific Region administrations and 2 international organizations, is expected to contribute significantly to the knowledge and experience necessary for the ongoing work of ATFM/SG and the further development of the regional ATFM framework.

Interoperability is the Key

3.6 The Framework takes into account the ATFM development initiatives undertaken by various States to balance demand and capacity within their airspaces. Recognizing the need to adopt a network wide view for improving the flow performance across the APAC region, the Framework has been developed in line with ATM performance improvement elements of Asia Pacific Seamless ATM Plan.

¹ IATA Asia/Pacific Region ATFM Study 2014

² Airports Council International (ACI) 2013 World Airport Traffic Report

³ Conclusion APANPIRG 25/2 – APAC Regional Air Navigation Priorities and Targets

3.7 A key consideration in the development of Version 1.0 of the Regional Framework for Collaborative ATFM was the interoperability of systems, procedures and practices to ensure not only regionally harmonized ATFM, but also the effective, complementary operation of other systems forming part of the gate-to-gate chain of air traffic management. It is vital that all systems and processes use common information, terminology and communications protocols to ensure common understanding and optimal outcomes. In particular, the interoperability of ATFM, Airport Collaborative Decision-Making (A-CDM), Arrival Manager (AMAN) and Departure Manager (DMAN) systems, and airspace user and ATM automation system interfaces, is critical to the success of a regional ATFM program and the optimized use of available capacity. ATFM/SG addressed these issues in the development of harmonized ATFM terminology and the specification of automated system communications protocols, and through its linkage to the ICAO Asia/Pacific Region Aerodromes Operations and Planning Working Group (AOP/WG).

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ABBREVIATIONS and ACRONYMS

Abbreviations and Acronyms

Note: Abbreviations and acronyms for ATFM-specific terminology developed for the Asia/Pacific Regional Framework for Collaborative ATFM are listed separately in an appendix to Section 5, Background Information - Terminology and Communications.

AAR	Aerodrome Arrival Rate or Airport Acceptance Rate
ATM	Air Traffic Management
ABI	Advanced Boundary Information (AIDC)
ACAS	Airborne Collision Avoidance System
ACC	Area Control Centre
ACP	Acceptance (AIDC)
ADOC	Aircraft Direct Operating Cost
ADS-B	Automatic Dependent Surveillance-Broadcast
ADS-C	Automatic Dependent Surveillance-Contract
AFS	Aeronautical Fixed Service
AIDC	ATS Inter-facility Data Communications
AIGD	ICAO ADS-B Implementation and Guidance Document
AIM	Aeronautical Information Management
AIRAC	Aeronautical Information Regulation and Control
AIRD	ATM Improvement Research and Development
AIS	Aeronautical Information Service
AIXM	Aeronautical Information Exchange Model
AMAN	Arrival Manager
ANSP	Air Navigation Service Provider
AN-Conf	Air Navigation Conference
AOC	Assumption of Control (AIDC)
AOM	Airspace Organization and Management
APAC	Asia/Pacific
APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Regional Group
APCH	Approach
APEC	Asia Pacific Economic Cooperation
APSAPG	Asia/Pacific Seamless ATM Planning Group
APV	Approach with Vertical Guidance
APW	Area Proximity Warning
ASBU	Aviation System Block Upgrade
ASD	Aircraft Situation Display
ASEAN	Association of Southeast Asian Nations
ASMGCS	Advanced Surface Movements Guidance Control Systems
ATC	Air Traffic Control
ATCONF	Worldwide Air Transport Conference
ATFM	Air Traffic Flow Management
ATIS	Automatic Terminal Information Service
ATS	Air Traffic Services
ATSA	Air Traffic Situational Awareness
ATM	Air Traffic Management
CANSO	Civil Air Navigation Services Organization
CARATS	Collaborative Actions for Renovation of Air Traffic Systems
CDM	Collaborative Decision-Making
CCO	Continuous Climb Operations
CDO	Continuous Descent Operations

Asia/Pacific Framework for Collaborative ATFM

CFIT	Controlled Flight into Terrain
CLAM	Cleared Level Adherence Monitoring
COM	Communication
CONOPS	Concept of Operations
CNS	Communications, Navigation, Surveillance
CPAR	Conflict Prediction and Resolution
CPDLC	Controller Pilot Data-link Communications
CPWG	Cross-Polar Working Group
CSP	Communication Service Provider
CTA	Control Area
CTR	Control Zone
DARP	Dynamic Airborne Re-route Planning
DGCA	Conference of Directors General of Civil Aviation
DMAN	Departure Manager
DME	Distance Measuring Equipment
EST	Coordinate Estimate
FAA	Federal Aviation Administration
FDPS	Flight Data Processing System
FIR	Flight Information Region
FIRB	Flight Information Region Boundary
FL	Flight Level
FLAS	Flight Level Allocation Scheme
FLOS	Flight Level Orientation Scheme
FRMS	Fatigue Risk Management System
FUA	Flexible Use Airspace
GANIS	Global Air Navigation Industry Symposium
GANP	Global Air Navigation Plan
GASP	Global Aviation Safety Plan
GBAS	Ground-based Augmentation System
GDP	Gross Domestic Product
GLS	GNSS Landing System
GNSS	Global Navigation Satellite System
GPI	Global Plan Initiative
HF	High Frequency
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IMC	Instrument Meteorological Conditions
INS	Inertial Navigation Systems
IO	International Organizations
IPACG	Informal Pacific ATC Coordinating Group
ISPACG	Informal South Pacific ATS Coordinating Group
ITP	In-Trail Procedure
KPA	Key Performance Area
LNAV	Lateral Navigation
LVO	Low Visibility Operations
MET	Meteorological
METAR	Meteorological Aerodrome Report
MLAT	Multilateration
MSAW	Minimum Safe Altitude Warning
MTF	Major Traffic Flow
NextGen	Next Generation Air Transportation System
OPMET	Operational Meteorological
OLDI	On-Line Data Interchange

Asia/Pacific Framework for Collaborative ATFM

OTS	Organized Track System
PACOTS	Pacific Organized Track System
PARS	Preferred Aerodrome/Airspace and Route Specifications
PASL	Preferred ATM Service Levels
PBN	Performance-based Navigation
PIA	Performance Improvement Areas
PKP	Passenger Kilometres Performed
PVT	Passenger Value of Time
RAIM	Receiver Autonomous Integrity Monitoring
RAM	Route Adherence Monitoring
RANP	Regional Air Navigation Plan
RPK	Revenue Passenger Kilometres
RNAV	Area Navigation
RNP	Required Navigation Performance
RVSM	Reduced Vertical Separation Minimum
SAARC	South Asian Association for Regional Cooperation
SATVOICE	Satellite Voice Communications
SAR	Search and Rescue
SBAS	Space Based Augmentation System
SCS	South China Sea
SESAR	Single European Sky ATM Research
SHEL	Software, Hardware, Environment and Liveware
SID	Standard Instrument Departure
SIGMET	Significant Meteorological Information
SPECI	Special Weather Report
STAR	Standard Terminal Arrival Route or Standard Instrument Arrival (Doc 4444)
STCA	Short Term Conflict Alert
STS	Special Handling Status
SUA	Special Use Airspace
SUR	Surveillance
SWIM	System-Wide Information Management
TAF	Terminal Area Forecast
TAWS	Terrain Awareness Warning Systems
TBO	Trajectory Based Operations
TCAC	Tropical Cyclone Advisory Centre
TCAS	Traffic Collision Avoidance System
TOC	Transfer of Control
UAS	Unmanned Aircraft Systems
UAT	Universal Access Transceiver
UPR	User Preferred Routes
VHF	Very High Frequency
VMC	Visual Meteorological Systems
VNAV	Vertical Navigation
VAAC	Volcanic Ash Advisory Centre
VMC	Visual Meteorological Conditions
VOLMET	Volume Meteorological
VOR	Very High Frequency Omni-directional Radio Range
VSAT	Very Small Aperture
WAFC	World Area Forecast Centre

BACKGROUND INFORMATION

ATFM Principles

5.1 The major areas of Collaborative ATFM principles are mainly aligned with those of the Asia/Pacific Seamless ATM Plan; People (human performance), Facilities (physical equipment), and Technology and Information. The 35 principles as agreed by ATFM/SG and endorsed by APANPIRG are included at **Appendix A**.

ATFM-Related Aviation System Block Upgrades (ASBU)

5.2 The ICAO ASBU initiative, detailed in Doc. 9750 – Global Air Navigation Plan (GANP), describes a way to apply the concepts defined in Doc 9854 – Global Air Traffic Management Operational Concept (GATMOC), with the goal of implementing regional and global performance improvements. They are intended to provide a set of aviation system solutions or upgrades that exploit current aircraft equipage and capability, and to establish a transition plan enabling global interoperability. The ASBUs comprise a suite of modules organized into flexible and scalable building blocks where each module represents a specific, well-bounded improvement. The modules may be introduced and implemented in a State or region depending on the need and level of readiness. It is recognized that all the modules are not required in all airspaces.

5.3 The 25th Meeting of the Asia/Pacific Region Air Navigation Planning and Implementation Regional Group endorsed ten regional priorities (and performance indicators), including five ASBU modules directly related to regional collaborative ATFM.

B0-NOPS – Improved Flow Performance through Planning based on a Network-wide View.

APAC ATFM Notes: Inter-linked and networked cross-FIR ATFM capability both within and between ANSPs, and having harmonized interfaces with AMAN/DMAN and A-CDM systems using common reference points and information exchange, should be developed to serve various sub-regions. (Refer Doc 9971 Manual on Collaborative Air Traffic Flow Management)

B0-FICE – Increased Interoperability, Efficiency and Capacity through Ground-Ground Integration.

APAC ATFM Notes: ATS Inter-facility Data Communications (AIDC). AIDC application exchanges information between ATS units in support of critical ATC functions, including notification of flights approaching a Flight Information Region (FIR) boundary, coordination of boundary-crossing conditions, and transfer of control. AIDC application improves the overall safety of the ATM system, as well as increasing airspace capacity, as it permits the controller to simultaneously carry out other tasks. AIDC provides for the necessary improvements in the accuracy and update of aircraft position and estimate information that permit earlier inclusion in sequence planning and application of ATFM measures.

B0-FRTO – Improved Operations through Enhanced En-route Trajectories.

APAC ATFM Notes: Flexible Use Airspace (FUA), User Preferred Routes (UPR), Dynamic Airborne Re-route Planning (DARP) and CDM. These will allow the use of airspace which would otherwise be segregated, along with flexible routing adjusted for specific traffic patterns for greater routing possibilities, reducing flight time and fuel burn.

B0-ASUR – Initial Capability for Ground Surveillance

APAC ATFM Notes: E.g. ADS-B, MLAT. Recognizing the principle that increasing capacity is central to the management of increased demand, this module provides States with the means to improve ATC capacity in en-route airspace sectors through the application of PANS/ATM-defined surveillance-based separation standards. Earlier surveillance of aircraft also provides real-time updates of ATFM system information. ADS-B data may be readily shared between neighbouring ATSU's, enhancing safety, increasing capacity and efficiency and facilitating seamless ATM and collaborative ATFM operations.

B0-TBO – Improved Safety and Efficiency through the Initial Application of data Link En-route.

APAC ATFM Notes: Automatic Dependent Surveillance-Contract (ADS-C), Controller Pilot Data-link Communications (CPDLC). Data-link application for ATC surveillance and communications supports flexible routing, optimized separation (and thus increased capacity) and improved safety in areas where technical constraint or cost-benefit analysis does not support the use of ground-based surveillance (SSR, ADS-B or MLAT). In these cases ADS-C and CPDLC provide for greater accuracy and update in aircraft position and estimate information for aircraft outside the coverage of ground-based surveillance systems than is provided in voice AIREP, and automated update of ATC information, facilitating earlier inclusion in sequence planning and application of ATFM measures and the timely, reliable and accurate transmission of ATFM measure instructions to such aircraft.

Other ATFM-Related ASBU Block-0 Modules

B0-ACDM: (Priority 2) – Improved Airport Operations through Airport CDM

APAC ATFM Notes: Airport CDM improves the outcomes of collaborative ATFM by facilitating the timely positioning of aircraft in order to comply with ATFM measures such as Calculated Take-Off Time (CTOT), where harmonized with ATFM and AMAN/DMAN systems using common reference points and information exchange.

B0-AMET: (Priority 2) Meteorological Information Supporting Enhanced Operational Efficiency and Safety

APAC ATFM Notes: Global, regional and local meteorological information including aerodrome warnings, SIGMETs, and other operational meteorological (OPMET) information, including METAR/SPECI and TAF, supporting flexible airspace management, improved situational awareness, collaborative decision-making and dynamically optimized flight trajectory planning. Meteorological information other than the OPMET information currently defined in Annex 3 provide optimized decision-making information to support ATFM.

B0-CCO: (Priority 2) – Improved Flexibility and Efficiency Departure Profiles – Continuous Climb Operations.

APAC ATFM Notes: Continuous Climb Operations (CCO). These procedures improve ATFM outcomes by segregating departing/climbing traffic from inbound/descending traffic, and facilitating higher runway departure rates by segregating the departure routes of aircraft having different speed and climb performance characteristics.

B0-CDO: (Priority 2) – Improved Flexibility and Efficiency Departure Profiles – Continuous Climb Operations.

APAC ATFM Notes: These arrival procedures allow aircraft to fly their optimum descent profile, taking into account airspace and traffic complexity, and permit the maximum use of aircraft capability to meet Calculated Times-Over (CTO) Arrival Fixes (AFIX) and Calculated Times of Arrival (CTA) during the descent and approach phases of flight.

B0-RSEQ: (Priority 2) Improved Traffic Flow through Sequencing (AMAN/DMAN).

APAC ATFM Notes: Arrival Manager (AMAN) and Departure Manager (DMAN) procedures and tools are designed to provide automation support for synchronisation of arrival sequencing, departure sequencing and surface information, and optimization of runway capacity. Collaborative, harmonized development of AMAN/DMAN, ATFM and Airport CDM systems should be undertaken, using common reference points and information exchange protocols.

B0-SURF: (Priority 3) Safety and Efficiency of Surface Operations (A-SMGCS Level 1-2)

APAC ATFM Notes: Advanced Surface Movements Guidance Control Systems (A-SMGCS), where warranted by weather conditions and capacity. While Implementation of A-SMGCS may not be a high priority in the Asia/Pacific except at high density aerodromes where the cost benefits are positive, it improves ATC capability to ensure the efficient positioning of aircraft to comply with ATFM measures and DMAN-generated departure sequencing, and improves the flow of aircraft to and from aprons and terminal gates under A-CDM.

ATFM-Related Performance Objectives of the Seamless ATM Plan

5.4 The Asia/Pacific Seamless ATM Plan specifies performance objectives under *Preferred Aerodrome/Airspace and Route Specifications (PARS)* and *Preferred ATM Service Levels (PASL)*, to be implemented in two phase:

- PARS/PASL Phase I – expected implementation by 12 November 2015; and
- PARS/PASL Phase II – expected implementation by 08 November 2018.

5.5 ATFM-related performance objectives of the Seamless ATM Plan, summarized as follows, were taken into account in the formulation of Regional ATFM performance objectives specified in this Framework:

- PARS/PASL Phase I

7.1 *All High density international aerodromes (100,000 scheduled movements per annum or more) should*

a) provide apron management service to regulate entry of aircraft into and coordinate exit of aircraft from the apron.

c) Conduct regular airport capacity analysis including a detailed assessment of passenger, airport gate, apron, taxiway and runway capacity.

7.2 *All High Density Aerodromes operate an A-CDM system serving MTF and busiest city pairs, with priority implementation for the busiest Asia/Pacific Aerodromes.*

7.3 *CCO and CDO operations should be considered for implementation at all high density international aerodromes after analysis, based on a performance-based approach.*

7.4 *All international high density aerodromes should have RNAV 1 (ATS surveillance environment) or RNP 1 (ATS surveillance and non-ATS surveillance environments) SID/STAR.*

7.25 *All high density aerodromes should have AMAN/DMAN facilities.*

7.26 *All high density aerodromes should provide meteorological forecasts, aerodrome warnings and alerts that support efficient terminal operations.*

7.27 *High density FIRs supporting the busiest Asia/Pacific traffic flows and high density aerodromes should implement ATFM incorporating CDM to enhance capacity, using bi-lateral and multi-lateral agreements.*

- PARS/PASL Phase II

7.13 All high density aerodromes should have a declared airport terminal and runway capacity based on a capacity and efficiency analysis, to ensure the maximum possible efficiency of aircraft and passenger movement

7.43 ATM system design should be planned and implemented to support optimal aerodrome capacity expectations for the runway(s) concerned.

7.44 All terminal ATC sectors should have a nominal aircraft capacity figure based on a scientific capacity study and safety assessment to ensure safe and efficient aircraft operations.

7.45 All AMAN systems should take into account airport gates for runway selection and other aircraft departures from adjacent gates that may affect arriving aircraft.

7.50 To ensure the safety and efficiency of aircraft operations a nominal aircraft capacity figure based on a scientific capacity study and safety assessment should be available for all en-route ATC sectors.

5.6 The regional ATFM performance objectives specified in Section 7 of this framework – Performance Improvement Plan, complement and where necessary expand upon the performance objectives of the Seamless ATM Plan.

Collaborative Decision Making

5.7 ICAO Doc 9971 defines Collaborative Decision Making:

A process focused on how to decide on a course of action articulated between two or more community members. Through this process, ATM community members share information related to that decision and agree on and apply the decision-making approach and principles. The overall objective of the process is to improve the performance of the ATM system as a whole while balancing the needs of individual ATM community members.

5.8 The planning and implementation of cross-boundary, networked ATFM requires new levels of collaborative decision-making among multi-national stakeholders. While current ATFM CDM processes and ATFM systems are oriented towards local or national demand and capacity balancing, the maturing of ATFM systems and expansion across national boundaries will lead to a CDM environment of multilateral decision-making with complementary individual goals.

5.9 Cross-border ATFM should have the following characteristics:

- an inclusive process – Participation by States and other Stakeholders is the key;
- a transparent process – Simple business rules to ensure compliance and build trust will be necessary;
- allows Sharing of information between all partners through a common network to improved efficiency and operational decision making; and

- achieve common situational awareness for all partners, taking into account the data-sharing capability of stakeholders.

5.10 Cross-border ATFM/CDM should provide opportunities for the efficient exchange of operational and strategic information for all stakeholders, ensuring strategic cooperation towards achieving the objectives of seamless ATM and optimization of traffic flows across the region.

5.11 The challenges in establishing a regional ATFM framework include the establishment of transparent, easily understood and flexible procedures, compliance, participation and demonstration of proven benefits to educate and encourage change among stakeholders

5.12 CDM partners and stakeholders should include:

- States, establishing regulations and overseeing safety and compliance;
- ANSPs, implementing ATFM capability;
- International Organizations such as ACI, CANSO, IATA and IFATCA;
- International ATFM Organizations (to share tactical flight data through ATFMU) – EUROCONTROL, FAA;
- Airport operators; and
- CDM-participating airlines.

5.13 Each State will develop ATFM capability according to its needs and requirements, and the overarching goal of seamless ATM across the Asia/Pacific Region.

5.14 The Regional concept for cross border ATFM is based on a *distributed multi-nodal ATFM network* concept. Under this concept each State/Administration participating collaboratively in cross-border ATFM will form a node of the multi-nodal network, and should be led by an agreed ANSP as the Node Leader.

5.15 Within an ATFM node there may be a number of airport operators and airspace users with access to the node arranged by the Node Leader, facilitating their participation in the cross-border ATFM initiative.

5.16 The Node Leader should be responsible for engagement with the various Node stakeholders and ensuring the Node is ready and able to participate in the Regional Cross Border ATFM process. The processes within a node to enable this readiness may vary from node to node, and be applicable to the particular environment within the State(s). However, the readiness to engage with the regional cross border multi nodal system should be in accordance with the Regional Framework for Collaborative ATFM and its underlying distributed multi-nodal ATFM network concept, and any specific procedures identified and agreed by the multi-nodal participants. The Node Leader is responsible for ensuring compliance and therefore readiness to participate in the APAC cross-border multi-nodal ATFM initiative.

5.17 ANSPs and airspace users may participate in transition or trial participation leading to their full participation in the multi-nodal ATFM network. An example of tiered trial participation levels for ANSPs and airspace users is provided at **Appendix B**.

ATFM Phases

5.18 ICAO Doc 9971 describes three phases of ATFM execution; *strategic*, *pre-tactical* and *tactical*, illustrated in **Figure 1**.

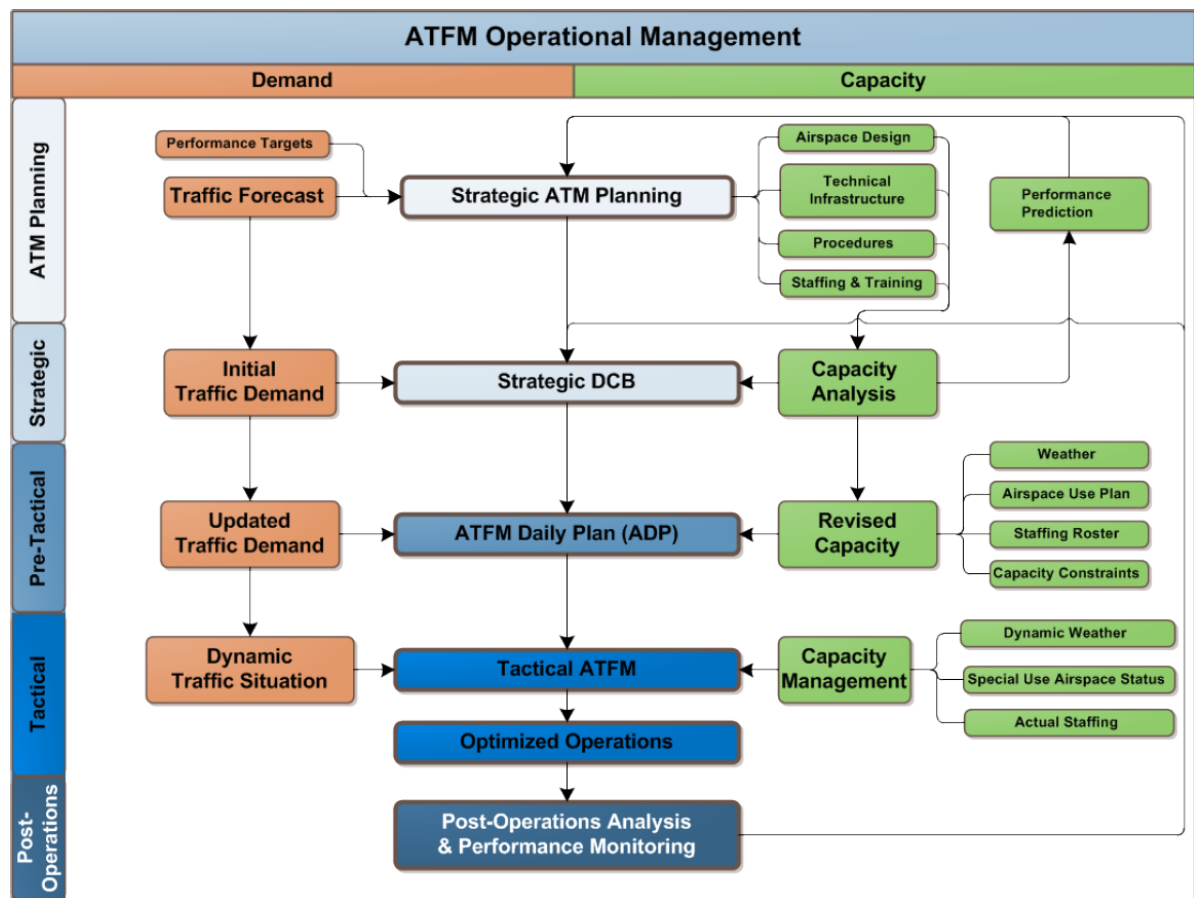


Figure 1: ATFM Operational Management and Phases

5.19 The **Strategic ATFM phase** encompasses measures taken more than one day prior to the day of operation. Much of this work is accomplished two months or more in advance. Strategic ATFM includes the planning and execution of long-term demand and capacity balancing including arrival slot allocation at Coordinated Airports.

5.20 The **Pre-Tactical ATFM phase** encompasses measures taken up to one day prior to operations, with the main objective of optimizing capacity through an effective, dynamic organization of resources. Effective Pre-Tactical ATFM is normally dependent on collaborative decision-making (CDM) processes established between all stakeholders, and in the broader network sense requires significant network communications and information processing capability. The necessary inter-State network capability in the Asia/Pacific Region is under development, and its final form may be determined by the outcomes of sub-regional collaborative trial projects.

5.21 **Tactical ATFM** measures are taken on the day of operation, managing traffic flows and capacities in real time. Tactical ATFM practices, procedures and competencies supported where necessary by Arrival Manager (AMAN) and Departure Manager (DMAN) capability should be the first priority for ATFM implementation. These are critical to the real-time operational response to demand/capacity imbalance, and the improvement and maintenance of safety in the management of operational situations where traffic demand exceeds capacity. Experience has demonstrated that inclusion of at least 70% of flights is necessary for ATFM programs to deliver benefits.

5.22 The timely application of measures in all three ATFM phases requires a fundamental understanding of airport and airspace capacity, and the continuous assessment of capacity and the factors that impact upon it.

Airspace and Airport Capacity Improvement

5.23 Increased capacity is the primary and central method for managing increasing demand. Capacity increases may be achieved by improvements in infrastructure, airspace and ATS route design, procedures and stakeholder behaviours.

5.24 Airspace capacity improvements may be achieved by:

- Improved ATS route design including segregation of inbound, outbound and overflight traffic flows and, where supported by a business case, mandating of RNP specifications for ATS routes;
- Civil-military cooperation, including increased use of FUA to replace SUA;
- Improved ATC sectorization to more evenly apportion workload, including the capability for dynamic sector configuration;
- Segregation of SIDs and STARs in terminal areas to reduce ATC and pilot workload;
- ATM automation system enhancements including automated coordination and hand-off of aircraft between systems (AIDC) and sectors, and transition from paper flight progress-strips to automated, integrated electronic displays and flight plan interfaces;
- Implementation or extension of ATS surveillance services, and surveillance based separations specified in ICAO Doc 4444 (PANS-ATM);
- Implementation of RNP-based separations (RNP 4 or better) in non-surveillance airspace;

5.25 Airport capacity improvements may be achieved by:

- Improved airport design including additional runways, taxiways and appropriately positioned rapid-exit taxiways;
- Harmonized AMAN, DMAN and A-CDM systems;
- Analysis and improvement of runway occupancy times through enhancement of procedures and associated pilot practices;
- Implementation of precision approaches to all runways.

5.26 The Seamless ATM Plan includes performance objectives aimed to improve airspace and airport capacity in the Asia/Pacific Region. The Performance Improvement Plan of this Framework includes capacity improvement objectives that are complementary to or expanding upon those of the Seamless Plan.

Capacity Planning, Assessment and Declaration

5.27 Annex 11 to the Convention on Civil Aviation (Air Traffic Services) defines declared capacity as a measure of the ability of the ATC system or any of its subsystems or operating positions to provide service to aircraft during normal activities. It is expressed as the number of aircraft entering a specified portion of airspace in a given period of time, taking due account of weather, ATC unit configuration, staff and equipment available, and any other factors that may affect the workload of the controller responsible for the airspace.

5.28 The primary areas of capacity assessment and declaration for ATFM are Airport Acceptance Rate (AAR), Airport Departure Rate (ADR), and airspace sector capacity. AAR and ADR are usually expressed in terms of landings or departures per hour. Sector capacity may be expressed in terms of occupancy count and/or entry count.

5.29 ICAO Doc 9971 – Manual on Collaborative ATFM provides the following guidance on capacity planning and assessment:

- Chapter 4 – Capacity, Demand and ATFM Phases;
- Appendix C – Determining Airport Acceptance Rate - A simplified methodology for determining the acceptance rate at an airport, based on scientific processes developed by the USA.
- Appendix D – Determining Sector Capacity – An example of a simplified methodology for determining sector capacity at an ACC, based on the scientific process developed by the USA.
- Appendix E – Capacity Planning and Assessment Process – Information developed by EUROCONTROL related to the ATFM capacity and planning assessment process.

5.30 Detailed, high quality assessments of ATC sector capacity may also be conducted using fast-time simulations to analyse relevant data and the effects on capacity of proposed ATS changes or improvements. Data inputs include static infrastructure data, traffic data, ATC logic, procedures and task definition, and aircraft performance data.

- 5.31 Steps in a sector capacity assessment methodology utilizing fast-time simulations include:
1. Collect the necessary airspace and traffic data;
 2. Verify (with the support of local controllers) the traffic sample routes and the procedures used on a flow-by-flow basis;
 3. Correct, refine and insert the information into the model (done by the simulation experts). This includes the ATC procedures used in the sector, standard controller tasks, simulation parameters and aircraft performance parameters;
 4. Run an initial test-run of the model;
 5. Verify flight profiles. The knowledge of local controllers is used to adapt aircraft performance to local conditions, to define and verify sector specific controller tasks together with simulation parameters including conflict detection and resolution mechanisms;
 6. Consolidate a final model which is used to calculate results for all simulation scenarios, e.g. different sector configurations, different traffic samples, etc.;
 7. Verify the simulation scenarios and the initial results, and if so required, do a fine-tuning of parameters.

5.32 A fast-time simulation capacity assessment methodology should use a simulation engine that reproduces the ATC environment, and should follow a reiterative process of validation involving licensed ATC staff currently active on the sector/s under assessment.

ATFM Daily Plan

5.33 ICAO Doc 9971 – Manual on Collaborative ATFM states that the organization and structure of the CDM process depends on the complexity of the ATFM system in place, and must be structured to ensure that the affected stakeholders, service providers and airspace users can discuss airspace, capacity and demand issues through regular meeting sessions and formulate plans that take all pertinent aspects and points of view into account.

5.34 Frequent tactical briefings and conferences can be used to provide an overview of the current ATM situation, discuss any issues and provide an outlook on operations for the coming period. They should occur at least daily but may also be scheduled more frequently depending on the traffic and capacity situation (e.g. an evolving meteorological event may require that the briefing frequency be increased). Participants should include involved ATFM and ATS units, chief or senior dispatchers, affected military authorities and airport authorities, as applicable.

5.35 The output of these daily conferences should be the publication of an ATFM daily plan (ADP) and should include subsequent updates. The ADP should be a proposed set of tactical ATFM measures (e.g. activation of routing scenarios, miles-in-trail (MIT)) prepared by the ATFM unit and agreed upon by all partners concerned during the planning phase. The ADP should evolve throughout the day and be periodically updated and published.

5.36 Feedback and review of the ADP received from ANSPs, AUs, and from the ATFM unit itself represent very important input for further improvement of the pre-tactical planning. This feedback helps the ATFM unit identify the reason(s) for ATFM measures and determine corrective actions to avoid reoccurrence. Systematic feedback from AUs should be gathered via specifically established links.

5.37 In addition to the daily conferences, the ATFM unit should consider holding periodic and event-specific CDM conferences, with an agenda based on experience. The objective should be to ensure that the chosen ATFM measures are decided through a CDM process and agreed to by all affected stakeholders.

5.38 An ADP should include the following items of information:

- Aerodrome or Airspace Sector identification;
- AAR;
- Description of constraints;
- Time frame
- Proposed ATFM measures; and
- Remarks/other relevant information.

5.39 A template for the ATFM daily plan is provided at **Appendix C**.

5.40 An important component of the CDM process is post-operations analysis, including consideration of feedback from airspace users, airports operators, ATS and other ATFM units. Daily post-operations analysis conferences should be held, supplemented where necessary by conferences called to assess the outcomes of programs of ATFM measures responding to non-normal situations.

ATFM Terminology

5.41 Recognizing the lack of a current, globally standardized ATFM terminology, ATFM/SG considered the terminologies used by States and organizations advanced in ATFM implementation, both within and external to the Asia/Pacific Region.

5.42 The Global development of ATFM has largely been undertaken in isolation by individual ANSPs, EUROCONTROL, ICAO Sub-Regions or other informal groups of States, or by ATFM system vendors. This has resulted in differences in concept development and in the technical terms used for operational and technical coordination of ATFM information.

5.43 ATFM/SG developed a standardized ATFM terminology for the Asia/Pacific Region to promote harmonization and interoperability of CDM/ATFM systems and procedures.

5.44 The terms and definitions were drawn from those used by Australia, Canada, EUROCONTROL, Japan, South Africa and USA, and those in the *Flight Information Exchange Model* (FIXM) data dictionary.

5.45 The Asia/Pacific Region ATFM terminology for use in ATFM communications is provided at **Appendix D**.

ATFM System Communications

5.46 Regional and Global interoperability of communications is critical to the implementation of effective, network-based cross-border ATFM.

5.47 The Flight Information Exchange Model (FIXM) is part of a suite of data exchange formats, including Aeronautical Information Exchange Model (AIXM) and Meteorological Information Exchange Model (WXXM), intended to provide a global standard for information exchange. FIXM is a data interchange format for sharing information about flights throughout their lifecycle.

5.48 **Figure 2** illustrates the data-level interoperability among domains achieved by FIXM.

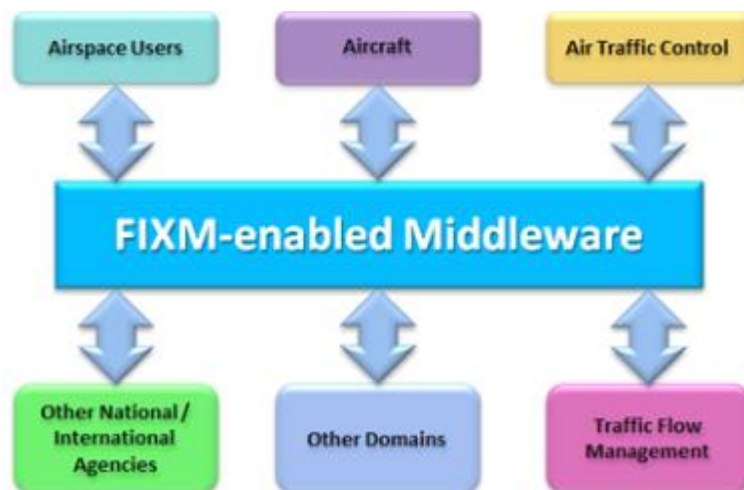


Figure 2: FIXM Interoperability among Domains

5.49 FIXM is referenced in Global Air Navigation Plan ASBU modules and roadmap:

- **ASBU B1-FICE** – Increased Interoperability, Efficiency and Capacity through Flight and Flow Information for a Collaborative Environment Step-1 (FF-ICE/1)⁴ application before Departure;
 - Introduces FF-ICE, Step 1 providing ground-ground exchanges using a common flight information reference model (FIXM) and extensible markup language (XML) standard formats before departure.
- **ASBU B1-DATM** – Service Improvement through Integration of all digital ATM Information Implements the ATM information reference model, integrating all ATM information, using common
 - Implements the ATM information reference model, integrating all ATM information, using common formats (UML/XML and WXXM) for meteorological information, FIXM for flight and flow information and Internet protocols.

⁴ ICAO Doc 9965 – Manual on Flight and Flow – Information for a Collaborative Environment (FF-ICE) describes the FF-ICE concept.

- **Roadmap 2** – in the Blocks 1 and 2 time frame:
 - FIXM will be introduced as the global standard for exchanging flight data.
- **Roadmap 8** – in the Blocks 1 and 2 time frame:
 - FIXM will propose a global standard for exchanging flight information.

5.50 FIXM version 3.0 (or later), extended where necessary to accommodate additional regional requirements, is the agreed ATFM information exchange model for exchanging ATFM data between ATFM systems in the Asia/Pacific Region.

5.51 More information on FIXM is available at www.fixm.aero.

ATFM Information Distribution

5.52 ATFM Daily Plans and ATFM Measures for individual aircraft may be distributed between ATFM units, ATS units and airspace users by the following means:

- Networked, web-based interface at ATFMU, ATSU and airspace user locations, each forming a node of a distributed multi-nodal ATFM platform;
- Web-based interface at ATFMU, ATSU and airspace user locations, providing access directly to ATFM information provided by the ATFMU responsible for the initiation of ATFM measures for the destination airport or constrained airspace; or
- AFTN messages distributed to individual ATSUs (ATFM measures);
- Email distribution (ATFM Daily Plan); or
- Voice Coordination

5.53 Considering the scope and performance objectives of this version of the Framework, and the stage of development of the multi-nodal ATFM network concept, **Table 1** outlines the minimum items of ATFM information that ATFM systems and processes should share.

The multi nodal ATFM network concept is described in paragraphs 5.72 to 5.73.

Estimated	Calculated	Actual	Applicable
EOBT		AOBT	Terminal Gate
	CTOT	ATOT	Departure Runway
ETO	CTO	ATO	RFIX or AFIX
ELDT	CLDT	ALDT	Arrival Runway
Other			
ADP			

Table 1: Minimum ATFM Information for Distribution and Sharing

ATFM Communications by AFS

5.54 Recognizing that States' needs for ATFM may vary, where necessary ATSUs may participate in collaborative ATFM without having the need for dedicated ATFM systems or terminals. The Aeronautical Fixed Service (AFS) may provide a suitable method for distribution of ADP and ATFM measure information to such ATSUs.

5.55 The *EUROCONTROL Specification for ATS Data Exchange Presentation* (ADEXP) provides a format for use in on-line, computer to computer message exchange and for message exchange over switched messaging networks. It is used in current generation ATM automation and supporting systems, and was used in the development of FIXM.

5.56 The ADEXP model provides machine-readable information that is also human-readable, rendering it useable for the distribution of ATFM information on computer-based displays and in text form via AFS.

5.57 ADEXP version 3.1 is the agreed format for ATFM message exchange in the Asia/Pacific Region in cases where an ATFM network interface has not been established, and ATFM information is distributed by AFS. More information is available on the EUROCONTROL website⁵.

ATFM Phrases

5.58 ATFM phrases for use in ATFM coordination, and in air-ground communications, are also included in **Appendix D**.

Note: The ATFM phrases are for use as an interim procedure, pending development of globally standardized ATFM-related phraseology.

Meteorological Information for ATFM

5.59 The accuracy of pre-tactical and tactical demand and capacity assessment is reliant on the predictability of events that will impact capacity. In the case of weather-related constraints, the traditional Annex 3 services in support of aerodrome operations and FIR/Global operations do not fully address the needs of ATFM. While globally, MET authorities are working steadily towards the institutional provision of Meteorological Services to support the Terminal Area (MSTA), there is a greater urgency for ATFM providers to collaborate closely with Met service providers to develop products that bridge the gap between the traditional information.

5.60 When predicting the capacity of an airport with regard to forecast meteorological conditions, it is important to not only consider the runway/s and immediate airport surroundings, which are covered by the Aerodrome Forecast (TAF) to a distance of 8km, but to also take into consideration the ability for air traffic to flow via the terminal area on the normal arrival routes and instrument approach procedures to that airport. In particular, weather affecting the airspace in the vicinity of the primary holding areas and initial approach fixes can have a significant impact on the delivery of flights into the approach airspace and onto the runway.

⁵ <https://www.eurocontrol.int/publications/ats-data-exchange-presentation-adexp-specification>

5.61 The current Annex 3 provisions do not include provisions for meteorological information that specifically support the determination of weather impact on capacity. OPMET information is typically pilot and/or tactical ATC oriented, with limited ATFM orientation. , and are largely produced in coded text format, which makes rapid interpretation difficult for ATM officers.

5.62 ICAO Annex 3 requires that each Contracting State shall determine the meteorological service which it will provide to meet the needs of international air navigation, and that this shall consist of the provision of meteorological information to users that is necessary for the performance of their respective functions. Therefore, to enable rational and quantifiable capacity determination, ANSPs and Meteorological service authorities should collaborate closely to define meteorological services to be provided to support ATM and ATFM decisions, based on specific impact to operations. Such targeted MET information should address key thresholds for various weather criteria which have a quantifiable impact on airport and terminal airspace capacity, such as headwind, crosswind, visibility, ceiling, wind shear, and convective weather at the initial approach fix (IAF) or in the vicinity of critical arrival fixes, holding points and sequencing areas. An example of the simple type of matrix that could be produced, with intuitive colour coding for quick recognition by ATM staff, is shown in **Figure 3**. In terms of the wider Terminal area, similar defined criteria, thresholds and colour coding can enable rapid interpretation of impact on operations.

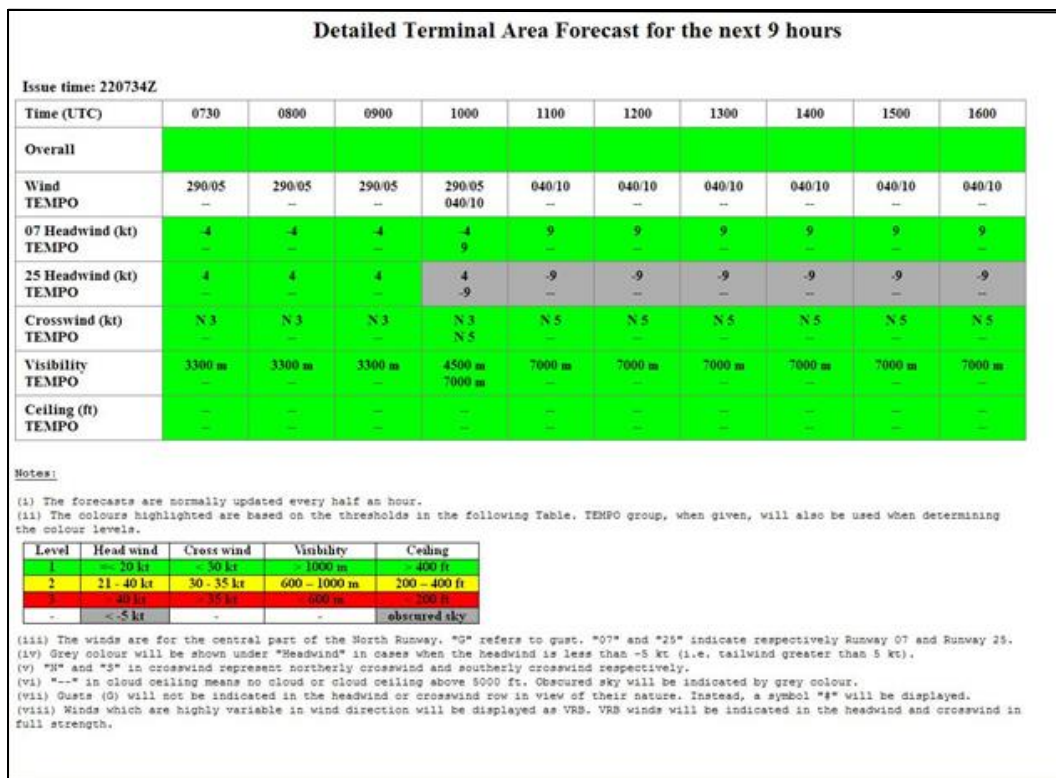


Figure 3: Example Colour-Coded Matrix of Met Information

5.63 An example of IAF and holding stack prediction based on weather intensity and coverage area is shown in **Figure 4**, using similarly defined criteria and thresholds to facilitate rapid interpretation of the impact on operations.

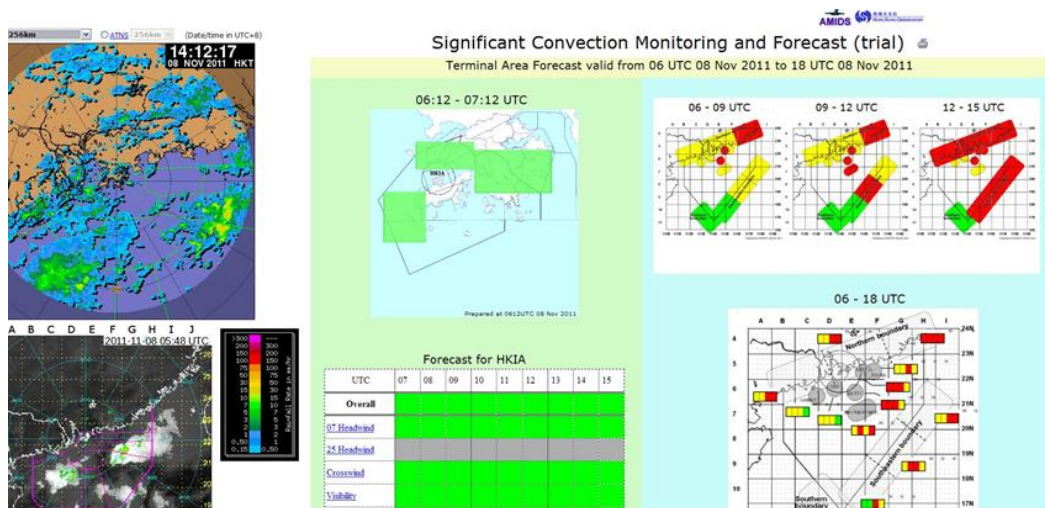


Figure 4: IAF and Holding Stack Weather Prediction.

5.64 When identifying criteria to be used in determining MET services, consideration should be given to thresholds for meteorological elements that result in a change of runway operating mode, such as:

- a change of runway dependency;
- a change of spacing between arriving aircraft;
- a change in nominal aircraft approach speeds;
- an exceedance of aircraft operating limitations for significant numbers of aircraft (eg maximum crosswind component);
- an inability to commence an approach via the IAF; or
- an inability to hold in the primary published holding areas, etc.

5.65 When considering the lead time requirements for such forecast products, it is necessary to strike a balance between the desired probability and accuracy and the target ATFM aircraft population.

5.66 Given the direction towards Regional ATFM through ground delay programs, it is therefore desirable that the forecast period cover at least 6-8 hours ahead to encompass the majority of regional length flights with notification of ATFM measures an acceptable time before estimated off blocks time (EOBT).

5.67 In accordance with Annex 3 requirements, including the requirement that close liaison shall be maintained between those concerned with the supply and those concerned with the use of meteorological information on matters which affect the provision of meteorological services for international air navigation, States should ensure that the MET service provides sufficient detail and accuracy.

Asia/Pacific Region ATFM Implementation Study

5.68 At the first meeting after its reconvention, ATFM/SG/2 supported a project funded by IATA that studied current and planned ATFM initiatives to establish a regional baseline view of ATFM capability and interoperability, and to develop recommended implementation strategies for collaborative Regional and sub-Regional ATFM.

5.69 Key outcomes of the study were:

- Most States had plans to implement or had implemented domestic ATFM;
- Very few States were planning cross-border ATFM;
- Significant effort would be required to establish a seamless, network based approach to regional ATFM.
- Budgetary and planning commitments must be made in 2015 to meet the 2018 timelines for ASBU and the Asia/Pacific Seamless ATM Plan.
- The ATFM Steering Group and ICAO have a critical leadership role to ensure coordination and development of the key initiatives that will lead to regional ATFM implementation.

5.70 Recommendations arising from the study were:

1. Adoption of the *Regional ATFM Concept of Operations* as the APAC concept of operations/implementation strategy for cross border ATFM;
2. Support for the multi-nodal operational trial program commencing June 2015;
3. Formal State commitment to regional cross border ATFM including budgetary and planning commitment for regional implementation;
4. Regional commitment to 2018 timeline for implementation;
5. State planning, procurement and resource commitment for expanded participation during Phase Two of the multi-nodal operational trial program.

5.71 ATFM/SG subsequently agreed to support Phase 2 of the IATA Regional ATFM Project, to develop a proposal for a regional cross-border ATFM implementation plan.

Asia/Pacific Region ATFM Operational Concept

5.72 The concept of the distributed multi-nodal ATFM network, conceived through the collaborative development of the *Regional ATFM Concept of Operations* (a research project by Singapore, together with industry partners and operational inputs from Malaysia, Hong Kong China, Thailand and other stakeholders), was adopted by ATFM/SG as the foundation for a Regional ATFM concept and implementation strategy, with an implementation target date of 8 November 2018 in alignment with the Seamless ATM Plan.

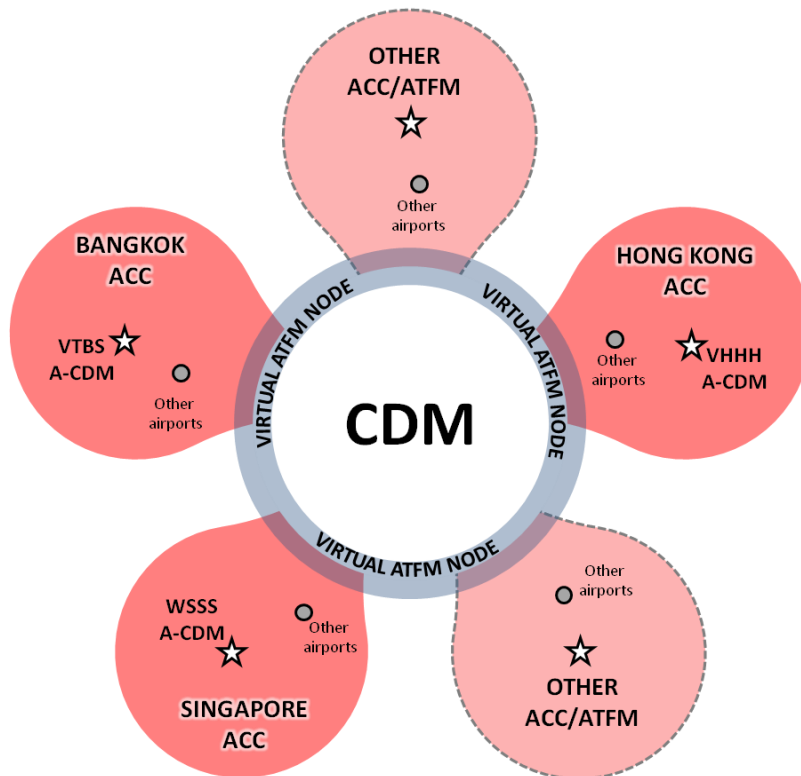


Figure 5: A Distributed Multi-Nodal ATFM Network

5.73 The concept recognizes that a centralized ATFM Unit (ATFMU) approach is not yet practicable for the Asia/Pacific region. At the centre of the concept is the distributed multi-nodal ATFM network, illustrated in **Figure 5**:

5.74 The *Regional ATFM Concept of Operations* document is available at [TBA].

Training and Competencies for ATFM Personnel

5.75 An ATFM service must be staffed by personnel with sufficient knowledge and understanding of the ATM system they are supporting and the potential effects of their work on the safety and efficiency of air navigation. To ensure this and within the framework of their training policy, States and ANSPs should establish training plans to ensure that ATFM service staff are properly trained.

5.76 ICAO Doc 9971, Manual on Air Traffic Flow Management, recognizes the requirement for training all stakeholders in an ATFM service, i.e. those directly operation and ATFM function and all other ATFM stakeholders including airspace users and ATS personnel.

5.77 **Appendix E** provides generic guidance on ATFM training requirements, which States may consider for inclusion in any existing or planned ATFM training programs.

Regional ATFM Implementation Guidance

5.78 Under Phase II of the IATA Regional Air Traffic Flow Management Project, as agreed by ATFM/SG/4, IATA delivered the Regional ATFM Implementation Guidance document for consideration by ATFM/SG/6 (Bangkok, Thailand, June 2016).

5.79 ATFM/SG/6 noted the importance of harmonized implementation guidance to assist States in the planning and execution of ATFM implementation projects, and to the future interoperability of State and Regional ATFM programs.

5.80 The Regional ATFM Implementation Guidance, provided at **Appendix F**, includes information and guidance on:

- The background of ATFM/CDM in the Asia/Pacific Region;
- Setting up an ATFM/CDM project;
- Implementation;
- Implementation Risks and Mitigation;
- Post-implementation activities;
- Timelines; and
- Assessment of benefits.

5.81 The Guidance document should, in conjunction with this document and the Asia/Pacific Regional ATFM Concept of Operations, be examined by all APAC Region States planning ATFM implementation.

Regional ATFM Implementation Monitoring

5.82 The Regional Framework for Collaborative Air Traffic Flow Management is one of several important plans that are subsidiary to the Seamless Air Traffic Management (ATM) Plan, namely:

- Asia/Pacific Search and Rescue (SAR) Plan;
- Asia/Pacific Region ATM Contingency Plan; and
- Asia/Pacific Regional Framework for Collaborative ATFM; and
- Asia/Pacific Collaborative Aeronautical Information Management (AIM) Plan (under development for 2018 delivery).

5.83 States report implementation of the performance expectations of the Seamless ATM Plan using an online reporting form. Monitoring and reporting schemes for subsidiary plans enhance the current Seamless ATM monitoring and reporting scheme.

5.84 The monitoring and reporting scheme for Regional collaborative ATFM implementation measures State implementation of the performance expectations specified in Section 7 of this document.

5.85 Asia/Pacific Administrations should report their implementation status to the ICAO Asia/Pacific Regional Office at least once annually, by no later than 30 April each year. Reported implementation status will be examined each year by the ATFM/SG, or other appropriate Regional body designated by APANPIRG, to measure, report and advance Regional implementation progress, and to recommend priority ATFM elements to be added to the Seamless ATM monitoring and reporting scheme.

5.86 It is expected that the relevant ATFM expert/s in each Administration will be responsible for the detailed reporting in the Regional ATFM Monitoring and Reporting form, and that these experts will then liaise closely with their Administration's Seamless ATM reporting point of contact to ensure the accuracy of the higher level reporting and consistency between the separate reporting levels.

5.87 The Regional ATFM Monitoring and Reporting Form is provided at **Appendix G**, and is available on the ICAO Asia/Pacific Regional Office eDocuments web-page at <http://www.icao.int/APAC/Pages/edocs.aspx>.

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CURRENT SITUATION

The IATA ATFM Study

6.1 This analysis of the current state of ATFM implementation and capability in the Asia/Pacific Region is extracted from the IATA *Asia-Pacific (APAC) Regional Air Traffic Flow Management – Phase 1 Final Report* (21 November 2014). The study was commissioned to establish a baseline view of ATFM capability and interoperability, and to develop recommendations for a cohesive and flexible approach for achieving integrated and coordinated ATFM capabilities within the Asia/Pacific Region.

The Benefits of Networked, Cross-Border ATFM

6.2 An interoperable network approach for the region will result in system-wide Demand Capacity Balancing. This approach enhances the safety and optimizes the efficiency of airports and available airspace.

6.3 As the Asia-Pacific region, the world's largest market for air transport, continues to grow, it becomes essential to optimize the use of available capacity through ATFM. In 2013, the Asia/Southwest Pacific Region was the fastest growing region by passengers in the world (**Table 2**). The region's passenger growth was 8.5%. Individual countries with notable passenger growth include: China (11.8%), Indonesia (20.4%), and Thailand (16.4%).

6.4	Passenger Volume	Annual %
Indonesia	92,534,902	20.4
Thailand	62,831,288	16.4
China	404,174,939	11.8
Singapore	42,438,276	7.6
Malaysia	51,821,210	7.5
Japan	148,450,196	4.9
India	97,677,318	4.4
Hong Kong	44,399,060	3.9
Korea, Republic of	62,166,163	1.2
Australia	81,983,309	0.6
Asia/Southwest Pacific	1,075,572,893	8.5

Table 2: Top Asia/Pacific Passenger Countries 2013

6.5 Throughout the Asia Pacific region, individual States' ATM and ATFM equipment, services, procedures, airspace design, communications, and resources have a wide disparity in capabilities. These limitations often result in a less efficient operational environment. Prevalent throughout the study region are excessive miles-in-trail restrictions (MITs), fuel burn, carbon dioxide (CO₂) emissions, aircraft departure holding on the ground, airborne holding, and delays.

6.6 Weather and other system constraints increase schedule buffer, delayed flights, cancellations, and missed connections. Flight delays add costs to airlines, passengers, airport operators, and States. Aviation inefficiencies have trickle-down impacts on other sectors due to lost time and productivity. As traffic demand increases, delays will also increase if resource capacity is not increased.

6.7 An interoperable ATFM network of States will have potential benefits to airlines, passengers, airport operators, and States.

6.8 The IATA ATFM Study listed the substantial benefits of implementation of an interoperable cross-border ATFM network. Key benefits were in the domains of safety, and operating efficiency.

Safety Benefits

6.9 Standard ATM practices of separating and sequencing traffic by vectors, speed control, and airborne holding are carried out during un-metered peaks of traffic. These practices are proven safe and effective. However, during these peak periods, the workload on ATC and pilots can increase significantly, thereby reducing the margin for error. Through ATFM, a constant manageable flow of traffic is achieved, resulting in a more manageable workload and hence, a safer operation. A network approach to ATFM reduces sector/system saturation, increases efficiency and enhances safety.

6.10 Often with implementation of ATFM, States enhance their ability for severe weather detection. This earlier detection of weather is shared with airline operators and ANSPs, increasing situational awareness. In addition this is taken into account when determining capacity of resources, resulting in the correct ATFM measure being implemented, which can have a direct impact on safety.

6.11 Communication networks will improve between States with ATFM implementation so as to accommodate CDM. A resultant benefit will be reduced coordination errors, leading to enhanced safety.

Economic Benefits

6.12 Air traffic demand in Asia Pacific is expected to grow significantly in the next five to ten years. While the growth is predicted to increase by approximately 5.5% - 6% annually, such an increase in demand will eventually lead to unsustainable levels of congestion and delay within the region's airport and airspace operating environments, until capacity enhancements are operationally available. **Table 3** shows the expected fuel savings benefit expected from ATFM in 2014 and 2019, based on this projected traffic growth.

	2014	2019
Regional ATFM	US\$250 – \$300M	US\$600M – \$800M
Domestic & Regional ATFM	US\$660 – 810M	US\$1.1B - \$1.4B

Table 3: Asia Pacific Annual Fuel Savings Benefit Projection

6.13 The benefit opportunity of a network-based Asia Pacific Regional ATFM implementation strategy is particularly significant in the following airport operating environments, where international arrival traffic accounts for 35-100% of the total demand, indicating that domestic ATFM deployments are not practical for demand/capacity balancing at these airports:

- China - Shanghai Pudong International
- Indonesia - Ngurah Rai International
- Hong Kong - Hong Kong International
- Japan - Narita International
- South Korea - Incheon International
- Malaysia - Kuala Lumpur International
- Philippines - Ninoy Aquino International
- Singapore - Changi International
- Taiwan - Taiwan Taoyuan International
- Thailand - Suvarnabhumi Bangkok International
- Vietnam - Tan Son Nhat International and Nội Bài International

6.14 Within the remainder of the major Asia Pacific airport operating environments, international arrival traffic currently accounts for 20-30% of the total demand. Achieving the benefit of fuel savings in these environments would be supported by domestic ATFM deployments and enhanced through the Regional ATFM implementation strategy.

Summary of Asia/Pacific Region Collaborative ATFM Capability

6.15 A comprehensive survey was conducted in mid-2014 of current ATFM initiatives within the Region. **Figure 6** summarizes the results:

		ATFM Structure			ATFM Demand and Capacity Balancing							Interoperability						
		Regulatory Requirements	Organizational Structure	Infrastructure	Airport Capacity Declaration	Airspace Capacity Declaration	CDM Processes Situational Awareness	CDM Processes Procedures and Tool	Demand and Capacity Balancing Strategic	Demand and Capacity Balancing Pre-Tactical	Demand and Capacity Balancing Tactical	ATFM as with Adjoining NSP	Message Exchange with Adjoining FIR	Exchange AR/ADR with Adjoining FIR	TMI Documented in External OA	External TMI Communication	ATFM Initiatives Planned Internally	ATFM Initiatives Planned with Adjoining FIR
States	Australia	1	1	1	1	1	1	1	1	1	1	1	4	1	1	1	4	
	Bangladesh	1	4	4	4	4	4	4	4	4	1	4	1	4	4	4	4	4
	China	1	2	2	1	4	1	1	1	1	1	4	4	4	4	1	1	4
	Hong Kong	1	2	2	1	4	2	2	1	1	1	1	1	1	1	1	1	1
	India	1	3	3	1	1	4	4	1	4	1	4	1	4	4	4	1	4
	Indonesia	4	3	3	1	4	4	4	1	4	1	4	4	4	4	4	1	4
	Japan	1	1	1	1	4	1	1	1	1	1	1	1	1	1	1	1	4
	Malaysia	1	3	3	1	4	3	4	1	4	1	1	1	4	4	1	4	4
	Maldives	4	4	4	1	4	4	4	4	4	1	4	1	4	4	4	1	4
	New Zealand	1	2	2	1	4	1	1	1	4	1	4	1	4	4	4	1	4
	Pakistan	1	3	3	1	1	4	4	1	4	1	4	1	4	1	4	1	4
	Philippines	1	2	2	1	4	2	2	1	1	1	4	4	4	4	1	1	4
	Singapore	1	3	3	1	4	3	4	1	4	1	1	1	1	4	1	1	1
	South Korea	1	3	3	1	1	4	4	1	4	1	1	1	1	4	4	1	4
	Taiwan	1	3	2	1	4	4	4	1	1	1	4	1	4	1	4	4	4
	Thailand	1	2	2	1	1	3	3	1	1	1	4	1	1	4	1	1	1
Vietnam	4	4	3	1	4	3	4	4	4	1	4	4	4	4	4	1	1	
More Advanced		1														Yes		
		2																
		3																
Less Advanced		4														No		

Figure 6: 2014 Asia/Pacific ATFM Survey – Summary of Results

6.16 It was observed that:

1. All respondent States recognized the requirement for ATFM;
2. Few States had well-established ATFM organizational structures;
3. There was a diverse range of ATFM capability infrastructure; only three States had mature ATFM systems, while others had little or no infrastructure;
4. CDM between States was minimal. While there was a common desire for better CDM, there was no standard for the region;
5. Airport capacities were declared for most major airports in the region, but only five States are declaring capacities for airspace.
6. Very few States were performing Demand Capacity Balancing (DCB) in the strategic phase of ATFM beyond allocating Airport Slots via the IATA World Scheduling Guidelines (WSG).
7. Only a limited number of States with mature ATFM systems were able to carry out DCB in the pre-tactical phase.
8. States without mature ATFM systems that were encountering DCB issues did not have any facility to monitor demand against capacity.
9. All of the States were performing DCB in the tactical phase, but only five States had the ability to issue ATFM Measures using allocated slot times to smooth traffic into airports.
10. There was no substantive interoperability between the States. There was very little formal ATFM procedure agreement between States.
11. The most prominent Regional development for cross-border ATFM implementation was the Singapore-initiated Regional ATFM Concept of Operations. Four States participated in the development of the concept with relevant stakeholder participation. The resultant operational trial of the distributed multi-nodal regional ATFM concept was being planned, with Australia, China, Hong Kong China, Indonesia, Malaysia, Thailand and Viet Nam participating.

Survey Scope

6.17 The survey was distributed to 22 States, of which 17 responded (**Table 4**).

6.18 Most of the responses were comprehensively completed. The States that have more mature ATFM capabilities were able to respond in a higher level of detail. Generally, the responses directly answered the survey with the possibility of limited misunderstanding. Any misunderstanding does not appear to have impacted the results of the study.

	State	Survey Sent	Response Received
1	Australia	Yes	Yes
2	Bangladesh	Yes	Yes
3	China	Yes	Yes
4	Hong Kong, China	Yes	Yes
5	India	Yes	Yes
6	Indonesia	Yes	Yes
7	Japan	Yes	Yes
8	Republic of Korea	Yes	Yes
9	Malaysia	Yes	Yes
10	Maldives	Yes	Yes
11	New Zealand	Yes	Yes
12	Philippines	Yes	Yes
13	Singapore	Yes	Yes
14	Taiwan	Yes	Yes
15	Thailand	Yes	Yes
16	Vietnam	Yes	Yes
17	Pakistan	Yes	Yes
18	Lao PDR	Yes	No
19	Nepal	Yes	No
20	Cambodia	Yes	No
21	Sri Lanka	Yes	No
22	Unites States Of America	Yes	No(Not relevant)
23	Papua New Guinea	No	No
24	Myanmar	No	No
25	Fiji FIR	No	No
	Organizations		
1	IATA	Yes	Yes
2	EU (AATIP)	Yes	Yes
3	ICAO	Yes	Yes
5	CANSO	Yes	Yes

Table 4: State Responses to Survey

6.19 All States were requested to supply supporting documentation; Australia, Singapore, Philippines, and India did so.

Regulatory Requirements

6.20 Thirteen States had regulatory requirements for ATFM in their FIR. Vietnam, Indonesia, and Malaysia, while having no regulatory requirement, had plans to implement ATFM.

Annex 11 to the Convention on Civil Aviation States: Air traffic flow management (ATFM) shall be implemented for airspace where air traffic demand at times exceeds, or is expected to exceed, the declared capacity of the air traffic control services concerned.

ATFM Infrastructure

6.21 ATFM infrastructure was assessed against each ANSP’s human resources commitment and personnel, dedicated positions and equipment available to perform ATFM, and the existence of internal and external stakeholder ATFM Letters of Agreement (LOAs). **Figure 7** illustrates the assessed ATFM infrastructure of the 17 respondents. Two States had mature ATFM structures and six States had developing ATFM structures. Six States had an Air Traffic Flow Management Unit (ATFMU). Seven States had some ATFM functionality, which was carried out from existing supervisory and/or Air Traffic Control (ATC) positions. Two States had no infrastructure. All respondents had plans to implement ATFM.

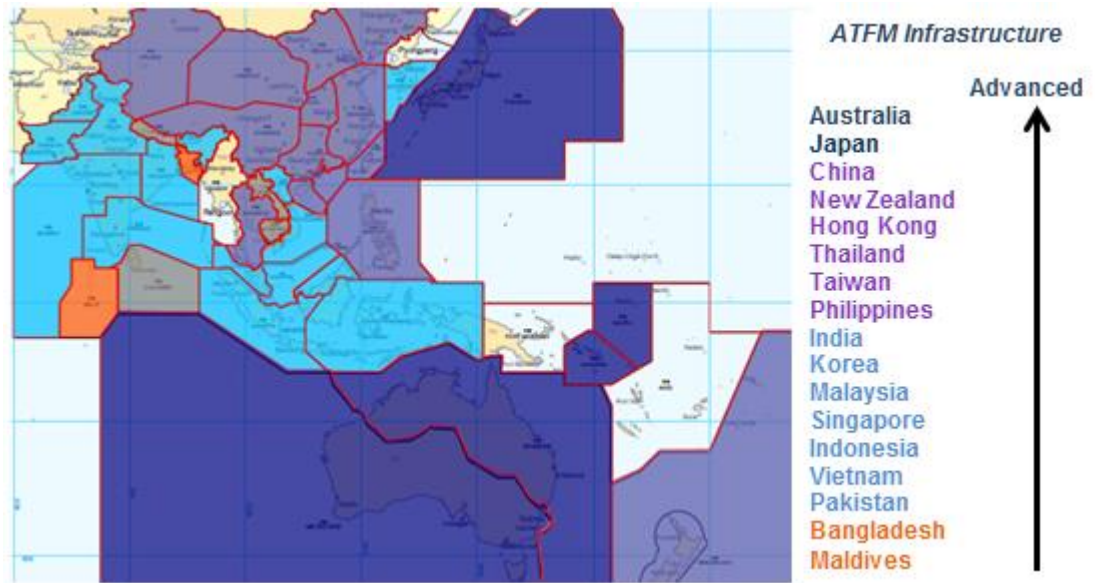


Figure 7: ATFM Infrastructure

CDM Infrastructure and Processes

6.22 Several States with mature ATFM infrastructure had implemented domestic CDM, but CDM between States was minimal. Some ad-hoc CDM was taking place across FIR boundaries when resources were constrained. Cross FIR CDM between Hong Kong, Thailand, Malaysia, and Singapore was under development on a trial basis, establishing initial cross-border procedures and communication. **Figure 8** illustrates CDM capability.

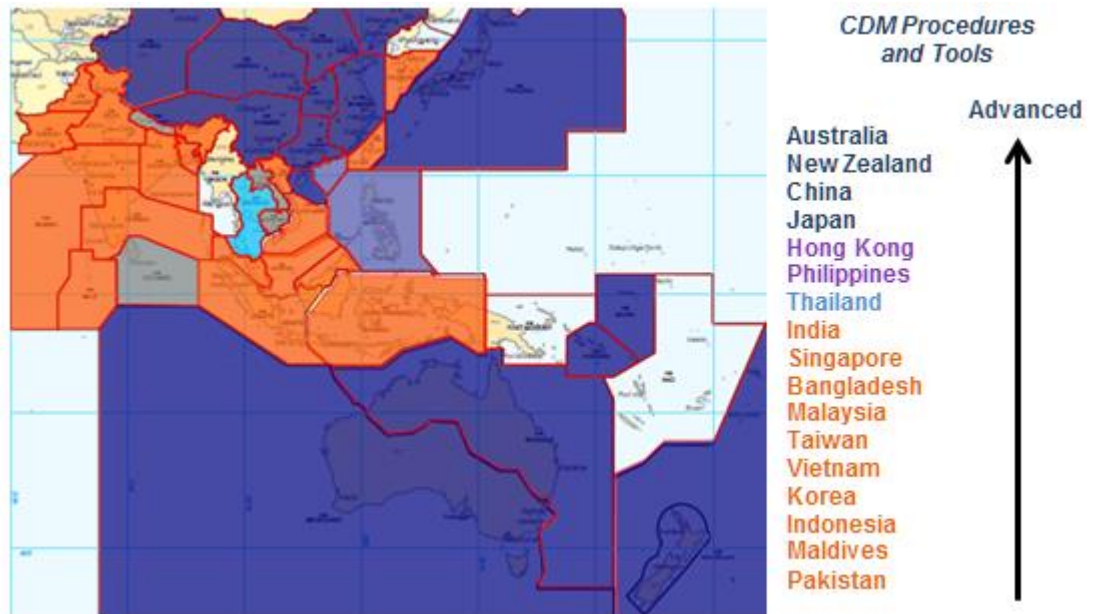


Figure 8: CDM Processes – CDM Procedures and Tools

ATFM Training

6.23 Some training was taking place in States; mostly in-house, but with some States having sent staff to EUROCONTROL and the USA for training. There was an initiative between the EU AATIP and Thailand to develop criteria for ATFM personnel and an ATFM training syllabus.

6.24 The experience of the survey consultant was that many States in the region needed assistance in general ATFM education and training in all levels of their organizations, and that airline operators in the region had limited knowledge and training in ATFM and CDM.

Airspace and Airport Capacity Declaration

6.25 Defining airport and airspace capacity is fundamental to a domestic ATFM system, and to an interoperable cross-border network. Accurate airport and airspace capacity declarations provide targets for the development of collaborative planning.

6.26 Capacity had been declared for most of the large airports in the region, as they were *slot controlled* airports. Five States had declared capacities for airspace. Airspace capacity (terminal and en-route airspace) declaration needed to be promoted. Many States did not have the ability or knowledge of how to determine airspace capacities.

Strategic Demand and Capacity Balancing (DCB)

6.27 Thirteen States were allocating airport slots to balance demand against capacity in the strategic time frame. Three States included military operations in strategic planning. Apart from these, little strategic ATFM was being undertaken domestically and no formal cross-border strategic ATFM was in place.

Pre-tactical DCB

6.28 Seven States are performing some pre-tactical ATFM. Lack of decision support tools was hampering States from carrying out pre-tactical ATFM. States needed to understand the importance of Pre-tactical ATFM and establish procedures and decision support capabilities to enable it to take place. Very little cross-FIR pre-tactical ATFM was taking place.

6.29 **Figure 9** shows the respondent States performing pre-tactical ATFM.

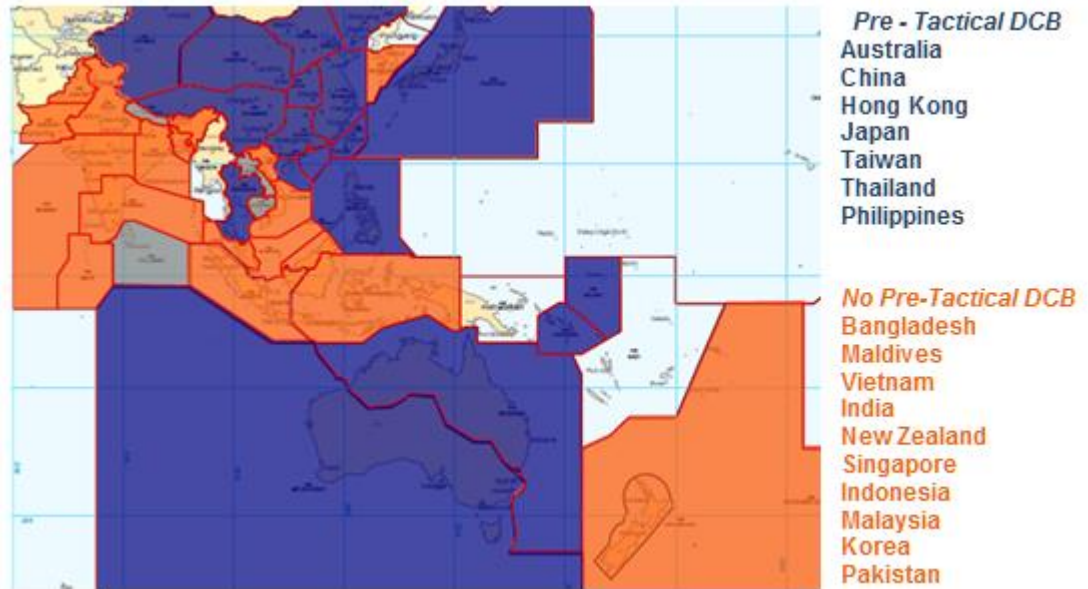


Figure 9: Pre-Tactical Demand and Capacity Balancing

Tactical DCB

6.30 All respondents were performing ATFM in the tactical phase in at least a rudimentary form. However, five States were using ATC slot allocation to balance demand capacity at airports. No ANSP was using ATC slot allocation to perform DCB in terminal or en-route airspace, even though sectors of airspace were capacity constrained.

6.31 Five States had dedicated resources implementing ATFM Measures, and nine States had plans to dedicate resources to implement ATFM Measures in the future.

Interoperability

6.32 A major focus of the study was to establish the interoperability between States with regard to ATFM. The analysis revealed that, while there were initiatives in the early stages of development, there was no substantial interoperability currently taking place. However, interoperability was a key consideration of the multi-nodal ATFM concept trial.

Air Traffic Service (ATS) Message Exchange with Adjoining FIR

6.33 Detailed databases of fundamental ATS routes, route systems, navigation aids (NavAids), airports, airspace status, sectors, and arrival and departure procedures were necessary to support ATFM interoperability.

6.34 The majority of States had automated ATS message exchange capability. The survey consultant’s experience suggested that those States that responded in the negative may have misunderstood the question. Current Regional ATFM initiatives required a minimum ATS message exchange capability.

Sharing Airport Acceptance Rate (AAR)/Airport Departure Rate (ADR) and Airspace Capacity

6.35 The stakeholder decision making process associated with DCB for an airport is dependent upon accurate AAR/ADRs. Advanced coordination with stakeholders and implementation of appropriate ATFM Measures based upon AAR/ADR as demand exceeds capacity results in efficient ATFM processes.

6.36 Only three Administrations (Thailand, Singapore, and Hong Kong, China) were AAR/ADR. While the majority of States did not share the AAR/ADR, there are times when an ANSP would ask an adjoining ANSP to reduce the flow of traffic as a result of the AAR being exceeded. No State was sharing airspace capacities with adjoining FIRs, and few States are declaring airspace capacity.

6.37 Operational information exchange of ATFM Measures is fundamental to ATFM. LOAs provide the ability to improve preplanning, reduce tactical coordination, and standardize actions and initiatives.

6.38 A low count of States having ATFM in LOAs with adjoining States was expected as a result of the lack of existing operational initiatives between States (**Figure 10**). The States where LOAs existed had advanced ATFM systems or had a requirement to meter traffic crossing FIRs as a result of demand exceeding capacity at resources. As more cross-FIR ATFM initiatives are implemented, LOAs will need to be developed or further developed.

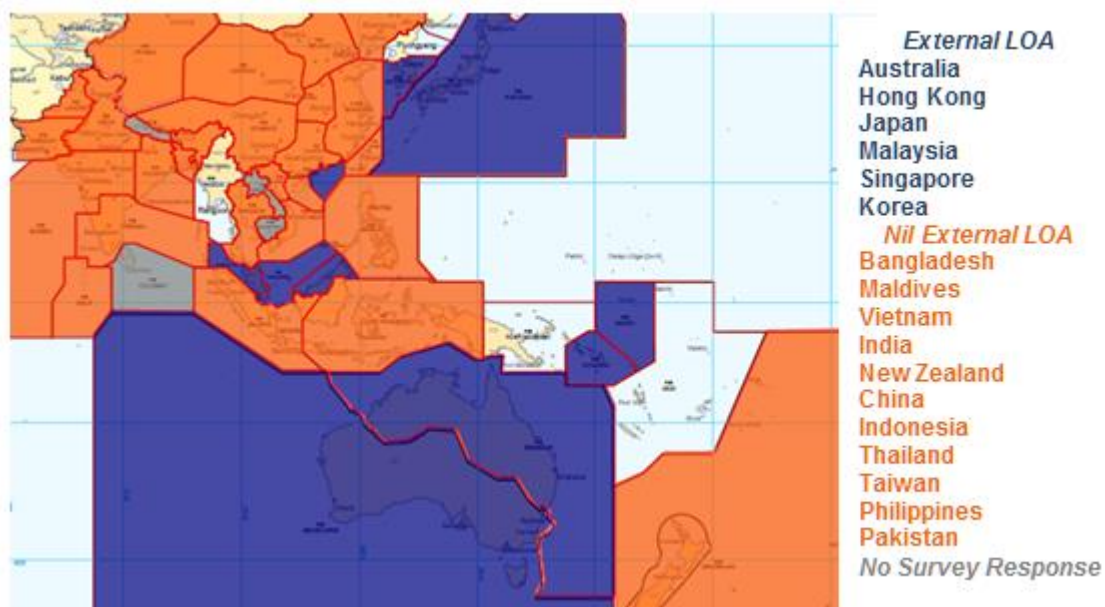


Figure 10: ATFM Measures Communicated in External LOA

External ATFM Measure Communication

6.39 An interoperable network approach necessitates external ATFM Measure communication. While there were only three States with LOAs in place, there was ATFM Measure communication taking place between nine States, including two that had automated communications (China and Republic of Korea). This communication was predominantly in the tactical time frame of ATFM on an as-needed basis, and was expected to increase as initiatives were implemented. Since these communications were not supported by formalized agreements (LOAs), there was little standardization of procedures.

ATFM Initiatives Planned with Adjoining FIRs

6.40 An interoperable network will be driven by stakeholder engagement and operational needs between States. Constraint management can be best achieved through the CDM process. Formal ATFM initiatives between States are often needed because of the widespread effects on the flow of air traffic.

6.41 While States were currently implementing ATFM Measures, which occasionally required adjoining FIR participation, there was only one initiative planned to include multiple FIRs in ATFM Measures, with seven States and four international organizations participating. **Figure 11** illustrates the States with external ATFM initiatives planned.

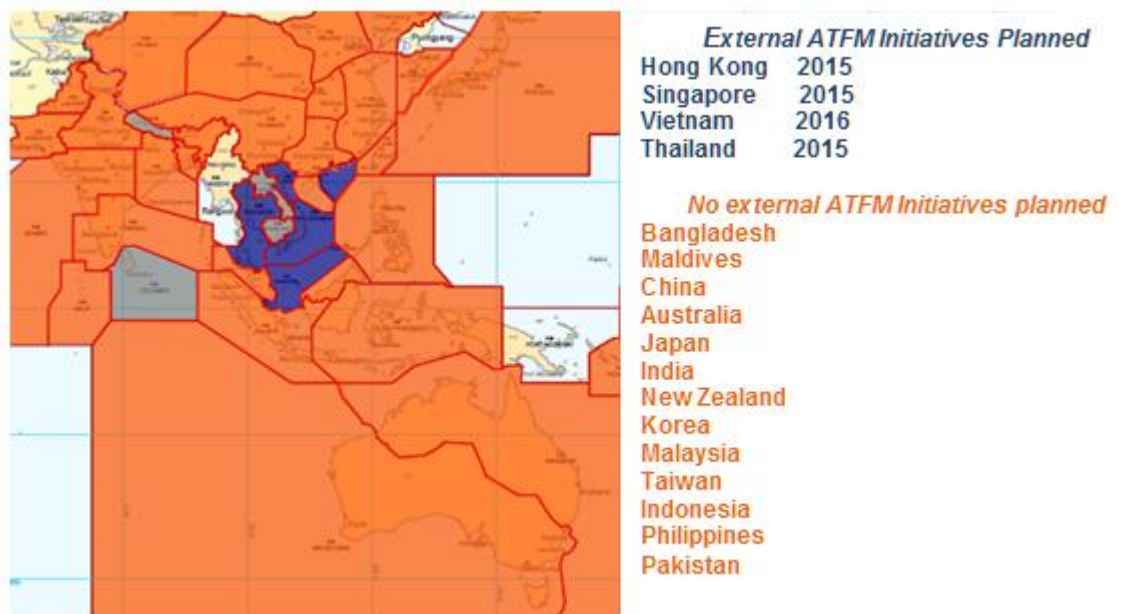


Figure 11: External ATFM Initiatives Planned

ATFM Systems

6.42 All of the advanced ATFM systems implemented in the APAC region were commissioned prior to the publication of ICAO Doc 9971. The systems installed in Japan and Philippines were developed by Japan. New Zealand and China had also developed their own systems. The Australian system was similar to systems in the USA, Canada, and South Africa.

6.43 Many of the States had direct involvement in the compilation of Doc 9971 and all States are now familiar with Doc 9971. It was therefore assumed that future implementations would be in line with recommendations from that document. The *Regional ATFM Concept of Operations* includes participation from individuals with experience in the FAA, EUROCONTROL, South African and Australian ATFM systems.

ANSP Initiatives

6.44 Most of the States, as a result of operational, ASBU and Seamless ATM Plan requirements, had initiatives to implement ATFM in the future. All the States were at various stages of planning, procurement, or implementation. **Figure 12** provides a timeline indicating current and planned ATFM initiatives.

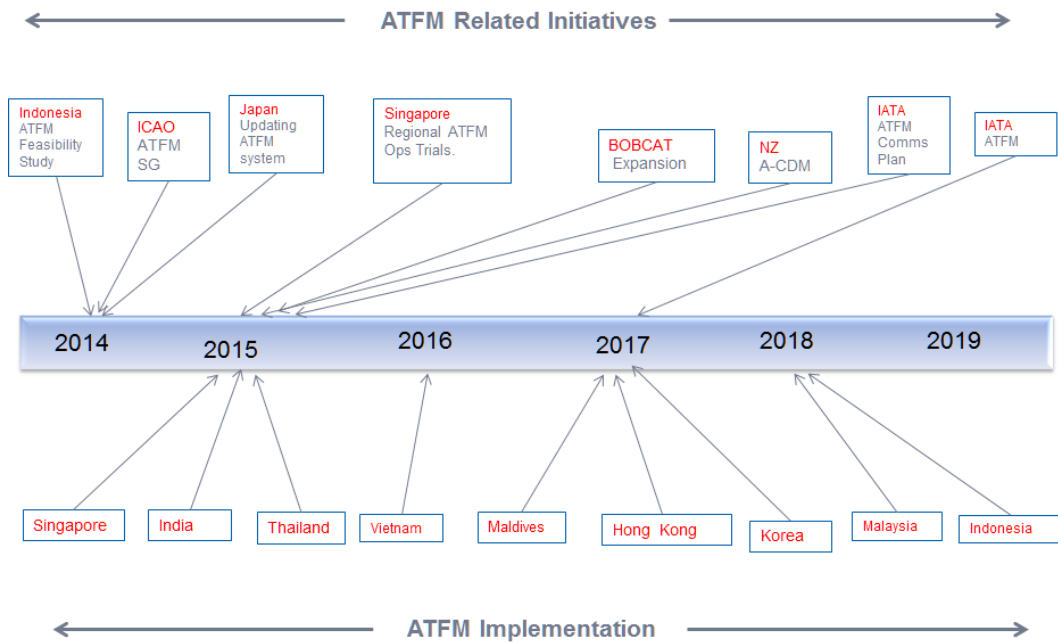


Figure 12: ATFM Implementation Timeline

Opportunities for Integration

6.45 The distributed multi-nodal ATFM concept has been widely accepted as a potential solution for the region, and eight States had joined the plan for an operational trial of the concept starting in June 2015. The trial may be expanded to additional States as feedback is received on the viability of the concept.

6.46 Australia and New Zealand, both having mature ATFM systems, were a possibility for integration. It was understood that discussions had taken place to incorporate traffic from New Zealand into ATFM Measures in Australia. The ATFM system in Australia had the ability to include international traffic into ATFM Measures.

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PERFORMANCE IMPROVEMENT PLAN

Note: prior to implementation, ATFM systems and procedures should be verified by safety assessment under State Safety Management Systems.

Structure of the Performance Improvement Plan

7.1 Regional collaborative ATFM performance objectives are arranged in *Regional ATFM Capability* phases aligned, where practicable, with Phases I and II of the Seamless ATM Plan's Preferred Aerodrome/Airspace and Route Specifications (PARS) and Preferred ATM Service Levels (PASL):

- PARS/PASL Phase I – expected implementation by 12 November 2015; and
- PARS/PASL Phase II – expected implementation by 08 November 2018.

7.2 Recognizing the short lead time between the finalization of the Framework and PARS/PASL Phase I, Regional ATFM Capability Phase I is divided into sub-phases A and B, with expected implementation 12 November 2015 and 25 May 2017 respectively.

7.3 Performance objectives are presented under the following general structure for each Regional ATFM Capability Phase, where relevant:

- ATFM Regulations
- ATFM Systems
- (Strategic ATFM, Pre-Tactical ATFM or Tactical ATFM)
 - Capacity and Demand Monitoring and Analysis
 - Capacity Improvement
 - ATFM Execution
 - ATFM Measures
 - Post-Operations Analysis

ATFM Program Airports

7.4 *ATFM Program Airports*, referenced in the performance objectives, are:

- The busiest Asia/Pacific Region aerodromes as defined in the Asia/Pacific Region Seamless ATM Plan;
- Airports where strategic slot allocation is implemented under these performance objectives; and
- All other airports designated by the relevant authority as requiring or potentially requiring ATFM implementation.

Asia/Pacific Framework for Collaborative ATFM
Appendix A

Note: prior to implementation, ATFM systems and procedures should be verified by safety assessment under State Safety Management Systems.

REGIONAL ATFM CAPABILITY PHASE IA

Expected implementation by 12 November 2015

ATFM Regulations

7.5 All States where air traffic demand at times exceeds, or is expected to exceed declared capacity, should enact regulations for the implementation of ATFM.

Annex 11 to the Convention on Civil Aviation section 3.7.5 refers.

Strategic Capacity and Demand Monitoring and Analysis

7.6 A regular program of bi-annual strategic airport and airspace capacity and demand analysis should be implemented for all international airports and associated terminal area airspace, and for all en-route ATC sectors supporting the busiest Asia/Pacific city pairs⁶ (**Figure 13**), including consideration of:

- CNS systems;
- ATC resources and capability;
- ATC separation standards and techniques;
- runway occupancy times;
- seasonal schedules; and
- historical traffic data and traffic growth forecasts

⁶ The Asia/Pacific Seamless ATM Plan lists the busiest Asia/Pacific aerodromes:

- Australia (Sydney, Melbourne);
- China (Beijing, Shanghai Pudong and Hong Jiao, Guangzhou, Hong Kong, Xi'an, Shenzhen, Chengdu, Kunming);
- India (New Delhi, Mumbai);
- Indonesia (Jakarta);
- Japan (Haneda, Narita);
- Malaysia (Kuala Lumpur);
- Philippines (Manila);
- Republic of Korea (Incheon);
- Singapore (Changi); and
- Thailand (Suvarnabhumi).

Asia/Pacific Framework for Collaborative ATFM
Appendix A

7.7 Where strategic analysis indicates that demand does not yet exceed capacity, preparation for the implementation of ATFM capability should be based on careful analysis of current traffic and expected growth in the next 5 years;

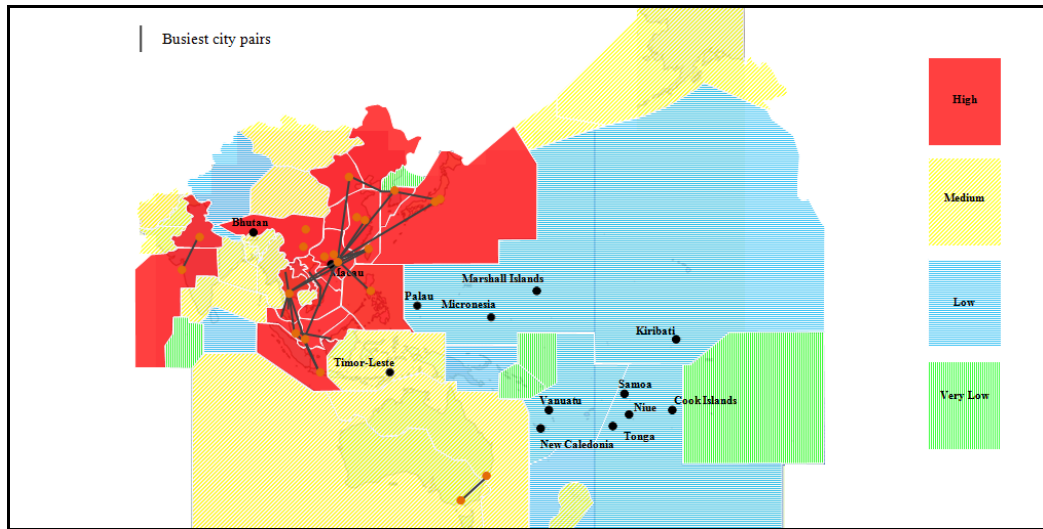


Figure 13: Asia/Pacific High Density FIRs, showing Busiest City Pairs
(Source: Asia/Pacific Seamless ATM Plan)

Pre-Tactical Capacity and Demand Monitoring and Analysis

7.8 Daily pre-tactical airport and airspace capacity and demand analysis should be conducted for all ATFM Program Airports and associated terminal area airspace, and for all en-route ATC sectors supporting the busiest Asia/Pacific city pairs, including consideration of:

- i. expected runway and airspace configurations;
- ii. forecast meteorological phenomena;
- iii. ATC resources, facilities and equipment;
- iv. other known or expected capacity constraints; and
- v. updated flight schedule and flight plan information.

Pre-Tactical ATFM Execution

7.9 ATFM Daily Plan (ADP) for all ATFM Program Airports and associated terminal area airspace, including airport and airspace capacity declarations and related background information, should be prepared and distributed to all relevant stakeholders.

ADP should be distributed to stakeholders by either:

- i. Web-based ATFM network; or*
- ii. Web-pages hosted by each participating ANSP; or*
- iii. Email distribution.*

Asia/Pacific Framework for Collaborative ATFM
Appendix A

Relevant stakeholders include:

- iv. *Neighbouring ATFMUs or, where not provided, ATSU*s
- v. *ATSUs supported by the originating ATFMU;*
- vi. *Relevant airport operators; and*
- vii. *Participating aircraft operators.*

7.10 ADP should be coordinated by the responsible ATFMU or ATSU and agreed with all relevant stakeholders, through chairing and/or participation in scheduled and, where necessitated by changes in airport or airspace capacity or other events, ad-hoc ATFM conferences for pre-tactical ATFM planning.

Post-Operations Analysis

7.11 The accuracy and effectiveness of capacity and demand analyses and ADP preparation and distribution, including supporting information listed in paragraph 7.7, should be verified through comparison with operational outcomes observed, and rectification of discrepancies included in planning for system and process improvements.

REGIONAL ATFM CAPABILITY PHASE IB

Expected implementation by 25 May 2017

ATFM Systems

7.12 Operational FPL and ATS message distribution systems and processes should be analysed and, where necessary, modified to ensure that FPL, CHG, DEP, DLA and CNL messages are originated, distributed and processed in accordance with the requirements specified in ICAO Doc. 4444 PANS-ATM.

7.13 Requirements should be published in all relevant State AIP, specifying that, except where necessary for operational or technical reasons, FPL should be submitted not less than 3 hours prior to EOBT.

7.14 A DLA message should be transmitted when the departure of an aircraft, for which basic flight plan data FPL has been sent, is delayed by more than 15 minutes after the estimated off-block time contained in the basic flight plan data.

7.15 Where the delay is the result of a GDP, the DLA message should be sent by the ATFMU responsible for the destination airport, addressed to the ATS unit serving the departure aerodrome for subsequent transmission in accordance with the provisions of ICAO Doc 4444 PANS-ATM.

7.16 Appropriate procedures should be implemented to ensure that FPL are not discarded from other ATM systems as a consequence of ATFM delay.

7.17 ATFM, AMAN/DMAN and A-CDM systems should be integrated through the use of common fixes, terminology and communications protocols to ensure complementary operations.

FIXM version 3.0 or later, extended where necessary is the agreed format for exchange of ATFM information in the Asia/Pacific Region.

Asia/Pacific Framework for Collaborative ATFM
Appendix A

Where full ATFM network communications capability is not yet established, ATFM messages conforming to ADEXP version 3.1 may be used for distribution of ATFM measures.

Capacity Improvement

7.18 Airport and terminal airspace capacity should be increased through optimized ATC separation standards and techniques and reduced runway occupancy at all ATFM Program Airports and in associated terminal area airspace.

7.19 Where necessitated by demand, and using a performance-based approach, terminal area ATS route structure improvements including CCO/CDO should be implemented to reduce ATC and pilot workload and enable better use of aircraft capability to meet ATFM measures.

Strategic ATFM Execution

7.20 Implement strategic airport slot allocation at all international airports, for periods where demand significantly exceeds the airport's capacity.

Pre-Tactical Capacity and Demand Monitoring and Analysis

7.21 Pre-tactical modelling of expected airport and airspace configuration and traffic demand, and the effect of ATFM measures, should be implemented for all ATFM Program Airports and associated terminal area airspace.

Pre-Tactical ATFM Execution

7.22 CDM capability should be implemented, enabling the sharing of all relevant information with all stakeholders, providing continuous availability of information and common reference material for daily and ad-hoc ATFM conferences.

Tactical Capacity and Demand Monitoring and Analysis

7.23 Dynamic update of airport and airspace capacity constraints, capacity calculation, demand information using schedule, flight plan and ATS messaging, and ATM system information and modelling of tactical ATFM programs should be implemented.

Tactical ATFM Execution

7.24 Tactical ATFM at ATFM Program Airports should be implemented using:

- i. Ground Delay Programs (CTOT), or
- ii. Minutes in trail (MINIT) or miles in trail (MIT) or other ATFM measures specified in ICAO Doc 9971 – *Manual for Collaborative ATFM*.

7.25 All States should ensure that local ATC procedures and, where available, CDM processes facilitating compliance with received CTOT are implemented.

Note 1: At controlled aerodromes, CTOT compliance should be facilitated through the cooperation of the aircraft operator and the issuance of ATC clearances. As a minimum, CTOT should be made available to the relevant ATC tower and the aircraft operator;

Asia/Pacific Framework for Collaborative ATFM
Appendix A

Note 2: For flights departing aerodromes where an ATC service is not provided, CTOT information should be made available to the aircraft operator and the first ATS unit providing services to the flight.

Note 3: States planning to implement ground delay programs should ensure adequate time is provided for local procedure development and promulgation at aerodromes where CTOT will be applied.

7.26 CTOT for individual aircraft should, where necessary, be revised, cancelled, suspended or de-suspended.

7.27 Tactical ATFM should be implemented for operations through constrained airspace sectors, only during periods affected by the constraint.

7.28 As far as practicable, individual aircraft should not be subject to more than one tactical ATFM measure per flight.

Post-Operations Analysis

7.29 Procedures and agreements should be developed to ensure post-operational analysis of cross-border ATFM programs, including the canvassing and consideration of feedback from airspace users, airports operators, ATS and other ATFM units. Daily post-operations analysis conferences should be held, supplemented where necessary by ad-hoc conferences called to assess the outcomes of programs of ATFM measures responding to non-normal situations.

7.30 The results of post-operations analyses should be used for planning ATFM, airspace and ATS route improvements.

ICAO Doc 9971 – Manual on Collaborative ATFM Part II-4-8 provides guidance on post-operations analysis

REGIONAL ATFM CAPABILITY PHASE II

Expected implementation by 08 November 2018

ATFM Systems

7.31 Distributed multi-nodal ATFM information distribution capability utilizing FIXM version 3.0 (or later) should be implemented, including:

- i. Sharing of ADP and dynamically updated demand and capacity data for all ATFM program airports, and for en-route airspace supporting the busiest city pairs and high density major traffic flows;
- ii. Slot allocation information for all flights subject to ATFM programs, including as a minimum CTOT, CTO and CLDT information;
- iii. Authorized user functions for slot amendment, cancellation or suspension (ATFMU), and slot-swapping (aircraft operator and ATFMU); and
- iv. Automated slot compliance monitoring and reporting, supplemented where necessary by authorized inputs by ATFMU, ATSU or airspace operator.

Asia/Pacific Framework for Collaborative ATFM
Appendix A

7.32 Full interoperability of cross border ATFM, A-CDM, AMAN, DMAN, ATM automation and airspace user systems should be implemented, utilizing FIXM 3.0 (or later) , to provide seamless gate-to-gate collaborative ATFM operations.

Pre-Tactical Capacity and Demand Monitoring and Analysis

7.33 Automated modelling of expected airport and airspace configuration and traffic demand, and the effect of ATFM measures, should be implemented for all ATFM Program Airports and associated terminal area airspace and, where possible, en-route airspace supporting the busiest Asia/Pacific Region city pairs and high density major traffic flows.

Tactical Capacity and Demand Monitoring and Analysis

7.34 Meteorological services to support ATM in the terminal area (MSTA) should be implemented, including near-term or *now-casting* forecasts of convective weather activity at or affecting ATFM Program Airports and associated instrument approach procedures, terminal area ATS routes and holding points and other significant locations.

Note: Annex 3 requires that States ensure the quality management of meteorological information.

Tactical ATFM Measures

7.35 ATFM measures including MIT, MINIT and, where necessary, CTO at AFIX or RFIX, should be applied to flights through constrained airspace.

7.36 Ground Delay Programs utilizing CTOT should be applied to:

- i. aircraft destined for constrained ATFM Program Airports, that have not yet departed; and
- ii. aircraft planned to operate through constrained airspace where tactical ATFM measure CTO at RFIX or AFIX is in place, that have not yet departed.

7.37 ATFM systems should have the capability to take into account long haul flights.

7.38 Systems should be in place to ensure the timely update of estimate information for airborne aircraft.

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RESEARCH AND FUTURE DEVELOPMENT POSSIBILITIES

Research and Development

8.1 Version 1.0 of the Regional Framework for Collaborative ATFM provides the initial framework for implementation of a distributed multi-nodal ATFM network, as envisaged in the *Regional ATFM Concept of Operations*. This concept, being untried elsewhere, will continue to develop as experience is gained through trials and subsequent operational implementation. The Framework is therefore iterative in nature, and will require regular update in the medium term.

8.2 Further research and development of the distributed multi-nodal ATFM network concept will largely be conducted by ATFM/SG participating States through their operations trial programs, consistent with Principle 36 of the Asia/Pacific Seamless ATM Plan Principle 36 – ‘*Clustering*’ for the *research, development and implementation of ATM projects*. The outcomes of trials and lessons learned from operational deployment will be considered by ATFM/SG for the improvement and updating of the Framework.

ATFM Interface Control Document

8.3 The ATFM Information Requirements Small Working Group (ATFM/IR/SWG) will develop an operational requirements document and an ICD for networked, cross-border multi-nodal ATFM information exchange, to be delivered to ATFM/SG for consideration before then being referred to the 4th Meeting of the ATM Sub-Group of APANPIRG (ATM/SG/4) in August 2016.

Collaborative ATFM Concept Developments

8.4 The following concepts should be researched, and developed, for implementation in the Asia/Pacific Region:

8.5 **Delay Absorption Intent** – included in the *Regional ATFM Concept of Operations*, provides aircraft operators with the flexibility to choose how to distribute the delay assigned by an ATFM measure to various phases of flight. Not yet included in the ATFM Performance Improvement Plan, this concept has the potential to improve outcomes by increasing the number of aircraft participating in the program, through the application of ATFM delays to longer distance flights that are currently exempt from ground delay programs. The development of this concept will be undertaken in trials before then being potentially included in the broader Framework.

8.6 **FIXM Extension** – may be required for implementation of any Asia/Pacific region ATFM practices or procedures that are not covered in FIXM version 3.0 or later versions deployed by States.

8.7 **Application of ATFM Measures to Long Range Flights** – will improve equity in ATFM processes, and contribute to better outcomes in those ATC sectors where long range flights are currently exempt from all but minimal en-route delays. This will require further development of ATFM measures the CTO ATFM measure, and the formulation of regionally agreed limits on the total ATFM+AMAN delay that may be applied to long range and ultra-long range flights.

8.8 **Interoperability of ATFM, AMAN/DMAN and A-CDM systems** – will require ANSPs and airport operators to collaboratively develop their local operational letters-of-agreement to incorporate procedures and practices optimizing gate-to-gate flow management of flights.

8.9 **Collaborative Trajectory Options** – provide for flexible routing options that permit aircraft operators to elect to re-route flights via longer trajectories to avoid constrained airspace and take advantage of the reduction or removal of ground delay (or en-route delay, where implemented) that would be imposed if the flight continued through the constrained airspace. A collaborative trajectory options program would significantly improve the safety and efficiency of ATM in cases of large scale weather deviations (LSWD) such as those experienced in the cyclonic weather season in the Bay of Bengal and South China Sea areas, and contingency operations including the avoidance of airspace that is either unsafe (e.g. volcanic ash cloud) or unavailable. A collaborative trajectory options program would first require a full understanding of airspace capacity, which should be supported by a comprehensive study.

8.10 The development of a collaborative trajectory options program in the Asia/Pacific Region, particularly in South East Asia, will require a coordinated multi-partite effort to improve the regional ATS route network and ATS surveillance/communications infrastructure, and to provide sufficient ATS route options for the program. ATS route specification and implementation of surveillance and communications infrastructure are included in the performance objectives of the Seamless ATM Plan.

8.11 **Network Collaborative Decision-Making** – to provide mechanisms within the distributed multi-nodal ATFM network for the formulation of executive flow management decisions in the event of competing stakeholder priorities. This will require research and development of network-suitable automated decision-support tools and associated business rules. Operational experience in the distributed multi-nodal ATFM network environment will be key to identifying the potential challenges, and formulating and testing strategies.

8.12 **Harmonization of Multiple Flow Management Programs** – will ensure that all ATFM measures applied are collaboratively managed to ensure that individual flights are not unduly penalized by multiple measures in one flight, and that ATFM network outcomes are more predictable. Currently aircraft may be subject to independently applied en-route and airport ATFM delays, resulting in potentially unreasonable cumulative delay over the course of a flight. A significant amount of research is being conducted, and needs to be conducted, into the effects and harmonization of multiple flow programs in multiple FIRs.

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MILESTONES, TIMELINES, PRIORITIES AND ACTIONS

Milestones and Timelines

9.1 Section 7 (Performance Improvement Plan) provides milestones and timelines for a number of elements generally aligned with the Asia/Pacific Seamless ATM Plan PARS and PASL Phase I and II, being effective 12 November 2015 and 09 November 2018 respectively:

<i>Regional ATFM Capability Phase</i>	<i>Expected Implementation</i>
<i>Phase 1A</i>	<i>12 November 2015</i>
<i>Phase 1B</i>	<i>25 May 2017</i>
<i>Phase 2</i>	<i>08 November 2018</i>

9.2 States that have not yet implemented collaborative ATFM, or having implementations that are not in accordance with the provisions of this Framework, should commence planning from the date of its approval by APANPIRG.

9.3 It should be noted, however, that the ATFM capability outlined in the Framework should be implemented as early as possible. The Framework timelines should under no circumstances be interpreted as limiting or deferring ATFM implementation where there is a current or expected need for it in an earlier timeframe than outlined.

Priorities

9.4 While it is a matter for each State to determine priorities in accordance with its own economic, environmental, safety and administrative drivers, States should be aware of the Asia/Pacific Regional Priorities adopted by APANPIRG, including ASBU **B0-NOPS**, and the Annex 11 requirement for States to implement ATFM where there is a current or expected imbalance of demand and capacity.

Actions

9.5 This Plan is iterative in nature, and will require further development as experience is gained in operational trials of the distributed multi-nodal ATFM network concept. ATFM/SG, under its terms of reference, should continue to oversee and coordinate the development of the concept and subsequent amendment of the Framework, facilitate the coordination and alignment of CDM/ATFM programs being conducted within the Region, and review the effectiveness of existing and planned ATFM programs. An important project being conducted by the ATFM/SG is the development of a Regional Interface Control Document (ICD) for ATFM, which is expected to be completed for consideration by ATFM/SG, then presented to the ATM Sub-Group of APANPIRG in August 2016.

APPENDIX A: COLLABORATIVE ATFM PRINCIPLES

General Principles

1. Increased capacity is the primary and central method for management of increasing demand.
2. FIR boundaries should not limit the delivery of ATFM messages and the coordination and application of ATFM measures.
3. Collaborative Decision-Making (CDM) to achieve optimum ATFM network outcomes while taking into account stakeholder goals.
4. An emphasis on delivery of ATFM services based where practicable on CNS capability, resulting in flexible, dynamic systems delivering optimal ATFM network outcomes while providing equity of access.
5. Regional distributed multi-nodal network model of inter-connected sub-regional ATFM networks or State ATFM systems, based on system-wide CDM, serving the busiest terminal airspace and major sub-Regional traffic flows.
6. Harmonized regional ATFM rules and guidelines based on the ICAO Manual on Collaborative Air Traffic Flow Management (Doc 9971).

People: Aviation Regulations, Standards and Procedures

7. Regionally harmonized methodology for the continuous monitoring and declaration of airport and airspace demand and capacity, the dynamic updating and sharing of capacity information, and for daily post-operations analysis.
8. Prioritization of ATFM implementation for high density airports and the busiest city pairs and FIRs.
9. Demand and Capacity inputs from automated data feeds including ATM automation systems, ATN/AFTN, and from FMPs and FOCs using web-based manual ATFM interfaces.
10. The minimum necessary ATFM Measures applied, for the shortest necessary time period and only to operations at or in capacity constrained airports or airspace.
11. Pre-tactical and tactical coordination of airport and airspace capacity constraints and proposed ATFM programs and measures with all affected Stakeholder organizations, before the independent execution of the program or measure in the ATFM system of the responsible ANSP.
12. Participation by at least 70% of aircraft operating in or to the constrained resource.
13. Aircraft operator options for delay absorption through the flexible distribution of total ATFM measure delay per aircraft to gate hold, surface hold and/or airborne delay.
14. Except in the case of flexible aircraft operator options for absorption of delay, separate ATFM measures should not be cumulatively applied to a flight.

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15. Harmonized ATFM, runway sequencing (AMAN/DMAN) and A-CDM processes using common reference points and information exchange.
16. Exemption from ATFM measures of emergency, humanitarian, declared medical evacuation, search and rescue, and Head-of-State flights, and other flights as determined by the State authority.
17. Direct coordination between aircraft operator and airport operator to determine maximum gate delay and surface delay.
18. Direct input of delay absorption intent into the ATFM system by aircraft operators.
19. Pilot-in-command responsibility for adherence to operational procedure for requesting speed, route or level changes where flexible delay option is exercised.
20. Continuous monitoring of compliance with ATFM measures, supported by procedures for the real-time and post-operational management of non-compliance.
21. Bi-lateral or multilateral agreements where necessary to support common business rules for departure, destination and en-route ANSPs and airport operators.
22. Development of manual processes and skills to promote practical knowledge and understanding of ATFM before implementing technology based solutions, and as a contingency response capability.
23. The use of high-fidelity simulators to train controllers and ATFM personnel in ATFM procedures and techniques.

ATM Coordination

24. The prioritization of integrated AIDC systems for timely ATM and ATFM system updates of trajectory data, including preferred implementation of advanced AIDC messaging and configuration of systems for early delivery of AIDC messages.

Facilities: Aerodromes

25. Encouragement for aerodrome operators to actively participate in ATM coordination in respect of A-CDM development and operational planning, including aerodrome complexity and capacity.

ATFM Systems

26. Collaboration by ANSPs for evaluation and planning of harmonized ATFM facilities.
27. Optimization of ATFM facilities through automated, networked, central flow management centres and units or equivalent virtual platforms.
28. Independent FMP/ATFM systems operated by each ANSP, connected to the sub-regional or regional ATFM network.
29. Continuous supervision, operation, adjustment, monitoring and executive control of ATFM systems and their output by dedicated ATFM or designated ATC personnel.

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- 30. ATFM communications via existing internet/telecommunications networks, or via the Asia/Pacific Common Regional Virtual Network when implemented.
- 31. Preference for relevant ATFM data and notifications from each ANSP, including slot assignments, distributed to stakeholders via web interfaces.
- 32. Collaborative development of A-CDM, ATFM, AMAN and DMAN capability.
- 33. Encourage the real-time sharing of dynamic air traffic data relating to flights operating or intending to operate in civil-controlled airspace, between military ATM systems and civil ATM/ATFM systems.

ATM Modernization Projects

- 34. Inter-regional and sub-regional cooperation ('clustering') for the research, development and implementation of ATFM projects.

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APPENDIX B: CDM/ATFM TRIAL TIERED PARTICIPATION LEVELS

Air Navigation Service Providers

Note: Outside ATFM Ops Trial ANSPs may already have been asked to support ATFM Operations through Minimum Departure Intervals between flights or providing longitudinal separation between flights such as Miles-in-Trial or Minutes-in-Trial

Level 1 – Observe Trial

- Participate in CDM/ATFM Meetings
- Participate in Operational Trial Planning process

Level 2 – Facilitate CTOT for Departures (includes Level 1)

- Receive CTOT for departure to other Demand-Capacity imbalance airports
- Facilitate airline operator CTOT compliance for departing flights

Level 3 – Demand-Capacity Balancing Capability (includes Levels 1 and 2)

- Evaluate Traffic Demand
- Evaluate and update Airport Acceptance Rate (AAR)
- Distribute CTOT to airline operators and ANSPs

Aircraft Operators

Level 1 – Participate in the Trial

- Receive CTOT for departure to other Demand-Capacity imbalance airports
- Manage flight operations and coordinate with ATCs and Airport Operators to achieve CTOT compliance for departures
- Participate in the ATFM / CDM Operational Trial Project and Focus Group meetings
- Participate in the Operational Trial planning process

Level 2 – Slot Swapping and CTOT User Inputs (includes Level 1)

- Optimize flight operations through slot swapping and CDM process
- Provide CTOT User to ATFM portal (advanced Operational Trial – later phase)
- Evaluate and update on outcomes of ATFM measures
- Refine CDM process for optimized flight operations

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APPENDIX C: ATFM DAILY PLAN SAMPLE TEMPLATE

ATFM Daily Plan	[Name of ATFM Unit]	[UTC DATE] [APPLICABLE TIME]
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CAPACITY and CONSTRAINTS			
Location (AD or SECT)	Applicable Period	AAR (landings per hour)	CONSTRAINT/REMARK

ATFM MEASURES			
Location (AD or SECT)	Applicable Period	AAR (landings per hour)	CONSTRAINT/REMARK

POSSIBLE/DEVELOPING ISSUES		
Location (AD or SECT)	APPLICABLE PERIOD	MEASURE REMARKS

EXAMPLE ATFM DAILY PLAN

ATFM Daily Plan	RJJJ	1504022000 - 1504031959
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CAPACITY and CONSTRAINTS			
Location (AD or SECT)	APPLICABLE PERIOD	AAR (landings per hour)	CONSTRAINT/REMARK
RJCC	2100 – 2300	04 – 06	LVP
RJTT	0200 – 0300	10	RWY34L/16R CLSD 0200 – 0245 CONST
RJTT	0300 – 0500	14	FLTCK RWY22 ILS
SECT 1	0130 – UFN	-	Developing CB

ATFM MEASURES		
Location (AD or SECT)	APPLICABLE PERIOD	MEASURE REMARKS
RJTT	2330 – 0140	CTOT DEST RJCC
SECT 12	2300 – 0005	3 MINIT DEP RJAA/RJTT
SECT 12	0130 – UFN	G585 8 MINIT AT [WAYPOINT] WB FOR ZMUB REGARDLESS OF FL

POSSIBLE/DEVELOPING ISSUES		
Location (AD or SECT)	APPLICABLE PERIOD	MEASURE REMARKS
RJAA	0300 – 0500	15 MIT, 250KT AT [WAYPOINT] [WAYPOINT]
RJTT	0300 – UFN	CTOT

.....

APPENDIX D: ATFM TERMINOLOGY AND COMMUNICATIONS

ATFM Terminology - General

Acronym	Term	Definition
AAR	Airport Acceptance Rate	Arrival capacity of an airport normally expressed in movements per hour
ADR	Airport Departure Rate	Departure Capacity of an airport normally expressed in movements per hour
ASD	Aircraft Situation Display	ATC Aircraft/Traffic Situation Display
AFIX	Arrival Fix	A waypoint during the arrival phase of a flight. In the context of ATFM it could a waypoint where an ATFM Measure may be applied
CDM	Collaborative Decision-Making	Process which allows decisions to be taken by amalgamating all pertinent and accurate sources of information, ensuring that the data best reflects the situation as known, and ensuring that all concerned stakeholders are given the opportunity to influence the decision. This in turn enables decisions to best meet the operational requirements of all concerned.
CDR	Conditional Route	ATS route that is available for flight planning and use under specific conditions
DFIX	Departure Fix	The first published fix/waypoint used after departure of a flight.
DMAN	Departure Manager	A planning system to improve the departure flows at an airport by calculating the Target Take-Off Time (TTOT) and Target Startup Approval Time (TSAT) for each flight, taking multiple constraints and preferences into account
FCA	Flow Constrained Area	An sector of airspace where normal flows of traffic are constrained, which could be caused by weather, military exercise etc.
FMP	Flow Management Position	A position in any ATCC that monitors traffic flows and implements or requests ATFM measures to be implemented"
GDP	Ground Delay Program	ATFM process where aircraft are held on the ground in order to manage capacity and demand in a specific volume of airspace or at a specific airport. In the process departure times are assigned and correspond to available entry slots into the constrained airspace or arrival slots into the constrained airport

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Acronym	Term	Definition
GS	Ground Stop	A tactical ATFM measure where some selected aircraft remain on the ground
MINIT	Minutes in Trail	A tactical ATFM measure expressed as the number of minutes required between successive aircraft. It is normally used in airspace without air traffic surveillance or when transitioning from surveillance to non-surveillance airspace, or even when the spacing interval is such that it would be difficult for a sector controller to measure it in terms of miles
MIT	Miles in Trail	A tactical ATFM measure expressed as the number of miles required between aircraft (in addition to the minimum longitudinal requirements) to meet a specific criterion which may be separation, airport, fix, altitude, sector or route specific. MIT is used to organize traffic into manageable flows as well as to provide space to accommodate additional traffic (merging or departing) in the existing traffic flows. It will never be less than the separation minima.
RFIX	En-route Fix	A waypoint during the en-route phase of a flight. In the context of ATFM it could a waypoint where an ATFM Measure may be applied
SUB	Slot Swapping	The ability to swap departure slots gives AUs the possibility to change the order of flight departures that should fly in a constrained area
-	ATFM Measure	ATFM Measure which will balance demand against capacity or assist in the safe expeditious flow of traffic

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ATFM Terminology – Phase of Flight

Acronym	Term	Definition
SOBT	Scheduled off Block Time	The time that an aircraft is scheduled to depart from the parking position
EOBT	Estimated Off Block Time	The estimated time that an aircraft will start movement associated with departure
TOBT	Target Off - Block Time	The time that an aircraft Operator or Ground handler estimates that an aircraft will be ready to startup/pushback immediately upon reception of clearance from the tower.
TSAT	Target Start Up Approval Time	The time provided by ATC taking into account TOBT, CTOT and/or the traffic situation that an aircraft can expect start up/push back approval
COBT	Calculated Off Block Time	A time calculated and issued by ATFM Unit, as a result of tactical slot allocation, at which a flight is expected to pushes back / vacates parking position so as to meet a CTOT taking into account start and taxi time.
AOBT	Actual Off Block Time	The time the aircraft pushes back / vacates parking position (Equivalent to Airline / Handlers ATD – Actual Time of Departure & ACARS=OUT)
STOT	Scheduled Take Off Time	The estimated take off time derived from an aircraft operators schedule, typically based on a standard taxi-out time
PTOT	Planned Take Off Time	Time aircraft is expected to take off derived from the flight plan.
TTOT	Target Take Off Time	The Target Take off Time taking into account the TOBT/TSAT plus Estimated Taxi-Out Time
CTOT	Calculated Take off Time	A time calculated and issued by ATFM Unit, as a result of tactical slot allocation, at which a flight is expected become airborne
ETOT	Estimated Take Off Time	The Estimated take off time taking into account EOBT plus Estimated Taxi-Out Time
ATOT	Actual Take Off time	The time that an aircraft takes off from the runway (Equivalent to ATC ATD–Actual Time of Departure, ACARS = OFF)
SEET	Scheduled Estimated En-route Time	The estimated elapsed time of a flight derived from the aircraft operators schedule

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Acronym	Term	Definition
ETO	Estimated Time Over	Estimated time at which an aircraft would be over a fix, waypoint or particular location typically where air traffic congestion is expected
CTO	Calculated Time Over	Time calculated and issued by ATFM Unit, as a result of tactical slot allocation, at which flight is expected to be over a fix, waypoint or particular location typically where air traffic congestion is expected (referred to in FIXM 2.0 as "Airspace Entry Time - Controlled")
PLDT	Planned Landing Time	The expected landing time of a flight derived from the flight plan
SLDT	Scheduled Landing Time	Scheduled time aircraft is expected to land on a runway, typically based on Scheduled In-Block Time (SIBT) and a standard taxi-in time
TLDT	Target Landing Time	Targeted Time from the Arrival Management process at the Threshold, taking runway sequence and constraints into account; Progressively refined planning time used to coordinate between arrival and departure management processes
CLDT	Calculated Landing Time	A landing time calculated and issued by ATFM unit, as a result of tactical slot allocation at which a flight is expected to land on a runway
ELDT	Estimated Landing Time	The estimated time that an aircraft will touch-down on the runway (equivalent to ETA)
ALDT	Actual Landing Time	Actual time an aircraft lands on a runway (Equivalent to ATC ATA –Actual Time of Arrival = landing, ACARS=ON)
SIBT	Scheduled In Block Time	The Time that an aircraft is scheduled to arrive at its first parking position.
CIBT	Calculated In Block Time	An in block time calculated and issued by ATFM unit, as a result of tactical slot allocation at which a flight is expected to be at its first parking position.
AIBT	Actual in block time	The time that an aircraft arrives in-blocks (Equivalent to Airline/Handler ATA –Actual Time of Arrival, ACARS = IN)

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ATFM Terminology Map

Phase of Flight	Scheduled	Flight Plan	Target (Airline)	Target (ANSP)	ATFM Measure	Estimated	Actual
Off-Block Time (OBT)	SOBT	EOBT	TOBT	TSAT	COBT		AOBT
Take-Off Time (TOT)	STOT			TTOT	CTOT	ETOT	ATOT
Time Over (TO)					CTO	ETO	ATO
Landing Time (LDT)	SLDT			TLDT	CLDT	ELDT	ALDT
In-Block Time (IBT)	SIBT				CIBT		AIBT

ATFM Phraseology

Note: The following phrases are suggested for use as an interim procedure, pending the development of globally standardized ATFM –related phraseology

Circumstance	Phraseology
Calculated take-off time (CTOT) delivery resulting from a slot allocation. The CTOT shall be communicated to the pilot at the first contact with ATC.	SLOT (<i>time</i>)
Change to CTOT resulting from a Slot Revision.	REVISED SLOT (<i>time</i>)
CTOT cancellation resulting from a Slot Cancellation	SLOT CANCELLED, REPORT READY
Flight suspension until further notice.	FLIGHT SUSPENDED UNTIL FURTHER NOTICE, DUE (<i>reason</i>)
Flight de-suspension.	SUSPENSION CANCELLED, REPORT READY
Start-up requested too late to comply with the given CTOT.	SLOT EXPIRED, REQUEST A NEW SLOT
Denial of-Start-up when requested too late to comply with the given CTOT. (Where supported by State regulation or procedure)	UNABLE TO APPROVE START-UP CLEARANCE DUE SLOT EXPIRED, REQUEST A NEW SLOT
Start-up requested too early to comply with the given CTOT.	REQUEST A NEW SLOT

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Circumstance	Phraseology
Denial of Start-up when requested too early to comply with the given CTOT. (Where supported by State regulation or procedure)	UNABLE TO APPROVE START-UP CLEARANCE DUE SLOT (<i>time</i>), REQUEST START-UP AT (<i>time</i>)

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APPENDIX E: ATFM TRAINING REQUIREMENTS

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INTRODUCTION

General

Air traffic Flow Management is an enabler of Air Traffic Management efficiency and effectiveness contributing to the safety, efficiency, cost effectiveness and environmental sustainability of an ATM system. ATFM aims at enhancing safety by ensuring the delivery of safe densities of traffic and by minimising traffic surges. Its purpose is to balance traffic demand and available capacity.

As traffic grows, an increasing number of States are moving towards the implementation of an ATFM service. Although this is a positive development, it also generates another challenge. Because of its effect on neighboring airspaces, ATFM needs to be coordinated between States. ATFM systems therefore need to be compatible and interoperable. In this respect, the development of coordinated and harmonised training requirements is a first step in ensuring a harmonised application of ATFM.

Once demand start to reach the levels of available ATC capacity, a functioning ATFM service becomes a vital component of safe and efficient provision of Air Traffic Control services. Therefore this service needs to be staffed by personnel with sufficient knowledge and understanding of the ATM system they are supporting and the potential effects of their work on the safety and efficiency of air navigation.

To ensure this and in the frame of their training policy, States and ANSPs should establish training plans to ensure that ATFM service staff are properly trained in order to ensure the availability, continuity, accuracy and integrity levels requested for the service provided.

ICAO Doc 9971, Manual on Air Traffic Flow Management recognizes the requirement for training all stakeholders in an ATFM service, i.e. both those directly operation and ATFM function and all other ATFM stakeholders including airspace users and ATS personnel (ref. Doc 9971 section 3.3).

Due to the complexity of the issues at hand when setting out to balance demand against available implementation options, the provision of an efficient ATFM service requires that training is approached in a systematic manner.

This document addresses the need to provide for a set of training requirements to be introduced in support of a harmonised and effective ATFM function. The document describes the requirement for training for staff having responsibilities with regard to the ATFM function. It addresses the requirement for the various levels of staff in an ATFM Unit, as well as those stakeholders affected by ATFM measures. The proposed training requirements are designed to support local application of ATFM at the same time as it prepares States for a regional application of ATFM.

It is assumed that each State and/or ANSP that will set out to train ATFM service staff will have to consider the type of equipment used in their area of operation. The material in this document is made very general when it comes to training required to operate the system that is used, and will have to be detailed based on the tools used in that particular area in support of ATFM services.

ICAO and EUROCONTROL sources were consulted for the development of the training concepts and methodology presented herein. The proposed training syllabus is derived with the support of in-depth ATFM service expertise.

Background

Regional networked Air Traffic Flow Management forms a major part of the ICAO ASBU framework since Block 0 (2013) through B0-NOPS. In support of the B0-NOPS module, ICAO enlisted a group of experts from States, ANSPs, and International Organizations with ATFM experience (ATFM Manual Coordination Team) to develop the ICAO Manual on Collaborative ATFM (Doc 9971), providing guidance on Collaborative ATFM implementation (published 2014).

Meanwhile, ICAO Asia-Pacific moved forward to develop ICAO Asia/Pacific Seamless ATM Plan, including provision on CDM/ATFM development to support Seamless ATM Operations in the region. Version 1.0 of the Seamless ATM Plan was endorsed by APANPIRG/24 meeting in June 2013. APANPIRG/24 meeting approved Conclusion 21/15 that States participate in and support the Asia/Pacific ATFM Steering Group to develop a common Regional ATFM framework, which addresses ATFM implementation and ATFM operational issues in the Asia/Pacific region.

The ATFM/SG/2 meeting in Hong Kong, China in September-October 2013 made the decision to form the ATFM Specialist Team of experienced ATM/ATFM specialist and other stakeholders to develop the Asia/Pacific Framework for Collaborative ATFM APANPIRG/26.

Purpose and Scope of the Document

The purpose of this document is to define a training process and specify training guidelines in order to have a common level of training for staff that operate and/or “experience” ATFM services.

In many cases an individual may already possess the required competence and experience in a particular domain and may not need to follow a formal training course on this subject. Nevertheless a process of confirm the individuals competence should still be followed. The document addresses the following:

- Who is to be trained?
- What pre-requisite skills are required or can be obtained?
- What are the job responsibilities and required competencies?
- What is the required content of ATFM training?
- What is the level of training depending on the level of responsibilities to be exercised?

Structure of the Document

The ATFM Training Requirement Guidelines consist of 5 Chapters, and 2 Appendices:

Chapter 1: Introduction

Chapter 2: ATFM Training Structure

Chapter 3: From job responsibilities via competencies to training requirements

Chapter 4: Ab-Initio ATFM Training

Chapter 5: Basic training

Appendix A: Glossary (*to be included*)

Appendix B: List of Abbreviations (*to be included*)

ATFM TRAINING STRUCTURE

A model of ATFM training

By means of ATFM training, it is expected that staff of an ATFM unit will obtain the appropriate skills to operate and maintain an ATFM function in an appropriate manner and consequently provide harmonised, homogenous and consistent ATFM services in the entire region.

In addition to the staff of the ATFMU itself, there are several other units/areas/entities where staff needs to be aware of ATFM services provided and the specific roles and responsibilities they carry in this process. Units where ATFM is exercised or directly experienced and where staff therefore needs training include:

- ATC
- Aircraft Operators
- Pilots
- Airport Operators
- Military, both service providers and users
- Regulatory bodies (CAAs and equivalent)

An ATFM service is provided at different levels, each with its own training requirements. The different levels of ATFM responsibilities considered include the operations management and supervision levels, planning and execution of the service and essential support staff. In addition, there are different support functions, CDM partners and general ATM personnel that need to be considered when developing training requirements.

This guidance document proposes a six level (taxonomy levels) set of training objectives for each ATFM population grouping depending on the level of responsibility to be exercised by each group.

- Level 0: To be aware of
- Level 1: A basic knowledge of the subject. It is the ability to remember essential points, to memorise data and retrieve it.
- Level 2: The ability to understand and to discuss the subject matter intelligently in order to represent and act upon certain objects and events.
- Level 3: A thorough knowledge of the subject and the ability to apply it with accuracy. The ability to make use of the repertoire of knowledge to develop plans and activate them.
- Level 4: The ability to establish a line of action within a unit of known applications following the correct chronology and the adequate method to resolve a problem situation. This involves the integration of known applications in a familiar situation.
- Level 5: The ability to analyse new situations in order to elaborate and apply one or other relevant strategy to solve a complex problem. The defining feature is that the situation is qualitatively different to those previous

(source: EUROCONTROL Specification for the ATCO Common Core Content Initial Training)

This guidance proposes that a matrix should be constructed to determine the level of training and competency required for each group in the ATFM population. A partial matrix template is shown below. This is developed further in the document. The levels are shown for illustrative purposes only.

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Appendix E – ATFM Training Requirements

	Operations management	Supervision	Planner	Execution	Support	CDM partner	General ATFM personnel
Subject							
ATM	2	2	2	2	2	1	1
ATFM	2	3	4	3	2	2	1
ATC	2	2	2	1	1	1	1
Airport operations	2	2	2	2	1	1	1
Aircraft operations	2	2	2	2	1	1	1
Meteorology	2	2	3	3	2	1	1
ICAO	3	2	2	2	2	1	1
ATFM tools	2	2	3	3	3	2	1
Capacity assessment	2	2	2	1	1	1	1
Airspace design	2	2	2	1	1	1	1

Phases of ATFM training

General

ATFM training can be divided into a number of phases. This document concentrate on training requirements for Ab-Initio and Basic training, other phases are only discussed briefly.

Ab-Initio Training

Ab-initio training is intended to ensure that new ATFM staff possesses the necessary contextual knowledge in order to follow the more detailed job related training. In many cases staff may already possess this knowledge (e.g. ATC staff will possess the necessary ATC knowledge, Airline operations personnel the necessary aircraft operations knowledge). The possession of the necessary ab-initio subject knowledge should be assessed upon recruitment / assignment. In cases where staff possess the necessary contextual knowledge these staff may be exempted in whole or part from elements of ab-initio training.

Basic Training

Basic training is the main phase where the core ATFM and associated operational topics are covered in a comprehensive fashion. Basic training also covers more detailed knowledge of subjects related to ATFM than in ab-initio training. At the successful completion of basic training the staff member should have all the relevant knowledge to proceed to on the job training before performing his role in the ATFM operation.

On the Job Training

ATFM, in common with many other operational occupations requires a substantial amount of practical application of the occupation under appropriate supervision in order to ensure that the acquired knowledge from the basic training course(s) can be applied in an autonomous manner. The purpose is to reinforce formal training and support the achievement of competency standards. If appropriate, OJT phases can also follow advanced or refresher training.

Advanced Training

As ATFM functions develop, a number of advanced ATFM analysis and application techniques are used. Secondly some staff involved in the execution of ATFM will require a higher level of skills and advance training modules will be required for both such cases. The purpose of advanced training is to augment the skills and knowledge of ATFM personnel in dealing with either more specific, complex problems or a wider breadth of issues.

Recurrent/Refresher Training

It is essential that ATFM personnel update his or her competencies in accordance with the latest operational requirements, and new methodology/technologies applied. Regular recurrent training should therefore be planned. It is important to maintain the current skills of ATFM personnel. Some ATFM techniques are applied only in very rare situations (contingency, exceptional events). ATFM personnel can be absent from their core operational function for extended lengths of time. For these three reasons recurrent/refresher training modules will be required.

Training requirements for ATFM instructors

To ensure efficient training, the trainers have to be in possession of the necessary skills. Apart from a thorough knowledge of the subject to be taught, the trainers also need to demonstrate the ability to convey the knowledge in a pedagogic and structured way. It is recommended that the trainers have attended Classroom Techniques training courses.

In cases where a State is implementing an ATFM service for the first time, and thereby do not have the expertise needed to perform the training available in their country, different solutions could be considered. In cases where a system is procured to support the application of ATFM, the inclusion of a package for training of the trainers should be considered. For more in-depth knowledge of the procedures and processes involved, it may be necessary to send the staff responsible for the training to attend courses given by trainers having the experience required to train staff on the application of ATFM.

FROM JOB RESPONSIBILITIES VIA COMPETENCIES TO TRAINING REQUIREMENTS

General

Introduction

The first steps in the process of designing detailed training requirements, are to:

- Identify job responsibilities and associated performance and measurement criteria;
- Identify the competencies required to meet these job responsibilities and performance.

With full understanding of job responsibilities, it is possible to determine what the competencies are of a fully competent staff member. Items that may be needed to perform this analysis include:

- the specific job or position description or summary;
- specific ATFM organization performance requirements or competencies; and
- standard operating procedures that apply to an individual's position or responsibilities.

When the pre-requisites described above are identified and analysed, it is possible to design the training required to address the gaps through the development of the learning objectives for each competency that needs to be addressed. Based on the identification of the learning objectives, a curriculum can then be designed.

The link between ATC and ATFM

Before looking at the details of the job responsibilities of an ATFM Unit, there is a requirement to understand its links with ATC. ATFM is a cross-domain activity, and even if the focus have shifted from the early task of protecting ATC from overload to a more comprehensive demand/capacity balancing activity, there are still very strong links between ATC and an ATFM service.

The ATC Supervisor is accountable for the provision of ATC services for enroute and TMA operations within the FIR`s for which this service is being provided. As part of that responsibility, he/she is normally also accountable for all strategic and tactical ATFM decisions. In a smaller ACC the supervisor may keep that responsibility, but in a larger ACC this is often delegated to an "Airspace Manager", either being the Flow Management Position (FMP) in the ACC or the ATFM Unit (ATFMU) Supervisor.

To be able to take strategic and tactical decisions related to the application of ATFM, there is a requirement for a large measure of ATC knowledge, and when the responsibility to take these decisions is delegated to an FMP and/or ATFMU Supervisor it normally requires that the staff manning these positions have an ATC background. As management knowledge is passed on and complexity issues in sectors and at airports are documented and understood by the ATFMU, there may not be a need for this pre-requisite. However, it is important that the training provided is such that the FMP and/or supervisor of the ATFMU are able to fully understand and discuss ATC operations so that the expected outcomes can be achieved.

Over time, the objective should be to develop the ATFMU to become an integral part of ATC so that it is seen as the manager of the airspace, ensuring the delivery of the right amount of demand in the right shape to achieve maximum capacity.

Tasks and Competencies

Main tasks for an ATFM Unit

The objective when defining the tasks of an ATFM Unit should be to ensure that the ATFMU become the focus for an effective management of airspace availability and capacity. The ATFMU should manage and coordinate actions associated with optimising demand against the capacity of the airspace, ensuring that the complexity of traffic does not exceed the capability of the control service.

The ATFMU should maintain a strategic and tactical overview of the network (airspaces and airports within and adjacent to its area of responsibility), being responsible for the development of tactical ATFM strategies, and for managing network responses to demand and capacity issues.

The main tasks of a service provided by an ATFM unit include:

- Receive and analyse all ATFM data and associated parameters;
- Plan and coordinate capacity adjustment for next day's operation;
- Plan and coordinate ATFM Daily Plan for the next day's operation;
- Manage proper execution of ATFM Measures on day of operation based on ATFM Daily Plan;
- Coordinate tactical capacity adjustment on ATM resources with the local ATC Supervisors;
- Monitor and execute ATFM Measures on day of operation as required based on ATFM Daily Plan;
- Ensure proper integration of traffic demand inputs;
- Ensure proper configuration of ATFM automation support systems;
- Ensure optimisation of resources through an efficient CDM process;
- Provide focus and specialist expertise for planning, coordinating and implementing measures for capacity management and contingency operations;
- Conduct post operations analysis of previous days ATFM operation.

Competencies for staff executing ATFM

To perform ATFM tasks, staff needs to be trained to possess a number of competencies. They need to have full knowledge of the FIR and/or airports for which the service is applied. They also need to understand the factors that impact on the capacities for the various parts of airspace and airports, and they need to be fully aware of the impact on the provision of ATC that the different actions they propose to implement may have. In order to be effective, the ATFMU needs to coordinate and cooperate closely with ATC, airports and civil and military airspace users.

The required competencies include the ability to:

- Determine an accurate picture of air traffic demand;
- Receive, verify, evaluate, enter and store all relevant ATFM data;
- Monitor the evolution of demand versus capacity identifying all shortfalls and opportunities for optimisation;
- Determine the need for ATFM measures in all phases of ATFM;
- Draw up and publish ATFM plans and any changes to the plan (understand what Information to be published);
- Create, maintain, monitor and adjust all relevant ATFM scenarios and measures;
- Ensure that AOs are provided with advice and guidance for minimising delays and disruption;
- Know and adhere to all relevant operational instructions, operations manuals and letters of agreement (actively locate, read and follow instructions).

ATFMU Operational Staff Job Descriptions

General

The job descriptions of staff operating an ATFM facility will depend on the chosen organization. For the purposes of this document the following job descriptions are proposed. Depending on the local organization responsibilities may be delegated or not, and functions may be combined or subdivided.

- ATFM Unit Operations Manager
- ATFM Unit Supervisor
- ATFM Unit Planner
- ATFM Unit Office (executive)
- ATFMU Support Assistant
- ATFMU CDM partner

ATFM Unit Operations Manager Job description

Each ATFM unit should have a clearly designated line manager directly responsible for the overall operation of the unit. He is the immediate hierarchical superior of the ATFMU supervisors. Although not normally involved in the direct execution of ATFM it is recommended that the Operations Manager be subject to an appropriate form of training and competency assessment.

The job description of the Operations Manager is not defined in this document as this will vary according to the organization management structure. However it is strongly recommended that the Operations Manager acquire and maintain level 2 (ability to **understand** and to discuss the subject matter intelligently in order to represent and act upon certain objects and events) competence in all the subjects contained in the basic training content.

ATFMU Supervisor Staff Job Descriptions

The duties of the supervisor/manager of an ATFM service function include:

- Ensure self-briefing and that all ATFM staff are fully briefed on all aspects of the operation;
- Plan and coordinate with ATC supervisor capacity adjustment for next day's operation ;
- Plan and coordinate ATFM Daily Plan for the next day's operation;
- In coordination with local ATC supervisor manage local and network resources to optimise capacity and minimise delays within their areas;
- Supervise the proper execution of ATFM Measures on day of operation based on ATFM Daily Plan;
- Organize, chair and conduct all necessary CDM conferences;
- Proactively use their experience and authority in an appropriate manner, be creative and use initiative in the resolution of problems that may arise using an inclusive collaborative process;
- Execute all appropriate staff management duties fairly and transparently in accordance with local procedures and processes;
- Manage disruption and contingency procedures and ensure appropriate escalation;
- Ensure ATFMU management is aware of all significant events;
- Ensure accurate log keeping and recording of all significant occurrence.

ATFMU Planner Staff Job Descriptions

The duties of the planning function of an ATFM service include:

- Manage and execute the short term strategic and pre-tactical operational processes and post operational evaluation;
- Maintain a good level of coordination with the ATC Supervisor in order to negotiate the best possible pre-tactical solutions including negotiating improved capacity, applying ATFM regulations where necessary and proposing & implementing the optimum ATFM measures for the network;
- Create and continuously adapt plans and to propose new solutions taking into consideration ever changing circumstances;
- Proactively provide all reasonable assistance to the airspace users in order to facilitate them to optimise their operations;
- Endeavour to maintain the principles of network optimisation and collaborative decision making during all ATFM processes;
- Coordinate ATFM solutions with other operational functions (tactical, AMC, Flight Planning);
- Ensure that the ATFM network plan and all changes are fully communicated with Aircraft Operators, Airports and Air Traffic Control Centres;
- Evaluate execution of the ATFM plan in order to determine lessons learnt and issues for future attention.

ATFMU Officer Job Descriptions

The duties of the ATFM Officer function of an ATFM service include:

- Execute the tactical flow management operational process from a network perspective;
- Constantly monitor traffic loads on all ATFM resources;
- Monitor any potential and actual changes in capacity (e.g. staffing, weather, airport infrastructure, etc.) and implement appropriate measures;
- Maintain a good level of co-ordination with the ACC/airport in order to negotiate the best possible tactical solutions including negotiating improved capacity, applying measures where necessary and proposing & implementing re-routing scenarios;
- Continuously adapt plans and to propose new solutions taking into consideration ever changing circumstances;
- Proactively provide all reasonable assistance to the airspace users and air navigation service providers in order to allow them to optimize their operations;
- Endeavour to maintain the principles of network optimization and collaborative decision making during all relevant ATFCM processes;
- Coordinate tactical capacity adjustment on ATM resources;
- Ensure the promulgation of all measures taken.

ATFMU Support Assistant Job Description

The duties of the ATFM Support Assistant function of an ATFM service include:

- Coordination with external clients (airspace users, ATS units, military) under the supervision of planning and executive staff;
- Reception, validation and input of ATFM data;
- Ensure proper integration of traffic demand inputs;
- Maintenance of operational documentation;

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- Responding to routine queries from external clients, providing standard information and referring issues to planner and officer where appropriate.

Note: The duties of the Support Assistant function will depend on which executive position the support function is assigned to. It is suggested that the same basic training curriculum is followed for support and executive staff, but that the level of knowledge and competency required be at a lower level.

CDM partner Job Description

The duties of CDM partners are not defined in this document. It is suggested that the training authority selects the appropriate subject and competency levels for each CDM partner group based on the detailed training requirements below.

Ab initio ATFM training

Ab-initio training is intended to ensure that new ATFM staff possesses the necessary contextual knowledge in order to follow the more detailed job related training. In many cases staff may already possess this knowledge (e.g. ATC staff will possess the necessary ATC knowledge, Airline operations personnel the necessary aircraft operations knowledge).

Basic Requirements

The possession of the necessary ab-initio subject knowledge should be assessed upon recruitment / assignment. In cases where staff possess the necessary contextual knowledge these staff may be exempted in whole or part from elements of ab-initio training.

There are several basic requirements or pre-requisites for the successful conduct of ATFM training. These include:

- Pre-requisite skills and experience (e.g. experience in ATM, aircraft, airport operations)
- Complementary skills (IT skills, written and oral communication skills, operations analysis, statistics experience)
- Medical requirements
- Language requirements

Normally these competences and requirements form part of the recruitment requirements. The definition of these general requirements is beyond the scope of this document. However, material is readily available in the public domain from other ATM related functions that can assist those responsible for recruitment and training to draw up appropriate general competency and experience requirements.

ATFM Ab-initio training content

The subjects contained in the modules below need to be covered in the Ab-Initio Training phase. It is recommended that the appropriate taxonomy level for ab-initio training is between level 1 (basic knowledge) and 2 (understand and discuss).

Level 1: A basic knowledge of the subject. It is the ability to remember essential points, to memorise data and retrieve it.

Level 2: The ability to understand and to discuss the subject matter intelligently in order to represent and act upon certain objects and events.

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ATFM as described by ICAO is a collaborative process between ATC and the Airspace User facilitated by the ATFM units. Airport operations authorities are also an essential ATFM partner. It is therefore suggested that these partners should be closely associated with the training content development and delivery. The ab-initio training should include facilitated visits of the operations units of these stakeholders.

The modules that need to be covered during the Ab-Initio Training Phase can be found at **Attachment A** to this guidance.

Basic ATFM training

Basic training is the main phase where the core ATFM and associated operational topics are covered in a comprehensive fashion. At the successful completion of the class room training part of the basic training the staff member should be fully prepared to begin his/her period of OJT in the pre-tactical and/or tactical area. He/she should have achieved all the relevant knowledge and skills and be able to understand the concept of ATFM, the operating procedures in place and the use of related equipment.

The start of the training should be preceded by an information session providing the training aims and the overall planning for the entire training. As part of the informative session, trainees would be informed about the design of the training modules, and their expected involvement during the training. Depending on the background of the trainees, it may be beneficial to consider involving the participants in a workshop style environment, encouraging them to develop their own ideas and to motivate them into thinking how the role of the ATFMU can be developed to support the overall objectives of the ATFMU.

The following modules need to be covered during the Basic Training phase:

1. Foundational objectives and principles of ATFM
2. ATFM Institutional and Regulatory background
3. The CDM Process in the context of ATFM
4. ATM Planning
5. ATFM Phases
6. ATFM Demand
7. ATFM Measures (Traffic Management Initiatives)
8. ATFM Contingency Procedures
9. ATFM Data and Tools

This document does not provide a detailed curriculum for ATFM training since this has to be individually prepared based on the pre-requisites for that particular training course. When deciding on training content for a specific Basic Training course, it is important to consider:

- the position that the trainees are going to be trained for, i.e. the job responsibilities;
- the competencies required to carry out the tasks; and
- the background of the trainees, i.e. the competency level.

Based on those three criteria and the training requirements they indicate, the content of the modules described at **Attachment B** to this guidance can be adapted to fit the needs of a specific course.

At **Attachment C** is a description of how one State (Japan) has organized its training for ATFM positions. The attachment includes a sheet where the details of what needs to be covered during the OJT period is listed, items against which the trainee has to demonstrate an acceptable level of knowledge and understanding.

Appendix E Attachment A: Modules to be covered during the Ab-Initio training phase:

Aviation Law and Institutional Background

Phase	Ab-Initio	
Subject	Aviation Law and institutional Background	
Objective	Understand the national and international regulatory context of ATM in general and ATFM.	
Content	Reference Documents	
• International Aviation Structure and Organizations	Chicago Convention, Annex 11, Local legislation and rules, Doc 4444. Doc 9971,	
• National Aviation Structure		
• National Aviation regulations		
• Structure of ANS and ATS		
• Institutional international and national background of ATFM		
• Safety Management Principles		

Air Traffic Management

Phase	Ab-Initio	
Subject	Air Traffic Management	
Objective	Learners shall understand the basic principles of air traffic management and be able to discuss basic operational procedures.	
Content	Reference Documents	
• Air Traffic Control Service (Aerodrome, Approach, En-route, Oceanic)	Annex 11, Doc 4444, Doc 9971, Doc 7030, ATFM Manuals introduction Local ASM rules Annex 2, Doc 7910 local rules	
• Flight Information Service and Advisory service		
• Alerting Service		
• ATFM Introduction		
• Airspace Management		
• Altimetry and Level allocation		
• Separations		
• ATM Data <ul style="list-style-type: none"> ○ ICAO designators ○ Other designators 		
• Flight Plan processing		

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Air Traffic Flow Management

Phase	Ab-Initio	
Subject	Air Traffic Flow Management	
Objective	Learners shall understand the basic principles and origin of air traffic flow management and be able to discuss basic operational procedures.	
Content		Reference Documents
• Objectives of ATFM		Doc 9971
• Benefits of ATFM		
• Principles of ATFM		

Aircraft and Flight Efficiency

Phase	Ab-Initio	
Subject	Aircraft	
Objective	Learners shall understand the basic principles of the theory of flight and aircraft characteristics and how these influence ATS and ATFM operations.	
Content		Reference Documents
• Principles of flight		Local airline SOP Doc 4444, EUROCONTROL ERNIP (flight efficiency section)
• Aircraft Engines		
• Aircraft Systems and Instruments		
• Aircraft categories		
• Factors affecting aircraft performance		
• Aircraft performance data		
• Flight efficiency concepts (economic, environmental)		

ATM Equipment and Systems

Phase	Ab-Initio	
Subject	ATM Equipment and Systems	
Objective	Learners shall understand the basic working principles of equipment that is in general use in ATC;	
Content		Reference Documents
• Radio communications		Local ATM System Manuals
• Radar, Primary, secondary, mode S, CPDLC		
• ADS		
• AFTN, OLDI, AIDC		
• AMAN, DMAN, ASMGS		

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Airport Operations

Phase	Ab-Initio	
Subject	Airport Operations	
Objective	Learners shall <u>understand</u> the operations related functions carried out at airports.	
Content	Reference Documents	
• Aerodrome infrastructure	IATA Slot allocation guidelines Local Airport documentation	
• Airport capacity		
• Airport scheduling, coordination. Airport slot allocation		
• Management of maintenance		
• Management of disruptive events		

Airline Operations

Phase	Ab-Initio	
Subject	Airline Operations	
Objective	Learners shall <u>understand</u> the ATM operations related functions carried out by aircraft operators.	
Content	Reference Documents	
• Airspace Users operating models (hub, point to point, major carriers, low fare sector...)	Local Airline Operations Manuals	
• The airlines operations Centre		
• Airspace Users (scheduled, non-scheduled, business, general aviation, military)		

ATFM and CDM

Phase	Ab-Initio	
Subject	ATFM and CDM	
Objective	Learners shall <u>understand</u> the fundamental CDM concepts underlying effective ATFM	
Content	Reference Documents	
• ATC v ATFM	Doc 9971	
• ATFM; bridging the gap between ATC and airline operations		
• CDM competencies		
• CDM skills		

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Meteorology

Phase	Ab-Initio	
Subject	Meteorology	
Objective	Learners shall understand how meteorology affects ATS operations and aircraft performance and limits ATFM capacity.	
Content		Reference Documents
	• Basic introduction to meteorological phenomena	Local MET Manuals
	• Aviation meteorological forecasts and observations	
	• Understand the meteorological hazards to aviation.	
	• Weather and capacity	

Appendix E Attachment B: Modules to be covered during the Basic Training phase:

Foundational objectives and principles of ATFM

Phase	Basic					
Subject	Foundational objectives and principles of ATFM					
Objective	<ul style="list-style-type: none"> • understand the philosophy of air traffic flow management, including the objectives and principles of ATFM; • know how the ATFM service operates; • know the terms and definitions used; • know the structure and organization of the ATFM service function, including the roles and responsibilities of the stakeholders in the ATFM service; • understand the training requirements for stakeholders in the ATFM service. 					
Content					Reference documents	
<ul style="list-style-type: none"> • Objectives and principles • Benefits of ATFM • How the ATFM service operates • Systems, processes and operational data that supports the application of ATFM • Basics of a CDM process • Link to ASM, Civ/Mil coordination • Organizational structure • Roles and responsibilities 					<ul style="list-style-type: none"> • ICAO Doc 4444, • ICAO Doc 9971, • Local ATFM doc. 	
Role	Operations management	Supervision	Planner	Execution	Support	CDM partner
Level	2	5	5	4	3	2

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ATFM Institutional and Regulatory Background

Phase	Basic					
Subject	ATFM Institutional and Regulatory background					
Objective	<ul style="list-style-type: none"> know the regulatory background, both global and local, for the application of an ATFM service. 					
Content				Reference documents		
<ul style="list-style-type: none"> ICAO standards and recommended practices (Annex 11, Annex 15) ICAO procedures (Doc 4444, doc 7030) Local rules and procedures (AIP, Letters of Agreement, local procedures, Start-up procedures, departure sequence) 				<ul style="list-style-type: none"> ICAO Annex 11 and 15 Doc 4444 AIP and other local documentation 		
Role	Operations management	Supervision	Planner	Execution	Support	CDM partner
Level	2	5	5	4	3	2

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The CDM Process in the context of ATFM

Phase	Basic					
Subject	The CDM Process in the context of ATFM					
Objective	<ul style="list-style-type: none"> • Full knowledge of the process to communicate and exchange operational information among stakeholders on a real-time basis. • Understanding of how the CDM process allow decisions to be taken to best meet the operational requirements of all concerned. 					
Content				Reference documents		
<ul style="list-style-type: none"> • CDM organization and structure <ul style="list-style-type: none"> ○ Support to ATFM stakeholders • Means of communication <ul style="list-style-type: none"> ○ Communications in tactical operations; e-conf, tele-conf etc. • Stakeholder roles and responsibilities • understanding of the interaction with other stakeholders at the various stages of the process <ul style="list-style-type: none"> ○ ATFM Operations and airports ○ ATFM Operations and aircraft operations ○ ATFM Operations and meteorology • CDM requirements and benefits • Link to A-CDM 				<ul style="list-style-type: none"> • Doc 4444 • Doc 9971 • Local ATFM documentation 		
Role	Operations management	Supervision	Planner	Execution	Support	CDM partner
Level	2	5	5	4	3	2

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ATM Planning

Phase	Basic					
Subject	ATM Planning					
Objective	<ul style="list-style-type: none"> • understand the process to optimize available capacity, and how to use other available capacities; • be aware of factors impacting capacity. 					
Content	<ul style="list-style-type: none"> • ATM Planning <ul style="list-style-type: none"> ○ Quantify imbalance between demand and capacity ○ How to address the imbalance at the strategic phase • Capacity assessment models <ul style="list-style-type: none"> ○ Monitoring values ○ Intervention values • ATC Capacity • Staffing schedules and opening schemes of the component ATC Units • Capacity optimisation • Factors reducing capacity • Coordination with ASM 				<ul style="list-style-type: none"> • ICAO Doc 4444 • ICAO Doc 9971 • Local ATFM doc 	
Role	Operations management	Supervision	Planner	Execution	Support	CDM partner
Level	2	5	5	4	3	2

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ATFM Phases

Phase	Basic					
Subject	ATFM Phases					
Objective	understand the main principles for how the ATFM processes are applied during the different phases in order to balance demand and capacity within a given area.					
Content					Reference documents	
<ul style="list-style-type: none"> • Strategic Phase <ul style="list-style-type: none"> ○ Strategic to pre-tactical • Pre-tactical Phase <ul style="list-style-type: none"> ○ Pre-tactical processes ○ Building a pre-tactical plan ○ The concept of a rolling plan ○ Airport role during pre-tactical ○ Aircraft operator role during pre-tactical ○ Special events planning ○ Slot allocation process, incl. principles, computer assisted or manual allocation process, and change process • Tactical Phase <ul style="list-style-type: none"> ○ Re-routing flights ○ Manual actions on a flight ○ Tactical management of the daily plan ○ • Post-Ops <ul style="list-style-type: none"> ○ Requirements for a good post-ops analysis ○ Feedback and evaluation ○ Operational feedback ○ Incident reporting 					<ul style="list-style-type: none"> • Doc 4444 • Doc 9971 • Local ATFM documentation 	
Role	Operations management	Supervision	Planner	Execution	Support	CDM partner
Level	2	5	5	4	3	2

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ATFM Demand

Phase	Basic					
Subject	ATFM Demand					
Objective	<ul style="list-style-type: none"> • know the process of organizing demand into traffic volumes based on particular reference locations; • understand the configurations used and the establishment of pre-defined scenarios; • understand how traffic demand, the tactical traffic situation and met forecasts can be used to optimise capacity; and • understand issues related to occupancy. 					
Content	<ul style="list-style-type: none"> • Establishing demand <ul style="list-style-type: none"> ○ Establishing demand for a sector/airport ○ Establishing demand along predefined major traffic flows • Determining Traffic Volumes based on defined demand <ul style="list-style-type: none"> ○ Determine reference locations ○ Occupancy counts/duration ○ Define major traffic flows in a traffic volume • Implementation and management of pre-defined scenarios • Set up and run simulations • Forecasts • Schedules and flight plans, including missing flight plans • Airport slots • Flight positions 				<ul style="list-style-type: none"> • Local ATFM doc 	
Role	Operations management	Supervision	Planner	Execution	Support	CDM partner
Level	2	4	5	4	3	2

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ATFM Measures

Phase	Basic					
Subject	ATFM Measures (Traffic management Initiatives)					
Objective	<ul style="list-style-type: none"> • know the different measures available and how to apply them in the ATFM service; • understand the role of the stakeholders in the process. 					
Content	<ul style="list-style-type: none"> • Apply, modify and cancel ATFM measures • Capacity Optimisation measures (sector/airport management, complexity reduction) • Demand distribution measures (routing scenarios, level capping, advancing traffic, balancing arrivals/departures, Ground delay) • Demand regulation/reduction measures (Airborne delay/holding, minimum departure intervals, miles in trail, policy, out of area traffic, adherence) • Exemptions and exclusions (compliance monitoring, reporting) • Slot adherence • Slot swapping and slot extensions, policy • Delay causes and attribution • Use tools to support the processes • Compliance monitoring 				<ul style="list-style-type: none"> • Doc 4444 • Doc 9971 • Local ATFM doc 	
Role	Operations management	Supervision	Planner	Execution	Support	CDM partner
Level	2	5	5	4	3	2

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ATFM Contingency procedures

Phase	Basic					
Subject	ATFM Contingency procedures					
Objective	Full understanding of procedures to be applied in the case of a contingency.					
Content	<ul style="list-style-type: none"> • Contingency procedures <ul style="list-style-type: none"> ○ Management of industrial actions ○ Non-availability of airspace/airports • Adverse weather situations <ul style="list-style-type: none"> ○ Convective weather ○ Low visibility ○ De-icing conditions 			<ul style="list-style-type: none"> • Local ATFM documentation 		
Role	Operations management	Supervision	Planner	Execution	Support	CDM partner
Level	2	5	3	3	2	1

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ATFM data and tools

Phase	Basic					
Subject	ATFM Data and Tools					
Objective	<ul style="list-style-type: none"> • ensure full knowledge of the function and use of tools providing support to the application of ATFM; and • understanding of the need for sharing of data. 					
Content	<ul style="list-style-type: none"> • ATFM Support tools <ul style="list-style-type: none"> ○ Main functionalities of tools used ○ Pre-tactical tools used ○ Building a plan in a pre-tactical tool • Environmental data in ATFM support tools <ul style="list-style-type: none"> ○ Static, semi-static and dynamic data • Flight data in ATFM support tools <ul style="list-style-type: none"> ○ Traffic load monitoring (types of traffic counts) ○ Flight activation monitoring ○ Data exchange and sharing 			<ul style="list-style-type: none"> • ICAO Doc 9971 • Local ATFM documentation 		
Role	Operations management	Supervision	Planner	Execution	Support	CDM partner
Level	2	4	5	4	3	1

Appendix E Attachment C: ATFM Training for ATM Officers in Japan

The Air Traffic Management Center (ATMC), is the organization of Japan Civil Aviation Bureau (JCAB) providing ATFM services to the aircraft flying Fukuoka FIR. As soon as transferring into ATMC, a rookie ATM officer starts initial training for an assistant position. The training course includes, but are not limited to:

- Concept of Air Traffic Management
- Organizational structure and regulatory bases of ATMC
- Outline of ATM services (i.e. ASM, ATFM, Oceanic ATM, and CDM)
- Knowledge and understanding of the present ATM environment (i.e. FIRs, Sectors of ACCs, TMAs, ATS routes, Training/Restricted areas, Navigational aids, Operations and performances of aircraft, Information processing system/tool/network related to ATM services, Communication procedures, etc.)

The special training for ATFM positions is scheduled following the above-mentioned initial training. The ATFM training consists of two parts. The first part is classroom lectures and practical simulator trainings. The second part is on-the-job trainings.

The ATFM training starts from the classroom lectures and practical simulator trainings, which are typically programmed as follows:

- Day 1: ATFM system and other associated equipment (*management and coordination procedures of standard routes and alternative routes*)
- Day 2: Capacity value calculation procedures (*weather and ATFM*)
- Day 3: Monitoring and prediction of traffic volume (*flow control procedures*)
- Day 4: Algorithm of Expected Departure Clearance Time (EDCT) calculation (*handling procedures related to diversions at major airports*)
- Day 5: Cross border ATFM (*characteristics of traffic flow and ATC operating procedures in ACC sectors*)
- Day 6: Specifications of airports/aerodromes and ATC operating procedure (*ATM operations plan (OP) and CDM*) (*simulator: extracting relevant information/lists, setting capacities*)
- Day 7: Regulations and agreements on ATFM (*simulator: flow management of ACC sectors*)
- Day 8: In-house operating procedures (*simulator: flow management of RJTT/RJAA*)
- Day 9: Recently introduced/amended procedures (*simulator: flow management of international ATS routes*)
- Day 10: Case studies (*final checks*)

The on-the-job training (OJT) is phased and standardized. The trainee and the training supervisors are supposed to use “OJT check sheet” so that the trainee can master a required skill for ATFM services systematically. The check sheet used in Japan is described below.

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OJT check sheet		phase			Starting date of the phase												
		A	B	C	A:			B:			C:						
ATFM	crew	graduating class	name	month	Number of mark earned by previous month												
					d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12	d13
phase	Monitoring traffic volume			4	hour SV	hour SV	hour SV	hour SV	hour SV	hour SV	hour SV	hour SV	hour SV	hour SV	hour SV	hour SV	
A	able to manipulate FMW and display necessary information timely																
A	able to calculate workload value of sectors per aircraft																
A	able to extract relevant departure flight plans for flow control initiatives																
A	able to evaluate EDCT flow controls before starting/lending the initiatives																
B	able to evaluate EDCT flow controls including a groundstop																
B	able to evaluate flow controls thru assignment of departure intervals																
B	able to evaluate flow controls thru assignment of inflow intervals																
B	able to except particular aircraft from flow controls or demand tallying process before/during initiatives																
B	able to monitor airports/sectors with traffic flow characteristics taken into account																
B	able to analyze flight plans correctly																
B	checking combine/decombine status of sectors and conditions of inflight aircraft by manipulating FPVD																
B	able to plan and input the pre-tactical operation of variable sectors																
C	able to perceive RWY operation patterns of RJTT/RJAA and input correctly																
C	able to input capacity values correctly in accordance with present MET conditions or RWY in use																
C	able to change capacity values in accordance with expected scenarios																
C	able to predict the change of traffic demand graph and cope with it when traffic is surged against prediction																
C	able to evaluate intended flow controls with the initiatives planned in the other ATFM position taken into account																
C	able to cope with the unexpected, such as RWY closure																

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Flow control procedures																			
A	able to figure out and input FROM-TO of EDCT flow controls																		
A	able to figure out and input START-END of EDCT flow controls																		
B	able to coordinate about the start of flow controls with related ATC facilities																		
B	Conveying just enough information (i.e. flow controlled area, measure, start time, end time, FROM-TO, max demand value, capacity value) to an ATM supervisor before starting initiatives timely																		
B	able to make flow controls on inflight aircraft (i.e. assigning inflow intervals, specifying airspeed/altitude/route, assigning airborne holding)																		
B	able to make flow controls on departures by assigning departure intervals																		
B	able to figure out appropriate FROM-TO of flow controls on airports																		
B	able to figure out appropriate FROM-TO of flow controls on sectors																		
B	able to figure out appropriate FROM-TO of flow controls on ATS routes																		
B	able to adjust EDCT appropriately as needed																		
B	balancing the amount of delay of EDCT and arising no reverse in departure sequence in the respective airports																		
B	able to evaluate and decide the end time of flow controls appropriately																		
B	able to coordinate about the end of flow controls with related ATC facilities																		
B	able to cope with the change in ending time of flow controls (including input timing of "TO")																		
B	able to cope with EDCT exceeding the ending time of flow controls																		
C	able to cope with reversed departure sequence arisen by the capacity change during EDCT flow controls																		
C	able to make flow controls on departures by using the groundstop feature																		
C	able to conduct time frame coordination																		
C	able to make a judgement on whether ongoing ATC restrictions should be changed to ATFM initiatives, and able to cope with the change																		

[Marks] 1: incapable/unknowing 2: lack of skill/understanding 3: barely able 4: able 5: well enough

The mark "4" indicates 70-80%, and "5" indicates beyond 80%, which are acceptable level.

When marking "5", the training supervisors should fill in own initials to the right column. The "5" marked training items will be exempted in the subsequent OJT.

The training items rarely happen can be substituted by oral tests in the OJT. The mark through oral tests shall be expressed by an encircled number.

Acquiring "4" three times or more, or acquiring "5" can complete the training item. After completing all the training items of the phase, the OJT moves on to the next phase.

[Abbreviations] FMW: Flow Management Workstation, EDCT: Expected Departure Clearance Time, FPVD: Flow Plan View Display
CCW: Traffic Control Condition Supervised Workstation, SSW: Strategic Statistics Workstation, SAW: Statistic Analysis Management Workstation

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Appendix E – ATFM Training Requirements

ATFM															
phase	Cross Border ATFM	4	d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12	d13
A	able to extract aircraft groups bound for particular destination via particular ATS route														
B	able to adequately communicate with foreign ANSPs														
B	able to make a judgement on whether the ATFM initiatives are consistent with the stipulations of LOA (i.e. flow controlled airport, reason, lead time for coordination, measure)														
B	able to coordinate with related ATC facilities about the flow controls on G585 (SAPRA) requested from Incheon ACC														
B	able to coordinate with related ATC facilities about the flow controls requested from Taipei ACC														
C	able to cope with the unexpected or any change in ATFM initiatives requested by foreign ANSPs														
	Operating procedures for handling diversions														
A	able to notify facilities concerned without omission in accordance with the phase of diversions														
A	able to input start/end to CCW														
A	able to display number of spots available all day in the phase 1														
B	able to allocate airports for diversion appropriately in response to requests														
B	able to manage the case when aircraft request diversion to RJOO														
B	able to manage the case when the width or length of diverting aircraft is unclear (including A346, B777, B773, B77W, etc)														
B	able to manage the case when aircraft request diversion to RJTY or RODN														
C	able to manage the case when aircraft request diversion to airports not registered in CCW														
C	able to manipulate CCW when aircraft canceled diversion														
C	able to make a judgement and coordination about ending respective phases of diversion														

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	Acquiring/providing adequate information													
A	able to extract necessary NOTAMs quickly													
A	able to display MET data of particular airports													
B	Keeping good watch on the situations being faced in the other ATFM positions													
B	able to get information about restricted areas, training/testing areas, etc													
C	able to exchange information with the other ATFM positions that will be affected by the own flow controls decided and being started shortly													
	Handling SAW/SSW													
B	able to manipulate SSW and get daily statistical information													
C	able to make coordination with AO thru SSW about flight planned routes for the next day													
C	able to confirm and input the information about the cancellation of a flight thru SSW													
	Miscellaneous													
B	able to take over the ongoing ATFM services accurately													
C	able to handle rarely happened situations													

[Marks] 1: incapable/unknowing, 2: lack of skill/understanding, 3: barely able, 4: able, 5: well enough

The mark "4" indicates 70-80%, and "5" indicates beyond 80%, which are acceptable level.

When marking "5", the training supervisors should fill in own initials to the right column. The "5" marked training items will be exempted in the subsequent OJT.

The training items rarely happen can be substituted by oral tests in the OJT. The mark through oral tests shall be expressed by an encircled number.

Acquiring "4" three times or more, or acquiring "5" can complete the training item. After completing all the training items of the phase, the OJT moves on to the next phase.

[Abbreviations] FMW: Flow Management Workstation, EDCT: Expected Departure Clearance Time, FPVD: Flow Plan View Display
CCW: Traffic Control Condition Supervised Workstation, SSW: Strategic Statistics Workstation, SAW: Statistic Analysis Management Workstation

APPENDIX F: ATFM IMPLEMENTATION GUIDANCE

INTERNATIONAL CIVIL AVIATION ORGANIZATION



**ASIA/PACIFIC REGIONAL
AIR TRAFFIC FLOW MANAGEMENT
IMPLEMENTATION GUIDANCE**

Version 1.0 September 2016

This document was developed by the Asia/Pacific Air Traffic Flow
Management Steering Group (ATFM/SG)

Approved by APANPIRG/27 and published by the

ICAO Asia and Pacific Office, Bangkok

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INTRODUCTION

Executive Summary

1.1 The large growth of air traffic movements in the Asia-Pacific (APAC) region in recent years has resulted in airport and airspace capacity that is inadequate to accommodate the ever increasing demand. The failure to balance demand and capacity has been exacerbated by airborne holding and excessive tactical Air Traffic Control (ATC) measures, which result in increased airline sector times. In addition, adverse weather often reduces the capacity of airports and airspace, resulting in additional strain on the air navigation service providers (ANSPs).

1.2 While it is a requirement under Annex 11 to the Convention on Civil Aviation for States to implement Air Traffic Flow Management (ATFM), the more urgent impetus to do so is that balancing the demand against capacity will create a more orderly and expeditious flow of traffic. There already have been many successful implementations of ATFM in other parts of the world; however, the APAC region has unique Cross-Border requirements which must be addressed through Regional and Sub-Regional ATFM planning and implementation. Positive progress has been made—with the involvement of all appropriate stakeholders—in defining the required Concept of Operations (ConOps) for the region. This development is ongoing and will evolve as the various initiatives mature.

1.3 The Asia/Pacific ATFM Steering Group (ATFM/SG) recommended that a *distributed multi-nodal ATFM network*, detailed in the *Asia/Pacific Regional ATFM Concept of Operations* (“the Regional ATFM ConOps”) be adopted as a key concept of the *Asia/Pacific Regional Framework for Collaborative ATFM* (“the Regional ATFM Framework”) Both the ConOps and the Framework were formally endorsed by the 26th Meeting of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/26, Bangkok, Thailand, 7-10 September 2015. Cross-Border Multi-Nodal ATFM will ensure a network approach to ATFM on a regional and/or sub-regional basis. Trials of the Cross-Border Multi-Nodal ATFM concept are currently underway with positive results being achieved.

1.4 Capacity growth should always be a priority and have ongoing focus by ANSPs and airports. ANSPs should carry out analysis of their operations to establish if ATFM/CDM is required and if required, which concept as described in this document should be implemented. Should a State not have requirements for ATFM, they are expected to support other States that are implementing ATFM/CDM by adhering to agreed region procedures. Cooperation and collaboration between all stakeholders in the region will ensure successful implementation of ATFM/CDM in the region, which will benefit all users by reducing airborne holding, increasing predictability, and providing greater operational flexibility.

Scope and Purpose of the ATFM Implementation Guidance Document

2.1 The purpose of this document is to provide guidance to the ANSPs in the APAC Region on ATFM/CDM implementation strategies, with particular emphasis on Cross-Border Regional ATFM/CDM. In addition to this, the document will support the the Regional ATFM Framework to ensure synergies during implementation of ATFM in the region.

2.2 There is clear evidence that implementation of ATFM/CDM in other areas of the world has brought significant benefits to the aviation community. For ATFM/CDM to be effective in the APAC region, Regional ATFM procedures and Cross-Border operations will be required due to the unique operational requirements of the region.

2.3 ATFM/CDM implementation is a complex task and this document is not the definitive manual on implementation; however, it is intended to serve as a guide for Cross-Border Regional ATFM implementation for APAC and should be read in conjunction with other relevant documentation on ATFM implementation.

2.4 The International Civil Aviation Organisation (ICAO) Doc. 9971 – Manual on Collaborative ATFM, together with the Regional ATFM ConOps and the Regional ATFM Framework guide ANSPs in the planning and implementation of interoperable cross-border ATFM. Regional ATFM ConOps details the ATFM concept for the Region, and the Regional ATFM Framework details the “what and when” of implementation. This document, the Asia/Pacific Regional ATFM Implementation Guidance Document, provides additional guidance (the “how”) for states in the APAC region and will assist ANSPs with both identifying and implementing the appropriate ATFM capability in their areas of responsibility. It is fully expected that this document will evolve as the Cross-Border Multi-Nodal ATFM concept further develops.

.....

LIST OF ACRONYMS

A-CDM	Airport Collaborative Decision Making
AATIP	ASEAN Air Transport Integration Program
ACC	Area Control Centre
ADP	ATFM Daily Plan
AFIX	Arrival Fix
AFTN	Aeronautical Fixed Telecommunications Network
AMAN	Arrival Management
ANSP	Air Navigation Service Provider
APAC	(ICAO) Asia and Pacific Region
APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Regional Group
ASBU	Aviation System Block Upgrades
ASEAN	Association of Southeast Asian Nations
ATC	Air Traffic Control
ATCC	Air Traffic Control Centre
ATCO	Air Traffic Controller
ATCSCC	Air Traffic Control System Command Center
ATFM	Air Traffic Flow Management
ATFM/CDM	ATFM Collaborative Decision Making
ATFM/SG	ICAO Asia/Pacific Region ATFM Steering Group
ATM	Air Traffic Management
ATS	Air Traffic Service
AU	Airspace Users
CAAS	Civil Aviation Authority of Singapore
CANSO	Civil Air Navigation Services Organisation
CBA	Cost Benefit Analysis
CDM	Collaborative Decision Making

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CFMU	Central Flow Management Unit
CLDT	Calculated Landing Time
CNS.....	Communication, Navigation, and Surveillance
CO ₂	Carbon Dioxide
ConOps	Concept of Operations
CTO	Controlled Time Over
CTOT	Calculated Take-off Time
DCB	Demand and Capacity Balancing
DMAN	Departure Management
ECAC.....	European Civil Aviation Conference
EU	European Union
FAA	Federal Aviation Administration
FDP	Flight Data Processor
FIR	Flight Information Region
FIXM.....	Flight Information Exchange Model
FMP	Flow Management Position
FMU	Flow Management Unit
FOC.....	Flight Operation Centre
FPL.....	Flight Plan Message
GDP	Gross Domestic Product
GDP	Ground Delay Program
HITL	Human-In-The-Loop
IATA	International Air Transport Association
ICAO.....	International Civil Aviation Organisation
ILS.....	Instrument Landing System
LOA	Letter of Agreement
MINIT	Minutes in Trail

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MIT	Miles in Trail
NARAHG	North Asia Regional ATFM Harmonisation Group
NAS	National Airspace System
NavAid.....	Navigation Aid
NOPS	Network Operations
PBN.....	Performance-Based Navigation
RFIX	En-route Fix
SG	Steering Group
SME	Subject Matter Expert
US/U.S.	United States of America
VIP	Very Important Person
WATS	World Air Transport Statistics
WSG.....	World Slot Guidelines

BACKGROUND OF ATFM/CDM IN THE ASIA/PACIFIC REGION

Introduction

1.1 In 2014, after identifying the need to have regional Air Traffic Flow Management (ATFM) in the region, the International Air Transport Association (IATA) initiated a project to establish a regional baseline of ATFM capability with particular reference to Cross-Border ATFM/ Collaborative Decision Making (ATFM/CDM) capabilities. The project, endorsed by the ATFM/SG, conducted a region wide survey of Air Navigation Service Providers (ANSPs) to establish the regional base-line of ATFM capability. The results showed that while all ANSPs in the Asia-Pacific (APAC) region have implemented or have plans to implement ATFM/CDM, little collaboration in regard to Cross-Border ATFM/CDM is evident. As a result, the ATFM/SG endorsed a second stage of the project to develop an Implementation Guidance for Cross-Border ATFM/CDM for the APAC region.

1.2 It was recognised that a centralised ATFM concept, as practised in other parts of the world, is not feasible in the APAC region. For ATFM/CDM to be fully effective in the region, a scalable, collaborative, cohesive, and flexible approach for achieving integrated and coordinated ATFM capabilities within the APAC region will need to be adopted. As a result of this and recommendations from Phase 1 of the IATA project, the Asia/Pacific ATFM/SG accepted and endorsed the Multi-Nodal ATFM concept as the regional foundation for Cross-Border ATFM.

History of ATFM/CDM Implementation

1.3 The 1990s saw air traffic increases previously unseen in the U.S., bringing with it unprecedented delays. There were few tools available for CDM and fewer still for common situational awareness. The Federal Aviation Administration (FAA) found their already limited resources extremely strained. Air traffic controllers (ATCOs) had limited and untimely access to delay information around the National Airspace System (NAS) and were unable to adequately manage ground operations for congested or weather-impacted airports and airspace. Moreover, with a decentralised database of aircraft route data, there were no systems to identify problems or areas of inefficiencies throughout the NAS. Officials at the FAA sought procedures and systems that would aid in information-sharing and through industry partnerships developed tools to assist them in predicting demand and consequently balancing demand against capacity. History has shown that these initiatives have enhanced safety and saved many tons of fuel over time.

1.4 In Europe the Central Flow Management Unit (CFMU) was created in 1995 as a response to the chronic delays plaguing European air traffic throughout the eighties. Based on ICAO's concept of centrally coordinated ATFM, and with the support of the European Civil Aviation Conference (ECAC) Member States, the CFMU succeeded in containing the delay crisis at the time. As a result, strong operational collaboration processes were put in place between all aviation actors—especially ANSPs and airlines—to manage traffic and delays in partnership.

1.5 ICAO has recognised that it is necessary for all ANSPs to have a common understanding of ATFM/CDM. To that end, ICAO published the following definition: “A *service established with the objective of contributing to a safe, orderly, and expeditious flow of air traffic by ensuring that Air*

Traffic Control (ATC) capacity is utilised to the maximum extent possible, and that the traffic volume is compatible with the capacities declared by the appropriate Air Traffic Services (ATS) authority.”

1.6 Additionally, ICAO has published *ICAO Doc 9971- Manual on Collaborative ATFM Part 1 and 2* developed by Subject Matter Experts (SMEs) in ATFM/CDM from across the globe. Stakeholders are encouraged to read *ICAO Doc 9971* in conjunction with this APAC ATFM Implementation Guidance document.

1.7 To improve efficiency and optimise operations in the APAC region, APANPIRG/24 in June 2013 endorsed the *Asia Pacific Seamless Air Traffic Management (ATM) Plan*. The objective of the Seamless ATM Plan is to facilitate Asia/Pacific Seamless ATM operations by developing and deploying ATM solutions capable of ensuring the safety and efficiency of air transport throughout the APAC region. The Plan provides a framework for a transition to a Seamless ATM environment by establishing an expectation of harmonised and interoperable systems in order to meet future performance requirements. Aviation System Block Upgrade (ASBU) B0-NOPS *Network Operations* (of which ATFM taking a Network view is a key element) is a critical part of the plan and is also one of APANPIRG’s top ten regional priorities.

APAC Regional ATFM/CDM Implementations and Strategies

1.8 In 2014, the study commissioned by IATA established a baseline view of ATFM capability and interoperability of States in the APAC region. It is important to list the key findings here as this implementation Guidance will address the shortcomings identified by the study.

1.9 The results of the study are summarised below (status in some countries may have changed since the study was completed):

- All APAC States have recognised the requirement for ATFM.
- Few States have well-established ATFM Organisational structures.
- ATFM infrastructure is very diverse; only two States, Australia and Japan have mature ATFM systems, while others have varying degrees of infrastructure, as indicated by the corresponding colours in the map and legend. See (**Figure 1**).
- CDM between States is minimal. While there is a common desire for better CDM, there is no standard for the region. (**Figure 2**).
- There is no substantive interoperability between the States. There is little official ATFM procedure agreement between States as written in the Letters of Agreement (LOAs). See (**Figure 3**).
- Airport capacities are declared for most major airports in the region, but only five States are declaring capacities for airspace.

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- Very few countries are performing Demand Capacity Balancing (DCB) in the strategic phase of ATFM beyond allocating Airport Slots via the IATA World Slot Guidelines (WSG).
- Only the limited number of States with mature ATFM systems are able to carry out DCB in the pre-tactical phase.
- States without mature ATFM systems that are encountering DCB issues do not have any facility to monitor demand against capacity.
- Only five States (Australia, New Zealand, Philippines, China, and Japan) have the ability to issue ATFM Measures using allocated slot times to smooth traffic into airports.
- The major development in Cross-Border ATFM implementation is the Civil Aviation Authority of Singapore (CAAS)-initiated Regional ATFM ConOps. ANSPs and relevant stakeholders from four States participated in the development of the concept. The resultant collaborative trial of the concept—Distributed Multi-Nodal ATFM Operational Trial—is underway with the following nine States participating: Australia, China, Hong Kong China, Indonesia, Malaysia, Singapore, Thailand, Philippines, and Vietnam.

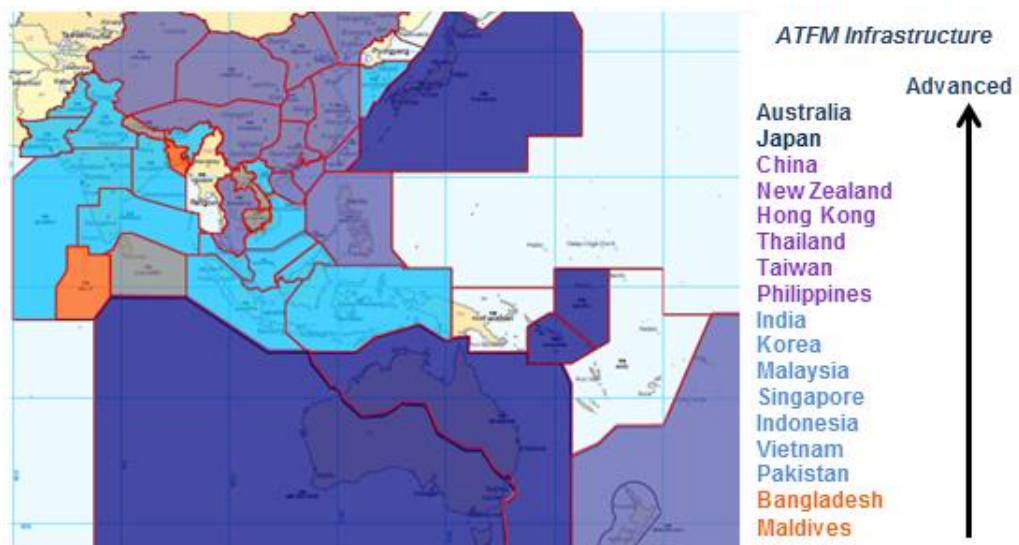


Figure 1: ATFM Infrastructure

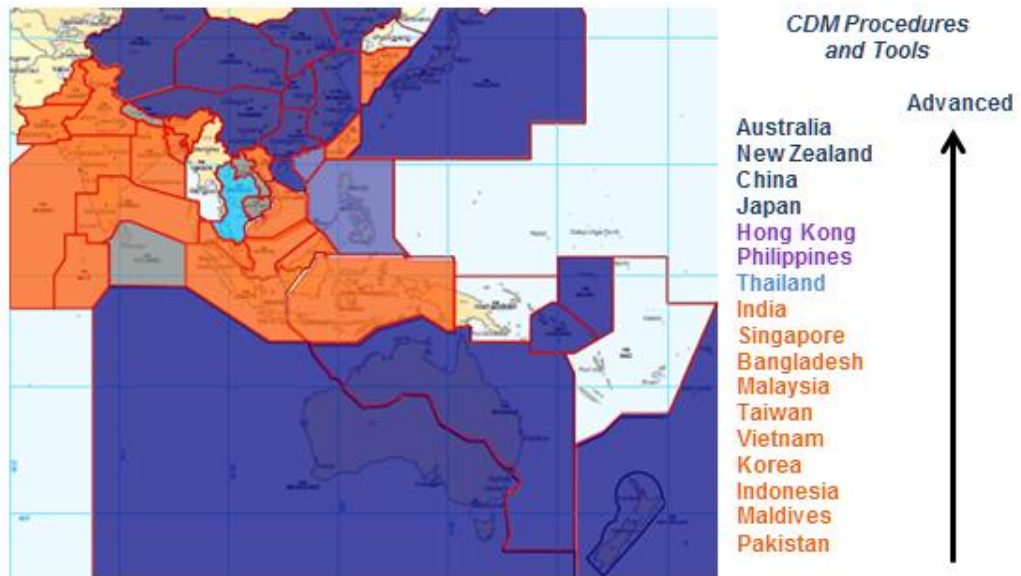


Figure 2: CDM tools and procedures between States

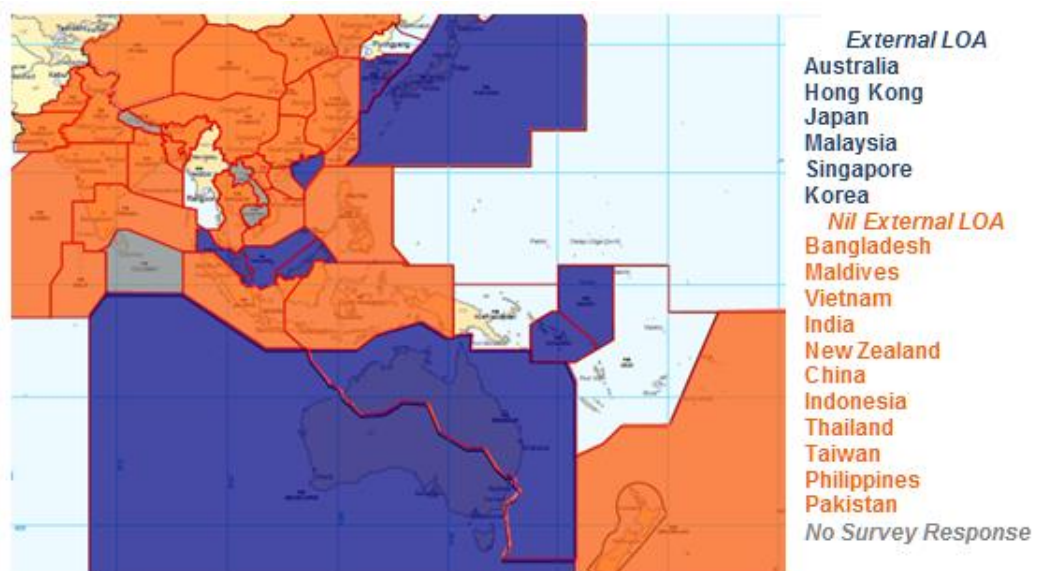


Figure 3: External LOA between States

1.10 The overarching finding of the study was that while all the surveyed ANSPs had ATFM/CDM implementation plans, there were no current Cross-Border arrangements to facilitate ATFM/CDM. There are initiatives to commence with Cross-Border ATFM which are discussed in following sections

ATFM/CDM in APAC and the Requirement for Cross-Border Regional ATFM/CDM

1.11 The APAC Region has experienced strong growth of 5–6% per year and is forecasted to continue this trend for the foreseeable future. Most regional hubs are already operating near the limits of their current capacity, and solutions to efficiently manage traffic flows are carried out to a large degree in isolation by individual ANSPs. During 2012, a Civil Air Navigation Services Organisation (CANSO) initiative led to Singapore, Hong Kong China, and Thailand commencing CDM trials. These trials showed that with the cooperation of ANSPs in the region, ATFM could be implemented; however, the existing centralised model of ATFM operations as in the Americas, Australia, South Africa and Europe was considered not suitable for the APAC region.

1.12 The traditional model of ATFM initiatives, which relies on delaying domestic traffic to achieve effective demand metering is not possible for a number of APAC ANSPs due to the lack of domestic traffic. During the development of the Regional ATFM ConOps it was determined that a 70% participation of flights is needed for ATFM measures⁷ to be effective. Additionally, the makeup of the region, particularly South-East Asia, with relatively small Flight Information Regions (FIRs) require a Cross-Border solution..

Understanding the impact of ATFM/CDM implementation

1.13 ATFM is now entrenched in the ICAO ATM operational concept, the ICAO Aviation System Block Upgrade - Block 0 and Block 1 (ASBU B0/B1) and the Asia Pacific Seamless ATM Plan. Some ANSPs in the region, such as Japan, Australia, and New Zealand, have implemented ATFM/CDM these implementations have had significant positive impact on operations resulting in both qualitative and quantitative benefits.

1.14 For ATFM to have a sustained impact, the cooperation of the majority of stakeholders is required. Stakeholders' participation in ATFM includes activities such as ANSPs being required to respect ATFM measures applied in other Flight Information Regions (FIRs) that will affect operations in their own areas of responsibility, Aircraft Operators having to manage assigned delay by either taking ground delay or providing en-route delay intent to comply with delays imposed, and Airport Operators accommodating flights being delayed at departure airports. While ATFM requires the various user groups to actively participate in ATFM measures, the additional workload ultimately provides network benefits. Estimated benefits are discussed in later sections

1.15 When increased ATFM measures are introduced in the APAC region, whether domestically or Cross-Border, stakeholder education, interaction and consultation are necessary to ensure impacts, goals and overall network benefits are well identified and understood.

⁷ ICAO Doc 9971 – *Manual on Collaborative Air Traffic Flow Management (Chapter 6)* defines ATFM Measures as *techniques used to manage air traffic demand according to system capacity. Some ATFM measures must be considered as control instructions or procedures.*

1.16 ATFM/CDM implementation will require new or changed working procedures, and a good understanding and application of these procedures will be required by all stakeholders for ATFM/CDM to be successful. It is essential that a collaborative approach is taken when agreeing new work practices and ensuring comprehensive communications and training is delivered to all stakeholders.

Cultural change

1.17 ATFM/CDM implementation requires a significant culture change in all stakeholder organisations. This culture change is required at all levels within organisations. In previous ATFM/CDM implementations, when a culture change was embraced at executive and senior management levels, the change has been effective. A change management process needs to be executed to ensure the culture change occurs. In particular, operational staff (ATCOs and pilots) are often reluctant to accept the change to a structured ATFM environment. It is essential that these groups are fully engaged and supportive of ATFM and special attention should be given to their training and education. This aspect of implementation should not be under-estimated and can be managed by education and effective change-management programs.

Benefits of ATFM/CDM implementation

1.18 The following are possible benefits derived as a result of ATFM/CDM implementation, whether Domestic or Cross-Border Regional ATFM. There are very clear advantages to the network if ATFM/CDM is conducted in accordance with a Cross-Border ConOps.

Qualitative benefits

- More timely and informed collaborative decision making which takes the entire region's requirements into consideration.
- A coordinated network ATFM approach to all air traffic flying in the region would result in a seamless, optimised, expeditious flow of traffic throughout the region.
- With the implementation of ATFM, automated and procedural communication will be implemented, benefiting not only ATFM communication, but also ATC communications.
- As ATFM develops in the region, States will be incentivised to collaborate on airspace design so as to accommodate better flows of traffic to accommodate ATM and ATFM procedures.
- Enhanced situational awareness for the region through shared information.
- As Regional ATFM matures, better planning and CDM in all phases of ATFM, including post-event analysis will occur.
- The traditional model of ATFM implementation requires only domestic traffic to adhere to the controlled times issued. The *Regional ATFM* ConOps requires all aircraft to adhere to assigned delays. Therefore, States with no domestic flights, such as Hong Kong China and Singapore, can perform demand and capacity balancing.
- In addition, if only domestic traffic is subject to ATFM measures, those aircraft can be unfairly delayed while non-participating aircraft (i.e., international flights) are not.

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With the Regional ATFM Concept, all traffic is expected to be subject to ATFM measures, and the delay is distributed fairly and equitably.

- Establishment of Regional ATFM will lead to enhanced information-sharing and CDM practises during events such as volcanic eruptions (as the FAA Air Traffic Control System Command Center [ATCSCC] and the EUROCONTROL Network Manager have collaborated during recent volcanic eruptions), disease, political unrest, and war.

Quantitative benefits

1.19 The aviation industry contributes significantly to State economies. In the Asia-Pacific region, the air transport sector supported 4.8 million jobs (2012) and contributed US\$265 billion to the Gross Domestic Product (GDP). Oxford Economics forecasts the number of jobs supported by aviation and tourism impacts will increase by 91% by 2032.⁸

1.20 Successful Regional ATFM will optimise traffic flows by balancing demand with the available system capacity. This is achieved through the implementation of flow management measures based on an accurate prediction and assessment of demand and capacity. These flow management measures transfer existing delay to a more efficient phase of operation. Efficiency encompasses many variables but typically focuses on fuel burn savings, which are impacted by aircraft type, configuration, weight, altitude, etc. While the goal is the elimination of airborne delay, the benefit of transferring delay from the arrival phase (holding, speed control, vectoring) to ground delay for air carrier operations has resulted in an average savings of US\$47 per minute in 2014. The Regional ATFM operational concept provides an additional mechanism to transfer assigned delay from the terminal area phase to the en-route phase of flight. It is estimated the benefit gained by absorbing some assigned delay more efficiently is projected to yield an average savings of US\$42 per minute. Table 1 shows the possible quantitative benefits resulting from ATFM in the region.

2	ATFM	2014	2019
	Regional ATFM	US\$250 – \$300M	US\$600M – \$800M
	Domestic & Regional ATFM	US\$660 – \$810M	US\$1.1B – \$1.4B

Table 1. Possible quantitative benefits of Regional ATFM

1.21 A complete list of benefits can be found in 0.

⁸ Aviation Benefits Beyond Borders, Air transport Action Group, April 2014.

SETTING UP AN ATFM/CDM PROJECT

Requirement assessment and gap analysis assessment

2.1 ANSPs should perform an analysis of ATM operations to determine whether ATFM is required in their environment and if so, the scope of ATFM implementation, capacity enhancement initiatives must be considered in conjunction with any assessment of the requirement for ATFM. The operational requirements assessment should determine the scope of ATFM implementation; either Domestic ATFM or Cross-Border ATFM as detailed in the Regional ATFM Framework. This assessment can be carried out internally or by an external experienced agency. Once the scope of ATFM is identified, a gap analysis needs to be carried out to identify the existing baseline, technical capabilities, and implementation requirements for the State concerned.

General ATFM/CDM implementation process

2.2 A general process for ATFM/CDM implementation is presented in

2.3 Figure 4. It shows the implementation process of ATFM/CDM, whether it be Domestic or Cross-Border Regional ATFM/CDM. The process commences with an interest in implementing ATFM/CDM from the Strategic phase to Post-Operational analysis with the entire process being regularly re-evaluated as requirements change. During the entire process there is continued stakeholder participation. A Cost Benefit Analysis (CBA) is not indicated; however, it should be performed.

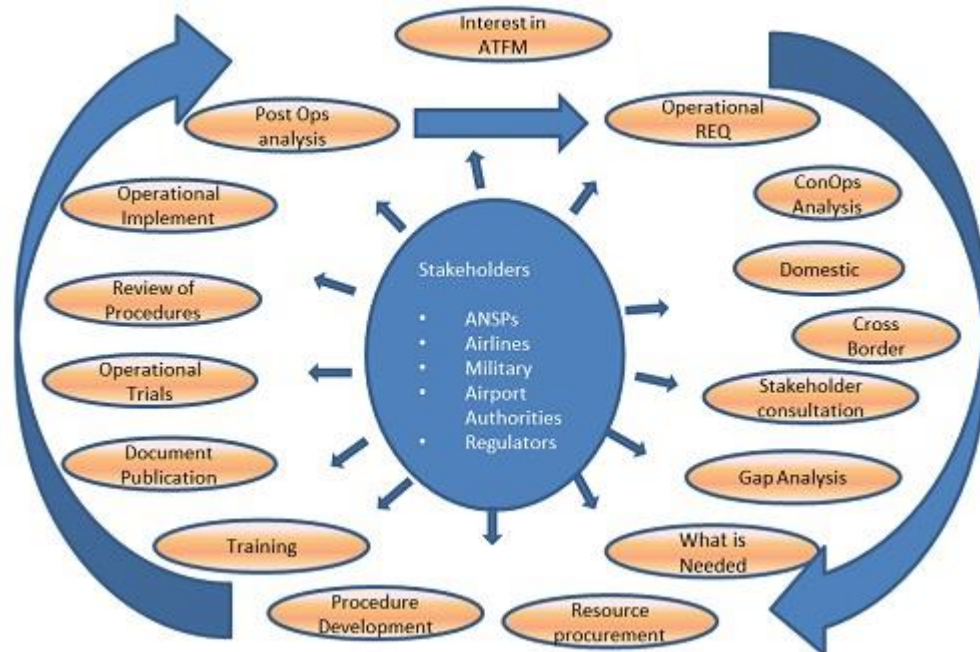


Figure 4: Typical ATFM/CDM process
Educating and convincing all stakeholders

2.4 Most stakeholders will realise the value and benefits of ATFM/CDM implementation; however, previous implementations have shown that some stakeholders require education and to be convinced of benefits before completely accepting and becoming part of the implementation process. Programs need to be developed to educate all levels in stakeholder organisations, from operational staff

to executive management. These programs could include workshops, seminars, etc. Printed and electronic media is also a valuable vehicle in educating stakeholders.

2.5 Experience shows it is imperative to get executive and senior management support. It is important to identify the correct stakeholders from the beginning of ATFM/CDM implementation and include them from the outset of ATFM/CDM implementation. Stakeholders may include but may not be restricted to the following:

1. Flow Management Units (FMUs);
2. Aircraft Operators – airlines, military, police, business aviation and general aviation;
3. Pilots;
4. Air Traffic Control (ATC) units
5. Airport authorities;
6. Adjoining ANSPs; and
7. Regulatory bodies.

Role of stakeholders

2.6 Stakeholders have distinct roles in ATFM /CDM. The following sections provide a high-level (i.e., non-exhaustive) description of their roles.

FMUs

- Daily Airport and Airspace Capacity determination
 - Demand Prediction – Flight progress is via manual input or automated data feed (e.g., ATM Automation System Flight Data Processor [FDP] or Aeronautical Fixed Telecommunications Network [AFTN])
- Capacity Management – Inputs from Flow Management Position (FMP) and Flight Operation Centre [FOC] are via ATFM web-based interface
- Assess effects of imbalance to traffic beyond capacity impact range
- Stakeholder CDM engagement
- Model Flow programs and set hourly capacity and arrival slots to ensure demand/capacity balance
- Slot assignments can be viewed via software web interface and notifications.
- Monitor effectiveness of ATFM measure and amend as required
- Provide daily post-operational analysis

Aircraft Operators

- Participate in CDM process (Telecons)

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- Supplying flight updates via ATS methods or through CDM processes
- Monitor flight progress for compliance
- Manage flight delay intent and substitute flights if necessary

Pilots

- Follow ATC operational procedures when trying to achieve compliance by meeting intended delay absorption
- Communicate potential non-compliance

ATC

- Departure Airports – Monitor compliance with Calculated Take-Off Times (CTOTs)
- En-route – Aware of ATFM Measures but minimal interventions required
- Arrival phase of flight – Assist with compliance with Calculated Time Over Fix

Airport Operators

- Departure Airports – Respect ATFM-measure-affected departures and assist in meeting departure times based on Airport capacity
- Declare daily maximum allowable delay at gates

Adjoining ANSPs

- Reach agreement on Cross-Border operational procedures
- Write and sign LOAs – (Specific ATFM LOA Templates should be developed)

Regulators

- Coordinate with appropriate government body to ensure legislation supporting ICAO Document Annex 11 (Section 3.7.5, a and b) “develop and publish regulations applicable to all ATFM/CDM stakeholders, responding to this legislation.”
- Ensure publication of ATFM procedures and information in the State Aeronautical Information Publication

Setting the objectives for ATFM/CDM Implementation

2.7 All ATFM/CDM partners have the common objective of providing a safe expeditious flow of traffic to Airspace Users to ultimately benefit passengers and cargo movement. To achieve this main objective, there are many supporting objectives such as:

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- Enhance Safety
- Reduce fuel burn
- Reduce carbon emissions
- Increase situational awareness
- Improve predictability
- Optimise airspace and airport operations

2.8 In addition to the aforementioned objectives, Cross-Border Regional ATFM objectives include:

- Enable ATFM/CDM to be effectively implemented in States where there is insufficient domestic traffic
- Enable and apply ATFM measures to regional flights and across multiple FIRs
- Implement seamless ATFM across multiple FIRs

IMPLEMENTATION

Introduction

3.1 The ATFM baseline study indicated that all regional ANSPs, in accordance with ICAO requirements, have intentions of implementing ATFM; these initiatives vary from existing tactical ATFM measures to advanced strategic, pre-tactical, and tactical automated systems.

When should ATFM be implemented

3.2 ANSPs should have a plan for implementing ATFM, either domestically or regionally, depending on their requirement and level of maturity. Even though ANSPs may not have the operational requirement to implement ATFM domestically, they may be expected to participate in Cross-Border Regional Multi-Nodal ATFM by adhering to regionally accepted procedures, for example, ensuring that all flights subject to an ATFM measure comply with CTOT.

3.3 During the requirements analysis (detailed in section 3.3) ANSPs should ascertain when and in what form ATFM is required, and what trigger points need to be identified for implementation. For example, the trigger points could include when certain demand levels are reached which would allow the required lead time to implement the appropriate ATFM processes.

3.4 The level of an ATFM service required in each ANSP will depend on a number of factors as previously described. It is important to note that an ATFM service may be simple or complex depending on the requirements in an individual ANSPs area of responsibility. For successful implementation in the region it is important that all ATFM implementations are harmonized.

ATFM/CDM Requirements Analysis

3.5 ANSPs should perform an analysis of ATM operations to determine whether ATFM is required in their environment and if so, the scope of ATFM implementation. Factors which need to be taken into consideration during this assessment are as follows (note that this should not be construed as an exhaustive list):

- Whether demand exceeds capacity on a regular basis in either airspace or **at** airports.
- Whether there are periods of high workload on ATC followed by periods of minimal traffic.
- Whether there are initiatives to increase capacity that are in line with predicted demand.
- What is the anticipated growth in traffic movements and whether that demand will exceed resource capacity in the future.
- What are the military airspace and operational impacts on capacity of airspace.

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- Whether there are significant increases in seasonal demand (holiday season) resulting in demand exceeding capacity.
- Whether airlines are experiencing increased sector times.
- Whether there are noise abatement procedures causing reduction in capacity.
- Whether there is excessive airborne holding, vectoring, speed control, and/or surface queuing.
- Whether there are capacity constraints (e.g., weather, very important person [VIP] movements, sporting events, military exercises, frequent equipage outages, political unrest, labour issues).
- Whether there are flights that depart from airfields within their area of jurisdiction to other FIRs where ATFM measures are in place.
- Participation in Cross-Border ATFM initiatives.
- What is the ratio of domestic traffic versus international and regional traffic.
- Whether there are multiple resources (airports or airspace) within the area of jurisdiction which require ATFM/CDM.
- What is the type and equipage of aircraft fleet.
- What are the Communication, Navigation, and Surveillance (CNS) capabilities of ANSP.
- Are major changes in CNS equipage changes likely to affect capacity during implementation.
- What are airport resources and processes (Airport Collaborative Decision Making [A-CDM]).
- Once the requirements are identified a gap analysis needs to be carried out to establish the existing baseline, technical capabilities, and develop ATFM implementation requirements for the State concerned.

ATFM/CDM ConOps

3.6 Once the ATFM/CDM implementation Requirements are established, the ANSP will need to develop a ConOps for its area of responsibility. This ConOps could be limited to one or be a combination the ATFM/CDM ConOps described in the following sections.

Domestic ATFM

3.7 The State may have the required number of domestic flights to make Domestic ATFM effective without including regional and international flights. As previously stated, it has been calculated that a minimum of 70% participation of flights in an ATFM program such as a Ground Delay Program (GDP) is the minimum required to gain operational and efficiency benefits. In this chosen option, only domestic flights will be subjected to ATFM measures; regional and international flights may be exempt. While a State may have enough domestic flights for ATFM to be implemented, it is advisable that a concept including regional and international flights is considered to ensure the distribution of delay is fair, equitable, and efficient.

3.8 Examples of Domestic ATFM/CDM implementations (South Africa, Australia, and Japan); have all recognised the requirement to include regional and/or international flights in ATFM measures. South Africa is considering including flights from surrounding States, and Australia is planning to include long-range flights in its ATFM program. Japan is part of the North Asia Regional ATFM Harmonisation Group (NARAHG) regional group which is considering how to develop Cross-Border ATFM/CDM in this sub region.

3.9 In APAC, ANSPs may initially implement Domestic ATFM/CDM; however, long-term plans should be to “upgrade” to Cross-Border Regional ATFM.

Key components of the Domestic ATFM/CDM concept.

- System Capability and functionality
 - ANSP independently manages demand/capacity of its own Airport(s).
 - Only domestic traffic is subject to ATFM measures.
 - Stakeholders/ANSPs communicate via Internet/Telecommunications networks.
 - CDM is performed by stakeholders via software web interfaces.
- Specify Capacity and Predict Demand
 - Demand Prediction – Flight progress is via manual input or automated data feed (e.g., FDP or AFTN).
 - Capacity Management – Inputs from FMP and FOC are via ATFM web-based interface.
- Evaluate Alternatives, Initiate/Modify ATFM Measures
 - Domestic Aircraft Operators manage the ATFM Measure delay assigned to flights.
 - Slot assignments can be viewed via software web interface and notifications.

Cross Border Regional ATFM/CDM

3.10 While it is not envisaged any state will implement a Cross Border Regional ATFM/CDM ConOps in isolation, the Cross Border Regional ATFM/CDM ConOps is explained for understanding.

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3.11 A State/ANSP implements and operates a single independent ATFM/CDM system applicable to their environment which would comprise a single ATFM entity employing concepts as described in the Regional ATFM ConOps. Implementation of this concept does not require a “Node” and can be implemented by an ANSP that implements an ATFM measure for a single resource. Key components of the Cross Border Regional ATFM/CDM ConOps include:

- Regional acceptance of the APAC Regional ATFM ConOps
 - Stakeholders agree to the adoption of the APAC Regional ATFM ConOps irrespective of the ConOps adopted in their area of jurisdiction.
 - States commit to planning commitments for ATFM/CDM implementation.
 - All stakeholders commit to time lines set for APAC Cross-Border Regional ATFM implementation.
 - Agreement to a common set of procedures for departure, destination and en-route ANSPs, Airport Operators, and Aircraft Operators. Continued education of all stakeholders of the benefits, both qualitative and quantitative, of ATFM/CDM implementation. Participating ANSPs to initiate the effort to build their individual capabilities and practise ATFM in accordance to ICAO guidance to provide ATFM service
- Cross Border Regional ATFM ConOps
 - ANSP has an independent ATFM System.
 - An ANSP implements ATFM even though surrounding states have not done so.
 - ANSP independently manages demand/capacity of its own resources.
 - To achieve at least 70% flight participation, regional, international, and possibly airborne flights are required to be included in ATFM Measures.
 - Agreements with ANSPs having flights departing from their airspace to ANSPs with Cross Border Regional ATFM ConOps operating to respect CTOTs and Controlled Times Over (CTOs) as issued.
 - Implementation of this concept does not require a “Node” (as described in Cross- Border Multi-Nodal Regional ATFM/CDM).
 - Agreement to a common set of procedures for departure, destination, and en-route ANSPs, Airport Operators, and Aircraft Operators.
 - Participating ANSPs to initiate the effort to build their individual capabilities and practise ATFM in accordance to ICAO guidance to provide ATFM service.
 - Participating stakeholders connected via Internet interfaces.
 - Continued education of all stakeholders of the benefits both qualitative and quantitative of ATFM/CDM implementation.
- Specify Capacity and Predict Demand
 - Demand Prediction – Flight progress is via manual input or automated data feed (e.g., FDP or AFTN).
 - Capacity Management – Inputs from FMP and FOC are via ATFM web-based interface.

- Evaluate Alternatives, Initiate/Modify ATFM Measures
 - Aircraft Operators manage the ATFM Measures delay assigned to flights.
 - Aircraft Operators perform CDM with Airport Operators for ground/surface delay intent.

3.12 In addition to including airborne and international flights into ATFM measures, the Regional concept has a future enhancement which envisages Aircraft Operators may specify their assigned program delay to various stages of the flights; Gate, Surface (between gate and departure), or en-route. This ability for Aircraft Operators to specify their delay intent gives additional operational flexibility to achieve the same result.

Cross-Border Multi-Nodal Regional ATFM/CDM

3.13 A State/ANSP implements and operates an ATFM system based on the application of remote CTOT delivery impacting multiple FIRs/ sectors of airspace or airports coordinated via one single node within the country (**Figure 5**).

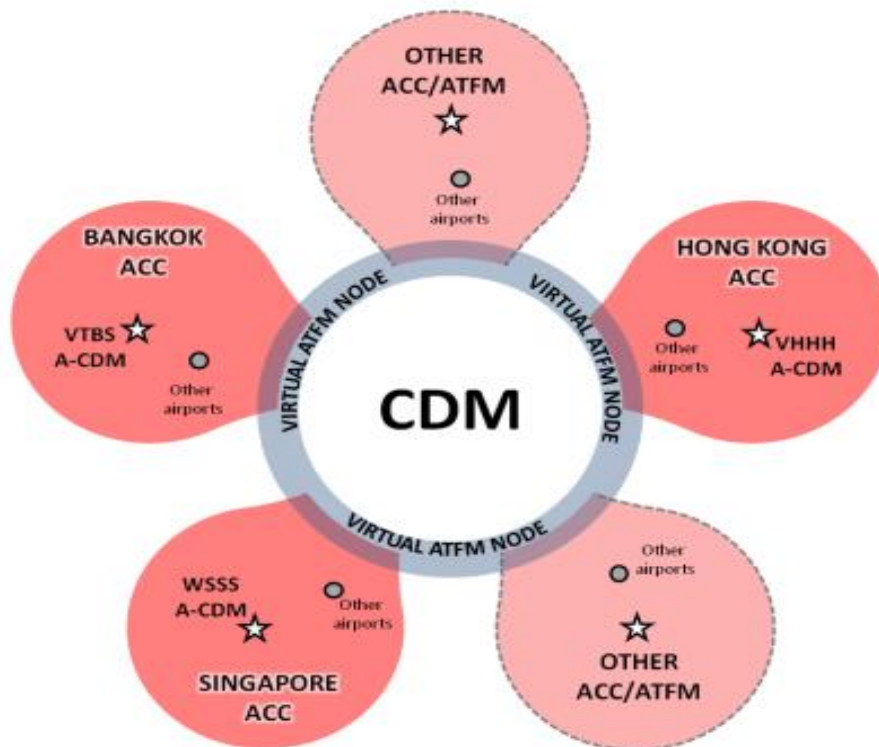


Figure 5: Distributed Multi-Nodal ATFM Network concept

3.14 In this concept, each ANSP operates an independent, virtual ATFM/CDM node (they are responsible for ATFM/CDM within their area of responsibility) supported by an interconnected information-sharing framework. The flows of air traffic will then be effectively managed based on a common set of agreed principles among the participating ANSPs and airports. A node comprising of the ANSP and associated airports will be able to manage the demand and capacity through adjustments in aircraft Calculated Landing Times (CLDTs) which will in turn generate CTOTs for particular aircraft at the departure airport.

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3.15 An ANSP performs demand and capacity balancing within their own area of authority and where ATFM measures require participation of regional and international flights, the flows will be managed by the agreed coordination procedures.

Key components of the Cross-Border Multi-Nodal Regional ATFM/CDM concept

3.16 Key components of the cross-border ATFM/CDM concept, to be considered in conjunction with the Regional ATFM Conops and Regional ATFM Framework, are:

- Multi-Nodal Stakeholders interconnected via virtual communication framework
 - Each ANSP has an independent ATFM System.
 - Each ANSP independently manages demand/capacity of its own Airport(s).
 - Common agreement to share essential data for ATFM by all Multi-Nodal stakeholders.
 - Stakeholders/ANSPs communicate via existing Internet/Telecommunications networks.
 - Harmonized and integrated data exchange between all stakeholders in the Multi-nodal network.
- Specify Capacity and Predict Demand
 - Demand Prediction – Flight progress is via manual input or automated data feed (e.g., FDP or AFTN).
 - Capacity Management – Inputs from FMP and FOC are via ATFM web-based interface.
- Evaluate Alternatives, Initiate/Modify ATFM Measures
 - Aircraft Operators manage the ATFM Measures 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.

Regulatory Aspects for ATFM/CDM Implementation

3.17 The support of the regulatory authority is critical for successful ATFM implementation. The regulator must be involved in ATFM planning an implementation at the very earliest opportunity. All ICAO and ANSP/Regulator requirements will need to be complied with prior to ATFM/CDM implementation. In addition, adherence to the Regional ATFM Framework ensuring a “seamless” ATFM/CDM process between FIRs in the region.

3.18 It will be a requirement to perform a safety assessment prior to implementation of ATFM/CDM as per ICAO Document *Annex 11* (Section 2.7).

Publication of information

3.19 ANSPs will be required to comply with normal Aeronautical Information Publication (AIP) processes to ensure the implementation of ATFM/CDM is communicated with the aviation community.

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3.20 Experience shows that early and on-going communication in the form of written, workshop and training in addition to the required formal AIS process is a very important factor in gaining “buy-in”, acceptance and support from the operational stakeholder community.

3.21 It is also recommended that all stakeholders publish in-house in house education material and formal procedures for ATFM/CDM processes.

IMPLEMENTATION RISKS AND MITIGATION

General risks and mitigation of Cross-Border ATFM/CDM implementation

4.1 **Tables 2 - 14** summarise the general risks and mitigation for Cross-Border ATFM/CDM implementation.

Definition:	ANSP does not abide by regional ATFM procedures.
Result:	Aircraft departing from within the airspace of non-participating ANSPs.
Mitigation:	Education on benefits of participation for region
Probability/Impact:	Medium

Table 2: Risk 1 – Non-participation by ANSP in Regional ATFM ConOps

Definition:	Airline does not abide by Regional ATFM procedures
Result:	Aircraft are non-compliant.
Mitigation:	Urge participation by direct contact with concerned non-compliant airlines
Probability/Impact:	Medium

Table 3: Risk 2 – Non-participation by Airline in Regional ATFM ConOps

Definition:	Airport Authority does not accept ATFM concept and does not allow airlines to absorb delay at gate and on the ground either at the gate or between pushback and departure.
Result:	Aircraft unable to absorb delay on the ground and becoming non-complaint.
Mitigation:	Education and convincing airport authorities of network benefits for ATFM implementation.
Probability/Impact:	Medium

Table 4: Risk 3 – Non-participation by Airport Operator

Definition:	Cross-Border Multi-Nodal Regional ATFM/CDM is not implemented.
Result:	Safety impact of congested airspace leading to ATC/Pilot overload, inefficiencies, excessive fuel burn and carbon dioxide (CO ₂) emissions.
Mitigation:	Popularise ATFM/CDM via all available means and to all possible stakeholders explaining benefits is very significant.
Probability/Impact:	High

Table 5: Risk 4 – Non-action with respect to Cross-Border Regional ATFM

Definition:	Awareness and hence commitment of one or more stakeholders is lacking during project planning or actual implementation.
Result:	Delayed or inefficient implementation.
Mitigation:	Comprehensive promoting and communication needed, early and continued benefits demonstrated at the airport to raise awareness.
Probability/Impact:	Low

Table 6. Risk 5 – ATFM/CDM awareness not sufficient amongst stakeholders

Definition:	Not adhering to functional requirements when defining system and implementation.
Result:	Implementation can be put in jeopardy, implementation may become fragmented.
Mitigation:	Basic and agreed principles and Regional ATFM procedures to be followed. The Regional ATFM Framework must be respected and maintained but can be enhanced in line with implementation maturity.
Probability/Impact:	Medium

Table 7: Risk 6 – Implementation not consistent with Cross-Border Regional ATFM principles or Regional ATFM procedures

Definition:	Stakeholders have different or even conflicting priorities and/or interests.
Result:	Difficult to convince all stakeholders to participate.
Mitigation:	Basic and agreed principles and Regional ATFM procedures to be followed. <i>The Regional ATFM Framework</i> document must be respected and maintained but can be enhanced in line with implementation maturity.
Probability/Impact:	Medium

Table 8: Risk 7 – Conflicting interests of stakeholders

Definition:	Stakeholders reluctant to release data.
Result:	Project can be put in jeopardy, implementation may become fragmented or non-consistent.
Mitigation:	Better Education and communication. Demonstrate security features.
Probability/Impact:	High

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Table 9: Risk 8 – Requirement for non-disclosure

Definition:	Unforeseen withdrawal due to political, budget restrictions, changes of priority, etc.
Result:	Non-compliant operations.
Mitigation:	Relying on airline participation to meet compliance standards.
Probability/Impact:	Medium

Table 10 Risk 9 – One or more stakeholders/States withdraw from Cross-Border ATFM/CDM

Definition:	Project may be seen of less importance/priority and reduce availability of staff, finance and resources.
Result:	Slow or non-implementation.
Mitigation:	Education and convincing management of benefits of ATFM/CDM implementation.
Probability/Impact:	Medium

Table 11: Risk 10 – Insufficient cooperation/support from Airport/Airline/ANSP management

Definition:	Poor data quality or insufficient acquisition.
Result:	Unreliable project results, poor costs/benefit ratio.
Mitigation:	Education and communication, standard acronyms and definitions to be used, standard ICDs to be used.
Probability/Impact:	Medium

Table 12: Risk 11 – Data acquisition not satisfactory

Definition:	Following initial drive to consider implementation ATFM/CDM and project preparation, one or more major stakeholders decide to not participate.
Result:	Project will stall, or implementation will have reduced effectiveness.
Mitigation:	Continued collaboration and communication on benefits of regional implementation to be undertaken.
Probability/Impact:	Medium

Table 13: Risk 12 – No go decision

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Definition:	Diverse systems communicate poorly or not at all.
Result:	Difficulty for users to access CTOT, CTO and CLDT information on various ATFM systems. Loss of confidence, benefits reduced.
Mitigation:	Use standard ICD.
Probability/Impact:	Medium

Table 14: Risk 14 – Insufficient system integration

POST-IMPLEMENTATION ACTIVITIES

ATFM/CDM becomes a daily operation

5.1 ATFM/CDM, whether Domestic or Cross-Border, will become a daily operation undertaken by all the stakeholders. Successful implementation will have shown the aviation community that for the entire supply chain to succeed, all will need to participate in the CDM process. Continued momentum and active engagement will need to be maintained.

Continued education of all stakeholders

5.2 As there might be no or partial participation by some stakeholders, continued education and benefit-proving must take place to continually increase participation by stakeholders.

Preparing for new functions

5.3 For Cross-Border programs there will be varying levels of participation of ANSPs. Therefore, there is a need for ANSPs to regularly review and apply the ATFM/CDM implementation criteria to assess if their operational and ATFM requirements have changed.

TIME LINE

6.1 Aviation System Block Upgrade (ASBU) module B0-NOPS is one of the ten Regional priorities determined by APANPIRG, and is listed among the Seamless ATM Plan's highest priority ASBU modules. In the Regional ATFM Framework, regional collaborative ATFM objectives are arranged in ATFM Capability phases, aligned where practicable, with Phases I and II of the Seamless ATM Plan's Preferred Aerodrome/Airspace and Route Specification. ANSPs should develop their ATFM/CDM implementation strategy in alignment with this plan:

- **Phase IA** – expected implementation by 12 November 2015;
 - Enact regulations for the implementation of ATFM.
 - Conduct bi-annual strategic airport and airspace capacity and demand analysis.
 - Prepare for capacity demand balancing based on demand analysis.
 - Develop and distribute an ATFM Daily Plan (ADP).
- **Phase IB** – expected implementation by 25 May 2017; and
 - Analyse operational flight plan (FPL) and ATS message distribution systems.
 - Requirements for FPL to be submitted 3 hours prior to Estimated Off Block Time.
 - Integrate ATFM, AMAN/Departure Management (DMAN), and A-CDM systems through common fixes, terminology, and communication protocols.
 - Implement strategic airport slot allocation if necessary.
 - Pre-tactical modelling of expected airport and airspace configuration and capacity demand balancing.
 - Implementation, revision, or cancellation of GDPs for inbound traffic, or minutes-in-trail (MINIT) or miles-in-trail (MIT) where CTOT may not be applied.
 - Post-Operational analysis to provide feedback for procedures and processes.
- **Phase II** – expected implementation by 08 November 2018.
 - Distributed Multi-Nodal ATFM information distribution capability utilising Flight Information Exchange Model (FIXM) version 3.0 (or later) should be implemented.
 - Full interoperability of Cross-Border ATFM, A-CDM, AMAN, DMAN, ATM automation, and Airspace User systems should be implemented, utilising FIXM 3.0 (or later), to provide seamless gate-to-gate collaborative ATFM operations.
 - Implementation of pre-tactical and tactical capacity, and demand monitoring and analysis
 - Pre-tactical GDP using CTOT for capacity demand balancing measures.
 - Tactical ATFM measures including MIT, MINIT, and where necessary, CTO at the arrival fix (AFIX) or en-route Fix (RFIX), should be applied to flights throughout constrained airspace when a GDP is not implemented.

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6.2 Refer to the Regional ATFM Framework document for further information on the ATFM Capability Phases and performance objectives.

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ATFM IMPLEMENTATION GUIDANCE ATTACHMENT A - Assessment of Benefits

An interoperable network approach for the region will result in system-wide Demand Capacity Balancing. This approach enhances the safety and optimises the efficiency of airports and available airspace. As the Asia-Pacific region, the world’s largest market for air transport, continues to grow, it becomes essential to optimise the use of available capacity through ATFM. In 2013, the APAC was one of the fastest growing regions by passengers in the world (see Table 15). The region’s passenger growth was 8.5%. Individual countries with notable passenger growth include: China (11.8%), Indonesia (20.4%), and Thailand (16.4%).

	Annual % Change	Passenger Volume
Indonesia	20.4	92,534,902
Thailand	16.4	62,831,288
China	11.8	404,174,939
Singapore	7.6	42,438,276
Malaysia	7.5	51,821,210
Japan	4.9	148,450,196
India	4.4	97,677,318
Hong Kong	3.9	44,399,060
Korea, Republic of	1.2	62,166,163
Australia	0.6	81,983,309
Asia/Southwest Pacific	8.5	1,075,572,893

Table 15: Top Passenger Countries 2013 *Source: WATS 58th edition, 1.4 Top Passenger Countries*

Throughout the Asia-Pacific region, individual States’ ATM and ATFM equipment, services, procedures, airspace design, communications, and resources have a wide disparity in capabilities. These limitations often result in a less efficient operational environment. Prevalent throughout the study region are excessive MIT restrictions, fuel burn, CO2 emissions, aircraft departure holding on the ground, airborne holding, and delays.

Weather and other system constraints increase schedule buffer, delayed flights, cancellations, and missed connections. Flight delays add costs to airlines, passengers, Airport Operators, and States. Aviation inefficiencies have trickle-down impacts on other sectors due to lost time and productivity. As traffic demand increases, delays will also increase if resource capacity is not increased.

The expectant results of an interoperable ATFM network of States will have potential benefits to airlines, passengers, Airport Operators, and States. Although we do not have any general figures for the region, our analysis identifies generic qualitative and quantitative benefits.

Qualitative Benefits

Regional Wide Benefits

Implementation of Regional ATFM will derive the following benefits:

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- More timely and informed collaborative decision making, which takes the entire region's requirements into consideration.
- A coordinated networked ATFM approach to all air traffic flying in the region would result in a seamless optimised expeditious flow of traffic throughout the region.
- Presently there is little communication between the ANSPs relating to ATFM. With the implementation of ATFM, automated and procedural communication will be improved, enhancing not only ATFM communication, but also ATC communications.
- As ATFM develops in the region, States will be incentivised to collaborate on airspace design so as to accommodate better flows of traffic to accommodate ATM and ATFM procedures.
- Enhanced situational awareness for the region through shared information.
- As Regional ATFM matures, better planning and CDM in all phases of ATFM, including post-event analysis, will occur.
- The traditional model of ATFM implementation requires only domestic traffic to adhere to the controlled times issued. The *Regional ATFM Concept of Operations* requires all aircraft to adhere to controlled times. Therefore, States with no domestic flights, such as Hong Kong China and Singapore, can perform demand and capacity balancing.
- In the traditional model of ATFM implementation, only domestic traffic is subject to ATFM measures, therefore domestic traffic can be unfairly delayed while non-participating aircraft (international flights) are not. With the Regional ATFM Concept, all traffic is expected to be subject to ATFM measures, and the delay is distributed fairly and equitably amongst all traffic.
- Establishment of Regional ATFM will lead to enhanced information-sharing and CDM practices during extraordinary events such as volcanic eruptions (as the FAA ATCSCC and the EUROCONTROL Network Manager have collaborated during recent volcanic eruptions), disease, political unrest, and war.

ANSPs

- Smoother transition of DCB from strategic to pre-tactical and tactical phases of ATFM.
- Network-managed DCB brings about overall optimisation of airspace.
- Better planning due to accurate and common view of demand and capacity predictions.
- More timely and informed decision-making, taking the entire region's requirements into consideration
- Improved modelling and evaluation of proposed ATFM Measures in collaboration with stakeholders prior to implementation.
- Availability of a data platform that integrates various flight data sources and provides common situational awareness to the stakeholders.
- An environment in which ATFM Measures and other operational procedures can be improved through post-operational analysis.

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- Improved special event and flexible usage of airspace planning.
- More efficient DCB at airports and in airspace.
- Optimisation and reduction of staffing. During peaks of un-metered traffic, ANSPs are often required to roster extra staff to cope with increased workloads. With metered flows of traffic, workload is reduced, therefore reducing staffing levels.
- Optimisation and allocation of resources (maintenance of equipment, Navigation Aid [NavAid] calibrations).
- Implementation of Performance-Based Navigation (PBN) procedures brings about many benefits to Airline Operators and ANSPs; however, if there is an un-metered flow of arrival or departure traffic, the effectiveness of PBN procedures could be negated. During times of high demand, ATC is required to vector aircraft off the PBN route in order to satisfy separation rules. Implementation of ATFM will ensure a steady stream of de-conflicted air traffic before entering the arrival phase, which will allow more aircraft to complete the full PBN approach and receive the maximum benefits. This results in reduced workload for the ATCOs and pilots.
- Improved safety.

Airline Operators

- Improved flexibility for Airline Operators to optimise their schedules through CDM.
- Improved flexibility for flights to absorb inevitable delay on the ground or efficiently through the en-route portion of the flight rather than by airborne holding in the terminal area.
- More reliable and timely access to information indicating stakeholder intent—this applies to Airline Operators sharing how they intend to operate the flights as well as to States and airports sharing any resource constraints.
- Reduced sector times resulting in reduction in schedule buffer times.
- Maximised benefits for aircraft with advanced avionics (PBN routings).
- Significant fuel savings.
- Significant reduction in CO₂ emissions.
- Better aircraft utilisation.
- Better passenger experience.
- Optimisation of staffing and allocation of resources.
- Improved safety.

Airport Operators

- With enhanced situational awareness of arrival and departure times, apron planners will be able to improve gate allocation, especially during constrained periods. This leads to better utilisation of ground resources (ground handling, catering, refuelling, etc.).

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- Enhanced situational awareness assists the entire community in the airport precinct (passengers, immigration, customs, security, baggage handling, etc.).
- Optimisation of staffing.
- ATFM integrated with A-CDM will result in better turnaround times and on-time performance of Airline Operators.

Safety

- Standard ATM practices of separating and sequencing traffic by vectors, speed control, and airborne holding are carried out during un-metered peaks of traffic. These practices are proven safe and effective. However, during these peak periods, the workload on ATC and pilots can increase significantly, thereby reducing the margin for error. Through ATFM, a constant manageable flow of traffic is achieved, resulting in a more manageable workload and hence, a safer operation. A network approach to ATFM reduces sector/system saturation, increases efficiency, and enhances safety.
- Unstable approaches have been recognised as a causal factor in aircraft incidents. A possible cause of unstable approaches is excessive and unreasonable speed control and vectoring (late or greater than 30 degree Instrument Landing System [ILS] intercepts). With a metered flow of traffic, the requirement of ATCs to undertake excessive tactical sequencing management (vectors and speed control) is reduced with the possible result of fewer unstable approaches.
- As ATFM develops in the region, States will be forced to collaborate on airspace design so as to accommodate better flows of traffic to accommodate ATFM procedures.
- Often with the implementation of ATFM, States enhance their ability for severe weather detection. This earlier detection of weather is shared with Airline Operators and ANSPs, increasing situational awareness. In addition, this is taken into account when determining the capacity of resources, resulting in the correct ATFM measure being implemented, which can have a direct impact on safety.
- Communication networks will improve between States with ATFM implementation so as to accommodate CDM. A resultant benefit will be reduced coordination errors, which leads to enhanced safety.

Quantitative Benefits

The aviation industry contributes significantly to State economies. In the Asia-Pacific region, the air transport sector supported 4.8 million jobs (2012) and contributed US\$265 billion to the Gross Domestic Product (GDP). Oxford Economics forecasts the number of jobs supported by aviation and tourism impacts will increase by 91% by 2032.⁹

A University of Westminster study comprehensively addresses European airline delay costs (passenger, crew, fuel, maintenance, reactionary). This study derived the average cost of delay to

⁹ Aviation Benefits Beyond Borders, Air transport Action Group, April 2014.

be US\$103 per minute in 2010.¹⁰ Aviation impacts also have a trickle-down impact on other sectors due to lost time and productivity.

Successful ATFM is the optimisation of flows of traffic by balancing demand with the available system capacity. This is achieved through the implementation of flow management measures based on an accurate prediction and assessment of demand and capacity. These flow management measures transfer existing delay to a more efficient phase of operation. Efficiency encompasses many variables but typically focuses on fuel burn savings, which are impacted by aircraft type, configuration, weight, altitude, etc. While the goal is the elimination of delay, the benefit of transferring delay from the arrival phase (holding, speed control, vectoring) to ground delay for air carrier operations has resulted in an average savings of US\$47 per minute in 2014. The Regional ATFM operational concept provides an additional mechanism to transfer assigned delay from the arrival phase to the en-route phase of flight. It is estimated that the benefit gained by absorbing assigned delay more efficiently is projected to yield an average savings of US\$42 per minute.

Based on the IATA project team’s understanding of the current (2014) Asia Pacific operating environments, publicly available and confidential assessments, a model was created to estimate fuel savings for Domestic and Regional ATFM within the Asia-Pacific region. The model assumes that under current 2014 air traffic demand and capacity, ATFM measures will be implemented, on average throughout the region, during 1.5–2 days per week. Air traffic demand in Asia Pacific is expected to grow significantly in the next five to ten years. While the growth is predicted to increase by approximately 5.5–6% annually, such an increase in demand would eventually lead to unsustainable levels of congestion and delay within the region’s airport and airspace operating environments until capacity enhancements are operationally available. Based on the projected growth in the 2015–2019 timeframe, the model assumes that the frequency of ATFM measures will increase as well, on average to 2–2.5 days per week, until capacity enhancements are operationally available. Error! Reference source not found. **Table A1** summarises the projected quantitative benefits from ATFM in 2014 and in 2019.

	2014	2019
Regional ATFM	US\$250 – \$300M	US\$600M – \$800M
Domestic & Regional ATFM	US\$660 – \$810M	US\$1.1B – \$1.4B

Table A1: Asia/Pacific Annual Fuel Savings Benefit Projection

Capitalising on this benefit opportunity through the network-based Asia Pacific Regional ATFM implementation is particularly important in the following airport operating environments, where international arrival traffic accounts for 35–100% of the total demand (an indication that Domestic ATFM deployments alone are not practical for demand capacity balancing at these airports):

- China - Shanghai Pudong International

¹⁰ European airline delay cost reference values Final Report (version 3.2), University of Westminster, March 2011.

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- Indonesia - Ngurah Rai International
- Hong Kong - Hong Kong International
- Japan - Narita International
- South Korea - Incheon International
- Malaysia - Kuala Lumpur International
- Philippines - Ninoy Aquino International
- Singapore - Changi International
- Taiwan - Taiwan Taoyuan International
- Thailand - Suvarnabhumi Bangkok International
- Vietnam - Tan Son Nhat International and Nội Bài International

Within the remainder of the major Asia Pacific airport operating environments, international arrival traffic currently accounts for 20–30% of the total demand. Achieving the benefit of fuel savings in these environments is supported by Domestic ATFM deployments and enhanced through the Regional ATFM implementation.

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Appendix G – Regional ATFM Monitoring and Reporting Form

APPENDIX G: ATFM MONITORING AND REPORTING FORM

ATFM PERFORMANCE INDICATORS

The following indicators are based on the Performance Improvement Plan of the Asia/Pacific Regional Framework for Collaborative ATFM, which should be read in conjunction with this form. The information provided will be used by the relevant Regional bodies to assess individual Administration and overall regional compliance with the Framework, and may be used by Administrations to internally evaluate their implementation status.

INSTRUCTIONS

A If your administration **is expected, or intends, to implement and distribute cross-border ATFM measures** under the terms of the Performance Improvement Plan of the Asia/Pacific Regional Framework for Collaborative ATFM:
Answer Questions 1 to 31

B If your Administration **is not expected to implement and distribute cross-border ATFM** as described above, answer questions 33 to 48.
Answer Questions 32 to 47

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A. Administrations Distributing ATFM Measures

Indicate whether your administration has:

1	Enacted regulations for the implementation of ATFM	0
2	Ensured the origination, distribution and processing of FPL and ATS messages in accordance with ICAO Doc 4444 PANS-ATM and the Regional Framework for Collaborative ATFM	0
3	Implemented common fixes, terminology and communications in ATFM, AMAN/DMAN and A-CDM systems	0
4	Implemented meteorological services to support ATM in the terminal area (e.g. Meteorological Service in Terminal Area - MSTA)	0
5	Established ATFM capability with appropriately trained staff and operating procedures	0
6	Implemented local procedures for ATFM operations and communication, including phraseology and terminology for ATFM Units, ATS Units, airspace users, and airport operators, drawn from ICAO Doc. 9971	0
7	Performed an analysis of current traffic demand and expected growth for the next 5 years (rolling)	0
8	Implemented a program of bi-annual strategic airport and airspace capacity, and strategic demand analysis	0
9	Commenced daily pre-tactical airport and airspace capacity-demand analysis for ATFM Program airports and associated terminal airspace as well as enroute ATC sectors supporting the busiest Asia/Pacific city pairs	0
10	Implemented pre-tactical modelling of airport and airspace configuration and traffic demand, and the effect of ATFM measures	0
11	Implemented dynamic updating of airport and airspace capacity constraints, capacity calculations and demand information	0
12	Implemented strategic airport slot allocation at all international airports where demand significantly exceeds airport capacity	0
13	Made arrangements for relevant ATFMU to chair and/or participate in daily ATFM conferences for pre-tactical ATFM planning	0
14	Commenced daily preparation of an ATFM Daily Plan (ADP) for all ATFM Program airports and associated terminal airspace	0
15	Enabled sharing of relevant information between all stakeholders through implementation of CDM capability	0
16	Developed procedures for ATFMU, ATS Units, airspace users, and airport operators when ATFM program is active	0
17	Implemented tactical ATFM measures for flights inbound to ATFM program airports	0

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18	Implemented tactical ATFM measures for flights inbound to constrained airspace	0
19	Promulgated procedures for tactical management of ATFM measures, including revision, cancellation, suspension, de-suspension, where necessary	0
20	Ensured tactical ATFM measures for are only applied during periods of constraint	0
21	Promulgated procedures to avoid subjecting individual flights to more than one tactical ATFM measure	0
22	Implemented local ATC procedures and, where available, CDM processes facilitating compliance with received CTOT	0
23	Implemented distributed multi-nodal ATFM information distribution capability	0
24	Ensured interoperability of implemented ATFM, A-CDM, AMAN, DMAN, ATM automation systems and airspace user systems, where operational interfaces exist or are planned, using FIXM.	0
25	Ensured ATFM systems take long haul flights into account in demand predictions	0
26	Ensured ATM and ATFM systems provide timely update of estimate information for airborne aircraft	0
27	Commenced ATFM post-operations analysis and rectification, taking guidance from the Regional Framework as starting point	0
28	Developed procedures and agreements for post-operational analysis of cross-border ATFM with stakeholders	0
29	Ensured post-operations analyses are used for planning ATFM, airspace and ATS route improvements	0
30	Implemented ATS route structure improvements including CCO/CDO to reduce ATC workload and use aircraft capability to meet ATFM measures	0
31	Optimized ATC separation and reduced runway occupancy times at all ATFM program airports and in associated terminal airspace	0

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B. States/Administrations Facilitating ATFM Measures (but not expected to implement and distribute cross-border ATFM)

Indicate whether your administration has:

32	Ensured the origination, distribution and processing of FPL and ATS messages in accordance with ICAO Doc 4444 PANS-ATM and the Regional Framework for Collaborative ATFM	0
33	Implemented local procedure with regards to ATFM operations and communication, including phraseologies, among ATFMU, ATS Units, airspace users, and airport operators	0
34	Educated ATM staff and stakeholders on the basic of ATFM and its connection with ATS	0
35	Made arrangements for relevant personnel from ATSU to participate in daily ATFM conferences for pre-tactical ATFM planning	0
36	Enabled sharing of relevant information between all stakeholders through implementation of CDM capability	0
37	Developed procedures for ATS units, airspace users, and airport operators when ATFM program is active	0
38	Developed procedures for ATS units, airspace users, and airport operators when ATFM program is active	0
39	Ensured local stakeholders are able to access CTOT information readily, either directly from the ATFMU distributing it or through local dissemination	0
40	Ensured ATM systems provide timely update of estimate information for airborne aircraft	0
41	Developed ATFM post-operations analysis workflow among ATFMU, ATS units, airspace users, and airport operators to ensure proper and timely feedback mechanism can be distributed to ATFMU originating the ATFM measures	0
42	Developed procedures and agreements for post-operational analysis of cross-border ATFM with stakeholders	0
43	Ensured post-operations analyses are used for planning ATFM, airspace, and ATS route improvements	0
44	Implemented ATS route structure improvements including CCO/CDO to reduce ATC workload and use aircraft capability to meet ATFM measures	0
45	Optimized ATC separation and reduced runway occupancy times at all ATFM program airports and in associated terminal airspace	0
46	Performed an analysis of current traffic demand and expected growth for the next 5 years (rolling)	0
47	Implemented a program of bi-annual strategic airport and airspace capacity, and strategic demand analysis	0

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