MID DOC 014

INTERNATIONAL CIVIL AVIATION ORGANIZATION

MID REGION

AIR TRAFFIC FLOW MANAGEMENT

PLAN

Version 2.0 Feb 2022

This Plan was developed by the ICAO MID Air Traffic Flow Management Task Force (ATFM/TF) and reviewed by the ATM SG.

Approved by MIDANPIRG/19 and published by the
ICAO MID Office, Cairo

RECORD OF AMENDMENTS

Edition Date	Description	Pages Affected
February 2021	First Draft Edition (Version 1.0)	ATFM CONOPS
February 2022	Second Edition (Version 2.0)	Restructured Doc 014 in 3 parts, Framework & common operating procedures and implementation Guidance parts are added to CONOPS

Table of Contents

PART II – MID ATFM CONCEPT OF OPERATION (CONOPS)

PART III – MID ATFM COMMON OPERATING PROCEDURE AND IMPLEMENTATION GUIDANCE

Glossary

1- Abbreviations and Acronyms

AAR	Aerodrome Arrival Rate or Airport Acceptance Rate
ABI	Advanced Boundary Information
ACAS	Airborne Collision Avoidance System
ACC	Area Control Centre
A-CDM	Airport Collaborative Decision Making
ACP	Acceptance
ADOC	Aircraft Direct Operating Cost
ADP	AFTM Daily Plan
ADS-B	Automatic Dependent Surveillance-Broadcast
ADS-C	Automatic Dependent Surveillance-Contract
ADR	Airport Departure Rate
AFIX	Arrival Fix
AFS	Aeronautical Fixed Service
AFTN	Aeronautical Fixed Telecommunications Network
ATFM	Air Traffic Flow Management
AIBT	Actual In Block Time
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
ALDT	Actual Landing Time
AMAN	Arrival Manager
AMROT	Arithmetical Mean Runway Occupancy Time per aircraft category
ANSP	Air Navigation Service Provider
AN-Conf	Air Navigation Conference
AOBT	Actual Off Block Time
AOC	Assumption of Control
AOM	Airspace Organization and Management
APAC	Asia/Pacific
APCH	Approach
APV	Approach with Vertical Guidance
APW	Area Proximity Warning
ASBU	Aviation System Block Upgrade
ASD	Aircraft Situation Display
ASMGCS	Advanced Surface Movements Guidance Control Systems
ATC	Air Traffic Control
ATCC	Air Traffic Control Centre
ATCO	Air Traffic Controller
ATCONF	Worldwide Air Transport Conference
ATCSCC	Air Traffic Control System Command Center
ATFM	Air Traffic Flow Management
ATFM/CDM	ATFM Collaborative Decision Making
ATIS	Automatic Terminal Information Service
ATM	Air Traffic Management
ATOT	Actual Take Off Time
ATS	Air Traffic Services
ATSA	Air Traffic Situational Awareness
AU	Airspace User
CANSO	Civil Air Navigation Services Organization
CARATS	Collaborative Actions for Renovation of Air Traffic Systems

CBA	Cost Benefit Analysis
CCO	Continuous Climb Operations
CDM	Collaborative Decision-Making
CDO	Continuous Descent Operations
CDR	Conditional Route
CFIT	Controlled Flight into Terrain
CFMU	Central Flow Management Unit
CIBT	Calculated In Block Time
CLAM	Cleared Level Adherence Monitoring
CLDT	Calculated Landing Time
CNS	Communication, Navigation and Surveillance
CO_2	Carbon Dioxide
COM	Communication
CONOPS	Concept of Operations
CNS	Communications, Navigation, Surveillance
COBT	Calculated off Block Time
CPAR	Conflict Prediction and Resolution
CPDLC	Controller Pilot Data-link Communications
CPWG	Cross-Polar Working Group
CSP	Communication Service Provider
CTA	Control Area
CTO	Calculated Time Over
CTOT	Calculated Take Off Time
CTR	Control Zone
DARP	Dynamic Airborne Re-route Planning
DCB	Demand and Capacity Balancing
DCR	Declared Capacity of the Runway set
DFIX	Departure Fix
DGCA	Conference of Directors General of Civil Aviation
DMAN	Departure Manager
DME	Distance Measuring Equipment
ECAC	European Civil Aviation Conference
ELDT	Estimated Landing Time
EOBT	Estimated off Block Time
EST	Coordinate Estimate
ETO	Estimated Time Over
ETOT	Estimated Take Off Time
EU	European Union
EUROCONTROL	The European Organisation for the Safety of Air Navigation
FAA	Federal Aviation Administration
FAS	Final Approach Segment
FCA	Flow Constrained Area
FDP	Flight Data Processor
FDPS	Flight Data Processing System
FIR	Flight Information Region
FIRB	Flight Information Region Boundary
FIXM	Flight Information Exchange Model
FL	Flight Level
FLAS	Flight Level Allocation Scheme
FLOS	Flight Level Orientation Scheme
FMP	Flow Management Position
FMU	Flow Management Unit
FOC	Flight Operation Center
FPL	Flight Plan Message
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
GDP	Ground Delay Programme
GLS	GNSS Landing System
GNSS	Global Navigation Satellite System
GPI	Global Plan Initiative
GS	Ground Stop
HF	High Frequency
HITL	Human-In-The-Loop
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
INS	Inertial Navigation Systems
IO	International Organizations
LOA	Letter of Agreement
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
MIDANPIRG	MID Air Navigation Planning and Implementation Regional Group
MINIT	Minutes in Trail
MIT	Miles in Trail
MLAT	Multilateration
MROT	Mean Runway Occupancy Time
MROTL	Arithmetical Mean Runway Occupancy Time during Landing per aircraft
MROTT	Mean Runway Occupancy Time during Take-off per aircraft category
MSAW	Minimum Safe Altitude Warning
MTF	Major Traffic Flow
MTTS	Mean weighted Time between Two consecutive landings, Taking into account Total Separation
NextGen	Next Generation Air Transportation System
NAS	National Airspace System
NavAid	Navigation Aid
NOPS	Network Operation
OP	Operations Plan
OPMET	Operational Meteorological
OLDI	On-Line Data Interchange
PACOTS	Pacific Organized Track System
PARS	Preferred Aerodrome/Airspace and Route Specifications
PASL	Preferred ATM Service Levels
PBN	Performance-based Navigation
PKP	Passenger Kilometres Performed
PLDT	Planned Landing Time
PTOT	Planned Take Off Time
PVT	Passenger Value of Time
RAIM	Receiver Autonomous Integrity Monitoring
RAM	Route Adherence Monitoring
RANP	Regional Air Navigation Plan
RFIX	En-route Fix
ROT	Runway Occupancy Time

ROTL	Runway Occupancy Time during Landing
ROTT	Runway Occupancy Time during Take-off
RPK	Revenue Passenger Kilometres
RNAV	Area Navigation
RNP	Required Navigation Performance
RVSM	Reduced Vertical Separation Minimum
SATVOICE	Satellite Voice Communications
SAR	Search and Rescue
SBAS	Space Based Augmentation System
SEET	Scheduled Estimated En-route Time
SESAR	Single European Sky ATM Research
SG	Steering Group
SHEL	Software, Hardware, Environment and Liveware
SIBT	Scheduled In Block Time
SID	Standard Instrument Departure
SIGMET	Significant Meteorological Information
SLDT	Scheduled Landing Time
SME	Subject Matter Expert
SOBT	Scheduled off Block Time
SPECI	Special Weather Report
STAR	Standard Terminal Arrival Route or Standard Instrument Arrival (Doc 4444)
STOT	Scheduled Take Off Time
STCA	Short Term Conflict Alert
STS	Special Handling Status
SUA	Special Use Airspace
SUB	Slot Swapping
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
TLDT	Target Landing Time
TA	Traffic Management
TOBT	Target off – Block Time
TOC	Transfer of Control
TOS	Traffic Orientation Scheme
TSAT	Target Start Up Approval Time
TTOT	Target Take off Time
UAS	Unmanned Aircraft Systems
UAT	Universal Access Transceiver
UPR	User Preferred Routes
VAAC	Volcanic Ash Advisory Centre
VHF	Very High Frequency
VMC	Visual Meteorological Systems
VNAV	Vertical Navigation
VMC	Visual Meteorological Conditions
VOLMET	Volume Meteorological
VOR	Very High Frequency Omni-directional Radio Range
VSAT	Very Small Aperture
WAFC	World Area Forecast Centre
WATS	World Air Transport Statistics
WSG	World Slot Guidelines

2- ATFM Terminology and Definition

ACC/sector group capacity: The theoretical maximum number of flights that may enter an ACC or sector group per hour, over a period of time (e.g. 3 hours), without causing excessive workload in any of the sectors. This capacity indicator is used for capacity planning and monitoring purposes and has no operational value. The indicator is calculated mathematically using a validated methodology.

Actual In Block Time (AIBT): The time that an aircraft arrives in-blocks (Equivalent to Airline/Handler ATA –Actual Time of Arrival, ACARS = IN).

Actual Landing Time (ALDT): Actual time an aircraft lands on a runway (Equivalent to ATC ATA – Actual Time of Arrival = landing, ACARS=ON).

Actual Off Block Time (AOBT): The time the aircraft pushes back / vacates parking position (Equivalent to Airline / Handlers ATD – Actual Time of Departure & ACARS=OUT).

Actual Take Off Time (ATOT): The time that an aircraft takes off from the runway (Equivalent to ATC ATD–Actual Time of Departure, ACARS = OFF).

Airport Acceptance Rate (AAR): Arrival capacity of an airport normally expressed in movements per hour.

Airport Departure Rate (ADR): Departure Capacity of an airport normally expressed in movements per hour.

Aircraft Situation Display (ASD): ATC Aircraft/Traffic Situation Display.

Arrival Fix (AFIX): 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.

ATFM Measure: ATFM Measure which will balance demand against capacity or assist in the safe expeditious flow of traffic.

Calculated In Block Time (CIBT): 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.

Calculated Landing Time (CLDT): 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.

Calculated Off Block Time (COBT): 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.

Calculated Take off Time (CTOT): A time calculated and issued by ATFM Unit, as a result of tactical slot allocation, at which a flight is expected become airborne.

Calculated Time Over (CTO): 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").

Capacity baseline: The value of the capacity indicator (see ACC/sector group capacity above) for the ACC and defined sector groups.

Capacity profile: The evolution of required capacity over the 5-year planning cycle, considering certain assumptions, for a specified volume of airspace (ACC or defined sector group), in terms of absolute demand (flights per hour) and annual percentage increases. These values are published annually and are used as a basis for local capacity planning by ANSPs.

Collaborative Decision-Making (CDM): 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.

Conditional Route (CDR): ATS route that is available for flight planning and use under specific conditions.

Declared sector capacity or monitoring value: The value the ANSP declares to the CFMU as the maximum number of flights per hour that can enter a sector before the application of an ATFM regulation becomes necessary. Several values may exist — depending on the ATC environment at the time (airspace, equipment, traffic pattern, staffing, weather, etc.). The value can change according to the situation at the ACC.

Declared traffic volume capacity: The capacity for a given period of time for a given traffic volume, as made known by the ANSP to the ATFM Function, so that it can provide the ATFM service. As with sector capacity, the value can change depending on the ATC environment at the ACC at the time.

Departure Fix (DFIX): The first published fix/waypoint used after departure of a flight.

Departure Manager (DMAN): A planning system to improve the departure flows at an airport by calculating the Target Take-Off Time (TTOT) and Target Start up Approval Time (TSAT) for each flight, taking multiple constraints and preferences into account.

Elementary sector: Primary component of the airspace structure, one or more of which may be combined to form a sector. In some cases the elementary sector can be the same as the operational sector; in other cases, the elementary sector is never open operationally without being combined with one or more other elementary sectors.

En-route Fix (RFIX): 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.

Estimated Landing Time (ELDT): The estimated time that an aircraft will touch-down on the runway (equivalent to ETA).

Estimated Off Block Time (EOBT): The estimated time that an aircraft will start movement associated with departure.

Estimated Take Off Time (ETOT): The Estimated take off time taking into account EOBT plus Estimated Taxi-Out Time.

Estimated Time Over (ETO): Estimated time at which an aircraft would be over a fix, waypoint or particular location typically where air traffic congestion is expected.

Flow Constrained Area (FCA): An sector of airspace where normal flows of traffic are constrained, which could be caused by weather, military exercise etc.

Flow Management Position (FMP): A position in any ATCC that monitors traffic flows and implements or requests ATFM measures to be implemented".

Ground Delay Program (GDP): 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.

Ground Stop (GS): A tactical ATFM measure where some selected aircraft remain on the ground.

Miles in Trail (MIT): 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.

Minutes in Trail (MINIT): 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.

Network effect: The network effect is the phenomenon where regulations placed on parts of the network affect the demand structure observed in other parts of the network. Network effects range from simple interactions of cause and effect to more complex interactions between groups of sectors, where causes are repeatedly re-triggered by effects, involving several oscillations before a stable equilibrium is reached. Affected sectors could be adjacent, in the same region, or distant sectors located on the far side of the European Civil Aviation Conference (ECAC) zone.

Planned Landing Time (PLDT): The expected landing time of a flight derived from the flight plan.

Planned Take Off Time (PTOT): Time aircraft is expected to take off derived from the flight plan.

Scheduled Estimated En-route Time (SEET): The estimated elapsed time of a flight derived from the aircraft operators schedule.

Scheduled In Block Time (SIBT): The Time that an aircraft is scheduled to arrive at its first parking position.

Scheduled Landing Time (SLDT): Scheduled time aircraft is expected to land on a runway, typically based on Scheduled In-Block Time (SIBT) and a standard taxi-in time.

Scheduled off Block Time (SOBT): The time that an aircraft is scheduled to depart from the parking position.

Scheduled Take Off Time (STOT): The estimated take off time derived from an aircraft operators schedule, typically based on a standard taxi-out time.

Sector: Primary operational component of the airspace structure that can be considered as an elementary capacity reference of the ATM system. A sector is made up of one or more elementary sectors.

Sector capacity: The maximum number of flights that may enter a sector per hour averaged over a sustainable period of time (e.g. 3 hours), to ensure a safe, orderly and efficient traffic flow. Some ANSPs manage sector capacities tactically over a shorter period of time (e.g. 15 minutes). However, for global assessment purposes, the hourly figure is used as a standard.

Sector group: Group of sectors that strongly interact with each other through close and complex coordination, satisfying the agreed concept of operations.

Slot Swapping (SUB): The ability to swap departure slots gives AUs the possibility to change the order of flight departures that should fly in a constrained area.

Target Landing Time (TLDT)*:* 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.

Target Off - Block Time (TOBT): 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.

Target Start Up Approval Time (TSAT): 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.

Target Take Off Time (TTOT): The Target Take off Time taking into account the TOBT/TSAT plus Estimated Taxi-Out Time.

Traffic volume: Airspace component based on traffic flow that serves as a reference to design the ATC sectors.

Table of Contents

PART I – MID ATFM FRAMEWORK

PART I

MID ATFM FRAMEWORK

1. Scope of the Framework

Regional Air Traffic Flow Management

1.1 This MID Regional Air Traffic Flow Management (ATFM) framework was developed based on ICAO Doc 9971, ICAO MID Air Traffic Flow Management – Concept of Operation (MID Doc 014 V1.0) and the Asia/Pacific Regional ATFM framework.

1.2 In the respect of traffic operation in the MID Region, the airspace and main airports have the following characteristics:

a) MID airspace influenced by verity of overflight traffic mainly at the interface between Asia APAC and EUR/NAT;
b) Extensive operation of major/hub airports in the region;
c) Globally operation of MID famous airlines (those airlines have been ranked among the best top ten);
d) During Haj season, additional traffic operation/movement will be imposed to MID airspace and associated airports;
e) Except during COVID-19 pandemic crisis, the annual traffic growth in the region is more than 5%;
f) However, most of the concerned states have already implemented ICAO SARPs in line with global improvement and invested on new technologies/equipment to build and optimize the capacity at the airports and airspace to the maximum extent possible, some airspace and airports are already saturated;
g) Interest and ability of the MID states for being host of major global events;
h) Tourism attraction destinations in the region; and
i) Potential of contingency events and crises in the region and its interfaces.

1.3 The ICAO MID Air Navigation Strategy (MID Doc 002) provides a blueprint for coordinated Regional development, including capability improvements described in the ICAO Doc 9750 (Global Air Navigation Plan (GANP) - Sixth Edition) regarding ICAO Aviation System Block Upgrades (ASBU) roadmap. Air Traffic Flow Management (ATFM) taking a network view, is a key module in ASBU Blocks zero, one, two and three. B0/1-NOPS element – Initial integration of collaborative airspace management with air traffic flow management - has been identified by MIDANPIRG/18 as one of thirty-five priority 1 for the MID Region.

1.4 The need for MID regional ATFM framework focusing on Multi-Nodal solution. A key to the concept is that each State/ANSP would be responsible for implementing ATFM programs to airports and airspace within their area of responsibility according to the concept illustrated in this document. Information sharing between the ATFM systems would allow the users from any of the systems to have access to network-wide information multi-State implementation, was solution was endorsed by MAPANPIRG/18 through the following Conclusion:

MIDANPIRG CONCLUSION 18/28: MID REGION ATFM CONOPS

That, the MID Region ATFM CONOPS V1.0 is endorsed and be published as MID Doc 014 on the ICAO MID website.

1.5 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. In this regard the meeting also endorsed the ATM Operational Data Exchange process, which was developed by the ATFM TF and the secretariat based on ICAO ATM/CDM data exchange process. Accordingly, the meeting agreed to the following MIDANPIRG Conclusion:

MIDANPIRG CONCLUSION 18/29: ATM OPERATIONAL DATA EXCHANGE

That, in order to ensure better coordination between ANSPs and improve ATS planning:

a) The MID ATM Operational Data Exchange process at Appendix 5.2L, is endorsed.

b) Airspace users are invited to share with the ICAO MID Office the data related to their "Intention To Operate (ITO)" on monthly basis, for posting on the ICAO MID Office Secure Portal (Group "RO-MIDITO");

c) States be urged to nominate Focal Points/Coordinators for ATM data exchange; in order to be granted access to the ITO data available on ICAO MID secure portal;

d) ICAO MID Office to organize periodic coordination meetings for ANSPs to exchange ATM operational data; and

e) States ensure that the ITO and ATM Operational data are used solely for airspace management and ATC planning purposes during the recovery phase, and should not be shared outside the ATM community as it contains operational and financial sensitive data.

Note 1: The group was established in the ICAO MID Secure Portal and Group name was renamed to be OPSDataEX.

Note 2: 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 ICAO 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, ANSPs, 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 ICAO MID ATFM TF/6, will be reviewed by ATM SG/7 and will be presented to MIDANPIRG/19 for endorsement, as a part of regional ANP documents relevant to the ICAO MID 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 6th edition), 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 The Framework includes analysis of the current situation, a performance improvement plan, and considerations for research and future development.

1.10 The performance objectives of the Framework are expected to be implemented in Level aligned, with the ICAO MID Air Navigation Strategy (MID Doc 002). The MID Region ATFM framework is expected to be implemented in the following Levels:

- Level I, expected implementation by 31 December 2022 (aligned with MID Doc 002, priority 1);

- Level II, expected implementation by 31 December 2023 (aligned with MID Doc 002, priority 2 and further decision/update in MIDANPIRG/19); and

- Level III, expected implementation by 31 December 2025. (aligned with MID Doc 002, the rest of ASBU related Threads/Elements and further update in coming MIDANPIRG meeting)

1.11 None of the above Levels 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, the Framework's Level 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 Levels.

1.12 In that regard, although it would be ideal if all States achieved capability on day one of Level 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 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 MIDANPIRG (regional level) and GANP (global level).

<u>Document Review</u>

1.13 The Framework is intended, as a minimum, to be reviewed by ATM SG and annual based thereafter. More frequent review and amendment will be conducted as recommended by ATFM TF that will be agreed by ATM SG and endorsed by MIDANPIRG.

2. Development and Objectives of the Framework

Framework Development

2.1 The MID Region ATFM/TF was formed by the MID ATM SG and established by MIDANPIRG to inter alia, develop a common Regional ATFM CONOPS and framework which addresses ATFM implementation and ATFM operational issues in the MID Region.

2.2 The Framework was developed by ICAO MID ATM ROs with contribution of ATFM TF Chairman, reviewed by MID State during ATFM TF/6 and ATM SG/7. The Framework was endorsed by the MIDANPIRG/19, Jeddah, Saudi Arabia, February 2022.

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

- A distributed multi-nodal cross-border ATFM network rather than a regionally centralized facility;
- The MID ATM Operational Data Exchange process endorsed as a practical model for ATFM information exchange and coordination;
- Airspace users are invited to share with the ICAO MID Office the data related to their "Intention To Operate (ITO)" on monthly basis; for solely airspace management and ATS units planning purposes by posting them on the ICAO MID Office Secure Portal (Group "OPSDataEX");
- States nominated Focal Points/Coordinators for ATM data exchange; in order to be granted access to the ITO data available on ICAO MID secure portal; and
- ICAO MID Office to organize periodic coordination meetings for ANSPs to exchange ATM operational data. When it becomes operationally required.

2.4 The performance objectives of the Framework are, wherever practicable, aligned with the ATFM-related objectives and implementation timelines of the ICAO MID Air Navigation Strategy (MID Doc 002).

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 and Collaborative Decision-Making.

ATFM Framework Objective

2.6 Having considered relevant documents such as the Global Air Navigation Plan (Doc 9750 6th edition), the ICAO MID Air Navigation Strategy (MID Doc 002) 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 ICAO MID Air Navigation Strategy;
- 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.

The Need for a Regional Framework for Collaborative ATFM

2.8 The MID Region is well known for its attractive business, religious and pleasure destination. This area geographically located at interface between Asia APAC and EUR/NAT airspaces. The number of air traffic operation and airport movements are extremely high. The annual air traffic growth in the region, except during COVID-19, is still increasingly to more than 5%. Those outstanding factors, encouraged MID States to invest in aviation by developing state of the art airports, establishment of famous airlines, enhance level of ANS or combination of those elements.

2.9 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.

2.10 The need for a regional, network-based response to the challenges of increasing demand was recommended in the ICAO ATFM Seminar (Dubai, UAE, from 13 to 15 December 2016). Consequently, MIDANPIRG/16, through Decision 16/16 endorsed to establish ATFM Task Force as follows:

MIDANPIRG DECISION 16/16: ATFM TASK FORCE

That,

a) *an ATFM Task Force be established to develop an ATFM Concept of Operations for the MID Region;*

b) *the ATM SG/3 meeting develop the terms of reference of the ATFM Task Force; and*

c) *States support the ATFM Task Force through:*

d) *assignment of ATFM Focal Point to contribute to the work of the Task Force; and*

e) *provision of required data in timely manner, and in particular to the survey that will be carried out related to the airspace and sectors capacity, hot-spots, ATFM measures/system, etc.*

Distributed Multi-Nodal ATFM Network Concept

2.11 The ATFM TF/2 proposed the Multi-Nodal Concept for the MID Region as a first Level, which would be evolved to a centralized ATFM system in the future. Accordingly, MIDANPIRG/17 agreed to the following Conclusion:

MIDANPIRG CONCLUSION 17/22: MULTI-NODAL ATFM Solution for the MID Region

That,

a) *the Multi-Nodal Concept be implemented in the MID Region, as a first phase, which would be evolved to a centralized ATFM system in the future; and.*

b) *the ATFM Task Force develop the ATFM Concept of Operations for MID Region, accordingly, including the minimum flight data that should be exchanged by ATFM Units.*

2.12 Also the MIDANPIRG/17 meeting highlighted that Asia Pacific Multi-Nodal documents including CONOPS, Regional Framework and Common Operating Procedures, would be used as basis for the development of the MID Region ATFM Documentation. In this regard, the meeting agreed to the following MIDANPIRG/17 Conclusion:

MIDANPIRG CONCLUSION 17/23: Action Plan for the Implementation of ATFM in the MID Region

That,

a) *the Action Plan for the implementation of ATFM in the MID Region at Appendix 6.2J is endorsed; and*

b) *States and Stakeholders to support the work of the ATFM Task Force and implement the actions relevant to them.*

2.13 The ATFM TF/4 proposed the draft of MID ATFM CONOPS version 1.1 to the MIDANPIRG/18 meeting. The draft was reviewed and endorsed by MIDANPIRG/18 meeting through the following Conclusion:

MIDANPIRG Conclusion 18/28: MID Region ATFM CONOPS

That,

the MID Region ATFM CONOPS V1.0 is endorsed and be published as MID Doc 014 on the ICAO MID website.

<u>ATM Operational Data Exchange process is the Key</u>

2.14 Accordingly, the MIDANPIRG/18 meeting reviewed and endorsed the ATM Operational Data Exchange process its Appendix 5.2L, which was developed by the ATFM TF/4 and the secretariat based on ICAO ATM/CDM data exchange process. In this respect, the meeting agreed to the following MIDANPIRG Conclusion:

MIDANPIRG Conclusion 18/29: ATM Operational Data Exchange

That, in order to ensure better coordination between ANSPs and improve ATS planning:

a) *The MID ATM Operational Data Exchange process at Appendix 5.2L, is endorsed.*

b) *Airspace users are invited to share with the ICAO MID Office the data related to their "Intention To Operate (ITO)" on monthly basis, for posting on the ICAO MID Office Secure Portal (Group "RO-MIDITO");*

c) *States be urged to nominate Focal Points/Coordinators for ATM data exchange; in order to be granted access to the ITO data available on ICAO MID secure portal;*

d) *ICAO MID Office to organize periodic coordination meetings for ANSPs to exchange ATM operational data; and*

e) *States ensure that the ITO and ATM Operational data are used solely for* *airspace management and ATC planning purposes during the recovery phase, and should not be shared outside the ATM community as it contains operational and financial sensitive data.*

Note: The group was established in the ICAO MID Secure Portal and Group name was renamed to "OPSDataEX".

3. Background Information

ATFM Principles

3.1 The major areas of Collaborative ATFM principles are mainly aligned with those of the ICAO MID Air Navigation Strategy (MID Doc 002), MID ATFM CONOPS endorsed by MIDANPIRG 18/28, ATM Operational Data Exchange process agreed by MIDANPIRG 18/29 and MID ATFM Action Plan endorsed by MIDANPIRG 17/23 included at ***Appendix A.*** The action plan is continuously reviewed and updated by the ATFM TF.

ATFM-Related Aviation System Block Upgrades (ASBU)

Note: in this section, the valid and update reference for each element applicability area, performance indicators/supporting metrics and timeline is MID Air Navigation Strategy (MID Doc 002).

3.2 The ICAO ASBU threads and elements, detailed in Doc 9750 – Global Air Navigation Plan (GANP) 6th edition, 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.

3.3 Based on APAC experience to address the prerequisites of ATFM implementation from ASBU point of view (modules, threads & elements) and taking into account 35 elements of Blocks 0 and 1 that were considered as priority one in the MID Air Navigation Strategy (MID Doc 002) endorsed by MIDANPIRG/18, the following threads and elements have been identified as the most related factors to ATFM implementation Level I in the MID Region:

- NOPS B0/1 (Initial integration of collaborative airspace management with air traffic flow management);
- FICE B0/1 (Automated basic inter facility data exchange (AIDC/OLDI));
- FRTO B0/2 (Airspace planning and Flexible Use of Airspace (FUA)) & B0/4 (Basic conflict detection and conformance monitoring); and
- ASUR B0/1 (Automatic Dependent Surveillance – Broadcast (ADS-B)), B0/2 (Multilateration cooperative surveillance systems (MLAT)) & B0/3 (Cooperative Surveillance Radar Downlink of Aircraft Parameters (SSR-DAPS).

3.4 In line with Para 4.3, the following most related elements also considered as priority two for implementation of ATFM Level II in the MID Region:

- NOPS B0/2, B0/3, B0/4, B0/5, B1/1, B1/2, B1/3, B1/4, B1/5, B1/6, B1/7, B1/8, B1/9 & B1/10;
- FRTO B0/1, B0/3, B1/1, B1/2, B1/3, B1/4, B1/5, B1/6 & B1/7; and
- ASUR B1/1.

3.5 In the same vein and taking into account the rest of selected 35 elements (Blocks 0 and 1) that were considered as priority one in MID Air Navigation Strategy (MID Doc 002) endorsed by MIDANPIRG/18, the following threads and elements have been identified as the complementary factors to ATFM implementation Level I in the MID Region.

- ACDM B0/1 (Airport CDM Information Sharing (ACIS)), B0/2 (Integration with ATM Network function) & B1/1 (Airport Operations Plan (AOP));

- AMET B0/1 (Meteorological observations products), B0/2 (Meteorological forecast and warning products), B0/3 (Climatological and historical meteorological products) & B0/4 (Dissemination of meteorological products);
- APTA B0/4 (CDO (Basic)) & B0/5 (CCO (Basic));
- RSEQ B0/1 (Arrival Management); and
- SURF B0/1 (Basic ATCO tools to manage traffic during ground operations), B0/2 (Comprehensive situational awareness of surface operations) & B0/3 (Initial ATCO alerting service for surface operations).

3.6 In line with Para 4.7, the following complementary elements also considered as priority two for implementation of ATFM Level II in the MID Region.

- ACDM B1/2;
- AMET B1/1, B1/2, B1/3 & B1/4;
- APTA B1/4 & B1/5;
- RSEQ B0/2, B0/3 & B1/1; and
- SURF B1/1, B1/2, B1/3, B1/4 & B1/5.

3.7 Determination of related threads and elements for implementation of ATFM Level III is postponed to after completion of study/review of the implementation progress/lesson learned in Level I and take into consideration the outcome of new research and development by ATFM TF to make required proposal for further decision/conclusion by related MIDANPIRG meeting.

<u>Collaborative Decision Making - ATM Operational Data Exchange process</u>

3.8 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.

3.9 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.

3.10 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.

3.11 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.

3.12 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 units (to share tactical flight data) i.e. CFMU, BOBCAT;
- Airport operators;
- CDM-participating airlines.

3.13 Each State will develop ATFM capability according to its needs and requirements, and the overarching goal of seamless ATM across the MID Region.

3.14 The Regional concept for cross border ATFM is based on ICAO ATM/CDM data exchange process. Under this concept each State and Stakeholder nominated Focal Point/Coordinator, will be tasked to participate collaboratively in national, cross-border and regional coordination meeting.

3.15 Based on all the above and take into consideration of ICAO ATM/CDM data exchange process, The MIDANPIRG/18 meeting in conclusion 18/29 endorsed the ATM Operational Data Exchange process. This process is a key element for implementation of ATFM collaboration in the MID region at Level I. the process is explained at this document, ***Appendix B***.

3.16 In this vein, and for harmonization in ATFM agreement between States, ICAO in Doc 9971 at ***Appendix G***, published a Template for Letter of Agreement (LOA) between ANSPs on flow management. In this regard and with consideration of MIDANPIRG/18 conclusion 18/29, this Template was aligned with MID Region ATM Operational Data Exchange process at ***Appendix H***.

ATFM Phases

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

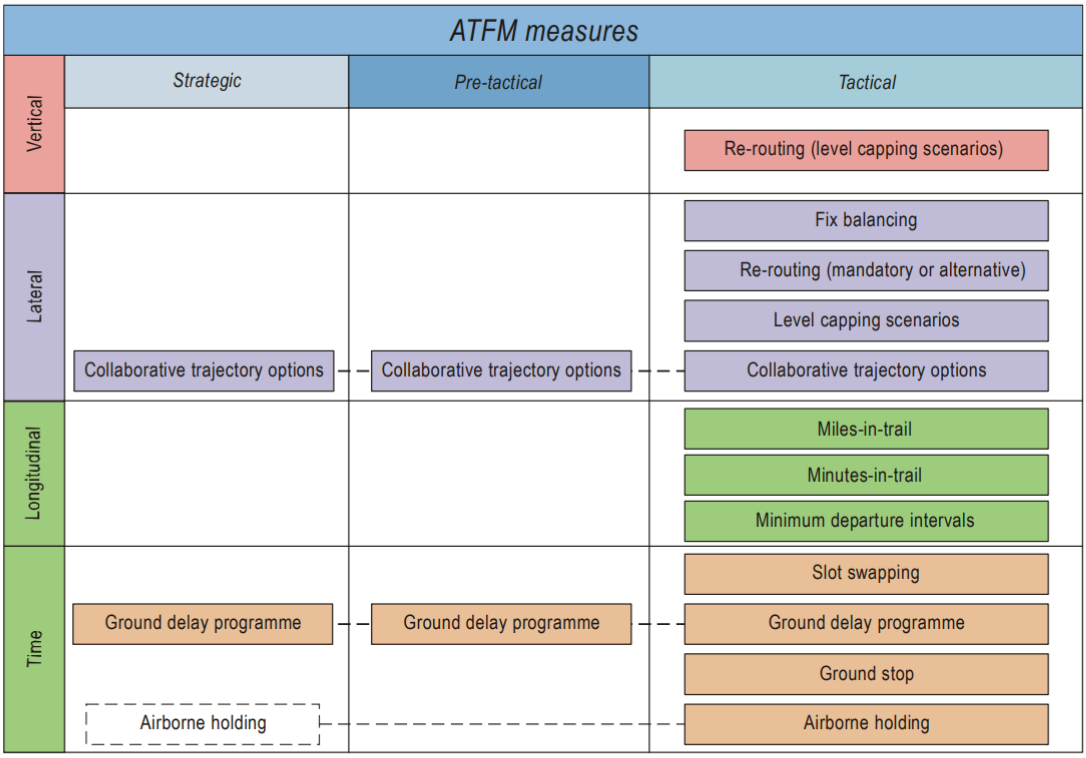


Figure 1: ATFM Operational Management and Phases

3.18 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.

3.19 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. The necessary inter-State ATFM network capability in the MID Region is not established, but based on MIDANPIRG/18 conclusion 18/29, states agreed to develop the ATM Operational Data Exchange process for implementation of MID ATFM level 1.

3.20 Tactical ATFM measures are taken on the day of operation, managing traffic flows and capacities in real time. 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.

3.21 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

3.22 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.

3.23 Airspace capacity improvements may be achieved by:

- Improved ATS route design including segregation of inbound, outbound (SIDS and STARs) and overfly (transit) traffic flows and, where supported by a business case, mandating of PBN 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;
- ATM automation system enhancements including automated coordination and hand-off procedure between systems (AIDC/OLDI) and sectors, and transition from paper-based 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); and
- Optimization Longitudinal (in-trail) and Lateral Separation Minima.

3.24 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; and
- Implementation of precision approaches to all runways.

3.25 The following ICAO MID documents aimed to improve airspace and airport capacity in the MID Region:

- MID Air Navigation Strategy (MID Doc 002);
- MID Region ATM Contingency Plan (MID Doc 003);
- MID High Level Airspace Concept (MID Doc 004);
- MID Region AIDC/OLDI Implementation Guidance (MID Doc 006);
- MID Region PBN Implementation Plan (MID Doc 007);
- Guidance on GNSS Implementation in the MID Region (MID Doc 011);
- MID Region Surveillance Plan (MID Doc 013); and
- MID Air Traffic Flow Management - Concept of Operations (MID Doc 014).

3.26 The demand/capacity analysis identifies a number of factors that are extremely important for the efficient planning of the ATM system so as to ensure an optimum balance that will benefit the ATFM. In this regard at ***Attachment A***, ICAO SAM regional project report in 2009 provides some guidelines for ATM planners to improve system capacity.

<u>Capacity Planning and Declaration</u>

3.27 The Collaborative Decision Making (CDM) process, a key enabler of ATFM, allows all of its subscribing members, called CDM stakeholders, to participate in decisions that affect them after all relevant information has been made available to them. This applies to all types of decisions in the strategic, pre-tactical, and tactical phases.

Note 1: Caution must be taken the only outcome of the following methodologies is not enough for calculation of declared capacity. On other hand, the calculated value will give us maximum capacity and states need to take into account the outcome of daily/periodic MID ATM Operational Data Exchange meetings (National, cross border and regional levels) as complementary resource to determine precise Declared Capacity.

Note 2: Many elements have positive or negative impact on declared capacity. To avoid elimination of such critical factors, MIDANPIRG/18 on conclusion 18/29 endorsed the MID ATM Operational Data Exchange process (MIDANPIRG 18, Appendix 5.2L) and invited States, ANSPs and AUs to share useful operational data/information such as NOTAM, weather, Intention To Operate (ITO) with ICAO MID through secure portal, Group "OPSDataEX". Meanwhile this conclusion urged States to nominate Focal Points/Coordinators for ATM data exchange; in order to be granted access shared data/information and participate in ICAO MID periodic coordination meetings.

3.28 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.

3.29 The capacity of an ATS system depends on many factors, including traffic density and complexity, the ATS route structure, the navigation accuracy and capability of the aircraft using the airspace, weather-related factors, controller equipment and workload. Every effort should be made to provide sufficient capacity to cater to both normal and peak traffic levels; however, in implementing any measures to increase capacity, the responsible ATS authority shall ensure safety levels are not jeopardized.

3.30 In case of particular events that have a negative impact on the declared capacity of an airspace or aerodrome, the capacity of the airspace or aerodrome concerned shall be reduced accordingly for the required time period. Whenever possible, the capacity pertaining to such events should be predetermined.

3.31 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.

3.32 The followings are the abstract and reference of global experiences for determination of capacity in different domain.

a) ICAO ATS planning manual, Doc 9426, specifically explained two techniques, implemented by the United Kingdom (DORA TASK) and Germany (MBB).

b) ICAO SAM regional office, had project in 2009 regarding implementation of ATFM in its own region. The outcome of the project is very valuable and comprehensive document have been published under their responsibility to introduce Model used in Brazil, Colombia and FAA for Trinidad y Tobago (ICAO NACC-20th E/CAR DCA-WP/21).

c) ICAO Manual on collaborative ATFM, Doc 9971, Part II, introduce two simplified methods related to determination of Airport Acceptance Rate (AAR) and Sector capacity.

d) Other models based on Simulation also developed by many States/Companies such as SIMMOD (FAA), RAMS (EUROCONTROL) and TAAM (Australia), these models do not measure capacity directly and more focus on delay.

3.33 Based on Para 4.31, also take into consideration of MID states capabilities, the following methodologies are recommended for calculation of Airport capacity:

Note 1: It may occur that the physical capacity of the aircraft parking Stand, the number of aircraft defining airport capacity in a given aerodrome, is less than the number of aircraft resulting from estimating the runway capacity for that given aerodrome; in such case, this would be the real constraint for that airport.

Note 2: Many different parameters should be considered for measuring airport capacity even in separate, but caution must be taken, normally the bottleneck factor, will determine the entire airport capacity.

a) Airport Acceptance Rate (AAR)

This is an example of a simplified methodology for determining the acceptance rate at an airport explained in ***Appendix C***. This methodology is based on the scientific process developed by the Federal Aviation Administration for establishing the acceptance rate, as outlined in FAA Order JO 7210.3X, Facility Operation and Administration. Chapter 10, Section 7.

Note: This method also explained in ICAO Manual on Collaborative ATFM, Doc 9971, Part II at ***Appendix C****.*

b) Steps to Estimate Runway Capacity in Brazil

In this model, the following sequence of events shall be followed to estimate runway physical capacity explained in ***Appendix D***:

- Step 1: Data collection
- Step 2: Estimating the runway occupancy time arithmetical mean
- Step 3: Estimating aircraft mix
- Step 4: Calculating Mean Runway Occupancy Time (MROT)
- Step 5: The physical capacity PER runway (PCR) shall be calculated for a one-hour

- Step 6: Aerodrome physical capacity calculation
- Step 7: Flight time between the OM and the THR (T)
- Step 8: Estimating the landing approach speed between the OM and the THR (V)
- Step 9: Mean speed in the final approach (MV)
- Step 10: Determination of safety separation (SS)
- Step 11: Determination of total separation between two consecutive landings(TS)
- Step 12: Calculation of the mean weighted time between two consecutive landings, taking into account total separation (MTTS)
- Step 13: Determination of the number of landings in a one-hour interval (P)
- Step 14: Determination of the number of take-offs in a one-hour interval (D)
- Step 15: Determination of theoretical runway capacity
- Step 16: Determining the declared capacity of the runway set (DCR)

3.34 Airport delays should not be considered in isolation. Capacity at a number of airports is limited and action is required to ensure that capacity is not exceeded by demand at a particular moment on the day of operations.

3.35 Maximum airside capacity is not solely reliant on runway capacity. Aprons and taxiways must be capable of maintaining sufficient traffic throughput to match runway capacity. Terminal area capacity, arrivals and departures, the terminal building, ATC staff levels, and equipment should not be neglected during the capacity declaration process.

3.36 In line with Para 4.31, also take into consideration of MID states capabilities, the following methodologies are recommended for calculation of Airspace capacity:

a) Determining Sector Capacity based on FAA methodology

This is an example of a simplified methodology for determining sector capacity at an ACC that explained in ***Appendix E***. This methodology is based on the scientific process developed by the Federal Aviation Administration for establishing the sector capacity.

*Note: This method also explained in ICAO Manual on Collaborative ATFM, Doc 9971, Part II at **Appendix** D.*

b) ATC Sector Capacity Calculation Model Used in Brazil

This method used to determine sector capacity takes into account the load borne by an ATCO in performing his/her tasks, and is based on the assessment of the tasks performed by the controller at times of high traffic volume, as seen in the DORATASK. This model was explained in this document at ***Appendix F***.

Capacity Assessment Process

3.37 Information developed by EUROCONTROL related to the ATFM capacity and planning assessment process is in ***Appendix G***.

3.38 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.

3.39 Steps in a sector capacity assessment methodology utilizing fast-time simulations include:

- Collect the necessary airspace and traffic data;
- Verify (with the support of local controllers) the traffic sample routes and the procedures used on a flow-by-flow basis;
- 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;
- Run an initial test-run of the model;
- 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;
- Consolidate a final model which is used to calculate results for all simulation scenarios, e.g. different sector configurations, different traffic samples, etc.; and
- Verify the simulation scenarios and the initial results, and if so required, do a fine-tuning of parameters.

3.40 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

3.41 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.

3.42 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.

Note: according to the approved MID ATM Operational Data Exchange process, States focal point is responsible to make required coordination at national level to cover all aforementioned aspects in Para 4.42 at cross-border and regional coordination meetings.

3.43 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.

Note: upon completion of regional MID ATM Operational Data Exchange meeting, ICAO MID office as the Secretariat is responsible to publish and share agreed ADP through ICAO MID Secure portal, Group OPSDataEX.

3.44 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.

3.45 Feedback and review of the ADP received from ANSPs, AUs, and from the ATFM unit/ACCs itself represent very important input for further improvement of the pre-tactical planning. This feedback helps the ATFM coordination platform to identify the reason(s) for ATFM decision and determine corrective actions to avoid reoccurrence.

3.46 Templates for the ATFM daily plan are provided at **Form A** (template ATFM Daily Plan for after pandemic) of MID Region ATM Operational Data Exchange process which is available at this document, **Form B**.

3.47 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 situation.

ATFM Terminology and Phraseology

3.48 Recognizing the lack of a current, globally standardized ATFM terminology, ICAO MID ATFM TF/6 and ATM SG/7 considered to use the terminologies developed by ICAO Asia/Pacific at ***Appendix I*** in ATFM communications.

3.49 ICAO MID ATFM TF/6 and ATM SG/7 ATFM considered to use the phrases at ***Appendix I*** for ATFM coordination, and in air-ground communications.

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

ATFM System Communications

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

3.51 Based on the last version of ICAO MID Air Navigation Strategy (ICAO MID Doc 002) endorsed by MIDANPIRG/18, the thread FICE, element B0/1 (Automated basic inter facility data exchange (AIDC/OLDI)) has been identified as the MID priority for implementation. In performing this objective, through MID Doc 002 at Attachment A, the list of MID Region AIDC/OLDI applicability area with priority 1 and 2 in ***Attachment B*** have been agreed.

Note: The current level of equipment and automation at the MID region is not mature enough to support ATFM interoperability requirement, further decision in this regard is pending future research and development.

ATFM Information Distribution

3.52 As endorsed in MIDANPIRG/18, conclusion 18/29, ICAO MID Secure portal, Group OPSDataEX is designated for distribution and sharing of ATFM data/information in the MID region.

Note 1: In addition of the above, States may have their own equipment for distribution of ATFM information based on bilateral/mutual agreement with their adjacent FIRs. In this regard ICAO MID recommend States to use the Template of Flow Management Letter of Agreement in ***Appendix H****.*

Note 2: 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 at level 1.

3.53 Considering the scope and performance objectives for level 2 ATFM in the MID region, Table 1 outlines the minimum items of ATFM information that ATFM systems and processes should share by using multi-nodal ATFM network concept.

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			

Meteorological Information for ATFM

3.54 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 and En-route 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.

3.55 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.

3.56 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.

3.57 ICAO Annex 3 requires that each Contracting Sate 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 preferably in the form of matrix that could be produced, with intuitive colour coding for quick recognition by ATM staff. In terms of the wider Terminal area, similar defined criteria, thresholds and colour coding can enable rapid interpretation of impact on operations.

3.58 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 (e.g. maximum crosswind component);
- an inability to commence an approach via the IAF; or
- an inability to hold in the primary published holding areas, etc.

3.59 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.

3.60 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).

3.61 The current MID Air Navigation Strategy (MID Doc 002) identified the following AMET elements as priority one in the MID Region that can support ATFM Level I:

- AMET B0/1 (Meteorological observations products);
- AMET B0/2 (Meteorological forecast and warning products);
- AMET B0/3 (Climatological and historical meteorological products); and
- AMET B0/4 (Dissemination of meteorological products).

3.62 The following AMET elements also considered as priority two in the MID Region that would support ATFM Level II:

- AMET B1/1 (Meteorological observations information);
- AMET B1/2 (Meteorological forecast and warning information);
- AMET B1/3 (Climatological and historical meteorological information); and
- AMET B1/4 (Dissemination of meteorological information).

MID Region ATFM Implementation history and progress

3.63 So far, the following activates have been done by ICAO MID office in contribution and support of MID member States, international and regional organization (ACAO, IATA, CANSO, AEROTHAI, EUROCONTROL, MAAR and MIDRMA) and voluntary states out of the region (Brazil, India, Thailand and USA (FAA)) to study ATFM implementation in the MID region:

- The ICAO MID ATM SG/1 (Cairo, Egypt, 9 – 12 June 2014):

  a) apprised, in accordance with the Questionnaire circulated to States on 7 March 2014, related to the application of ATFM in the MID Region, the majority of the MID States indicated willingness to participate in a regional ATFM service/system; and

  b) agreed to consider the implementation of Bilateral, Sub-regional or regional ATFM services in the initial MID Region High Level Airspace Concept.

- The ICAO MID MSG/4 (Cairo, Egypt, 24 - 26 November 2014) assigned ATM SG to develop the Draft Project Proposal addressing the necessity, feasibility, cost benefit analysis and timelines related to the eventual implementation of a regional/sub-regional ATFM system, to the MSC/2 meeting for consideration.

- The ICAO MIDANPIRG/15 (Bahrain, 8-11 June 2015):

a) recalled that ATFM has been identified as one of the global air navigation priorities;
b) agreed that the ASBU Block 0-NOPS be added to the list of priority 1 ASBU Block 0 Modules in the MID Region Air Navigation Strategy;
c) noted that the MAEP SC/1 (Dubai, UAE, 20-22 January 2015) agreed to include in the MAEP Master Plan a project related to a regional/sub-regional ATFM system; and
d) agreed on decision 15/16, Collaborative Air Traffic Flow Management (ATFM-CDM) that, the ATM Sub-Group develop a Preliminary Project Proposal addressing the necessity, feasibility, and timelines related to the eventual implementation of a regional/sub-regional ATFM system, for consideration by the MAEP Steering Committee.

- MAEP SC/2, (Cairo, Egypt, 11-13 April 2016) emphasized the importance of the project. However, it was agreed that the project implementation could be initiated after 2017, providing that all the enablers/prerequisites are implemented and taking into consideration the initiatives carried out by States.

- ICAO MID ATFM Seminar, (Dubai, UAE, 13-15 December 2016) recommended the following:

    a) establishment of a ATFM TF/WG under the ATM SG;
    b) development of ATFM CONOPS taking into consideration Asia Pacific and Europe experiences;
    c) need to raise awareness about ATFM;
    d) conduct training courses related to ATFM;
    e) States to consider the establishment of ATFM Cell or National Operation Centre composed of all concerned Stakeholders;
    f) carry out a survey to determine airspace and sector capacity, hotspots, ATFM systems/measures, etc.;
    g) expedite MID IFPS project implementation; and
    h) continue working on airspace improvements.

- ICAO MIDANPIRG/16 (Kuwait, 13 – 16 February 2017) encouraged States and Stakeholders to implement the Recommendations emanating from the ATFM Seminar. Accordingly, the meeting agreed to decision 16/16, ATFM Task Force.

- ICAO MID ATM SG/3 (Cairo, Egypt, 22 – 25 May 2017) agreed on the ATFM Task Force Terms of Reference (ToRs) and assigned the first quarter of 2018 for the ATFM TF/1 meeting. In this meeting, also India shared their experiences to establish Central ATFM.

- ICAO MID ATFM TF/1 (Muscat, Oman, 23 – 25 September 2018):

    a) shared knowledge and experiences gained by India (C-ATFM), AEROTHAI (Distributed Multi-Nodal ATFM Project), CANSO (CADENA), EUROCONTROL (Network Manager) and UAE (SWIM Gateway); and

    b) established the ATFM Core Team composed of experts from; Bahrain, India, Oman, Qatar, Saudi Arabia, UAE, USA, AEROTHAI, ACAO, CANSO, EUROCONTROL, IATA and ICAO to follow-up on the agreed actions by the ATFM TF.

- ICAO MID MSG/6 (Cairo, Egypt, 3 – 5 December 2018):

    a) recalled that the ATFM TF Concept of Operations for the MID Region and requested India, USA, AEROTHAI, CANSO, EUROCONTROL, IATA, MAAR and MIDRMA to support the commitment of MID Region ATFM TF;

b) noted that the MID Office circulated a Questionnaire based on the one used in ASIA Pacific and the Americas, which would be considered as basis for the actions that will be undertaken by the ATFM TF; and

c) reviewed and endorsed the TORs of the ATFM TF by MSG decision 6/18.

- Joint ACAO/ICAO ATFM Workshop (Casablanca, Morocco, 17-18 March 2019):

  a) recognized that:

    - a regional solution to manage the traffic flow across the MID Region became a priority;
    - collaboration between all stakeholders is a key success for effective development and implementation of regional framework for ATFM/CDM;
    - development of ATFM Concept of Operations requires inputs/data from all stakeholders to ensure it meet the projected objectives; and
    - sharing information is the most important enabler for ATFM/CDM.

  b) Recommend States to:

    - establish ATFM framework at the national level (regulations, organizational structure, functions, operating procedures, etc.);
    - develop ATFM National Implementation Plan;
    - ensure that ATFM personnel are trained and qualified to effectively carry out their tasks. ATFM Manager (decision maker) should have adequate ATC experience;
    - carry out necessary studies to determine airspace and airports capacities;
    - exhaust all measures that would increase capacity and continue working on the airspace improvements and the enhancement of the air navigation services within their relevant FIRs taking into consideration the airspace users' requirements;
    - support the implementation of the IFPS at regional level;
    - ensure the implementation of the Collaboration Decision Making (CDM) concept; and
    - support flight data exchange between for the management and monitoring of air traffic flow at regional and inter-regional levels.

  c) ATFM TF is invited to:

    - develop a training programme template to be used by States;
    - develop a Template for National ATFM Implementation Plan;
    - support States in carrying out their airspace and sector capacity studies ACAO and ICAO, supported by ATFM experts as required, are invited to:
      i. organize workshops and training courses related to ATFM.
      ii. conduct visits to States to support the ATFM Implementation

- ICAO MID ATFM TF/2 meeting (Casablanca, Morocco, 19 – 20 March 2019) shared India Case Study toward Cross Border ATFM, Outcome of the First ATFM Core Team Meeting in (Abu Dhabi, UAE, 22 – 24 January 2019) and UAE Development related to ATFM.

- ICAO MIDANPIRG/17 meeting (Cairo, Egypt, 15 – 18 April 2019):

  a) noted that the ATFM TF have been supported by Brazil, India, FAA, ACAO, AEROTHAI, CANSO, EUROCONTROL and IATA. The meeting encouraged States to implement the Recommendations emanating from the ACAO/ICAO ATFM

Workshop (Casablanca, Morocco, 17 – 18 March 2019);

b) agreed that the Recommendations should be considered during the development of the ATFM CONOPS;

c) based on the analysis of the survey results carried out by the ATFM TF, recognized that the MID Region is still in the first steps related to the establishment of ATFM capabilities. Accordingly, the meeting agreed that raising awareness related to ATFM and qualifying ATFM Specialists should be given high priority;

d) agreed with the ATFM TF/2 meeting and endorsed conclusion 17/22 that the Multi-Nodal Concept should be applied for the MID Region as a first phase, which would be evolved to a centralized ATFM system in the future;

e) the ATFM Task Force develop the ATFM Concept of Operations for MID Region, accordingly, including the minimum flight data that should be exchanged by ATFM Units; and

f) the Action Plan for the implementation of ATFM in the MID region endorsed by conclusion 17/23.

- ICAO ATM SG/5 meeting (Aqaba, Jordan, 1 – 4 December 2019):

  a) noted the flight planning issues in processing some of the published ATS routing schemes and/or ATM restrictions, which are used as ATFM measures. Accordingly, the meeting encouraged IATA to coordinate with the States concerned for visits to discuss and rectify the situation;
  b) agreed that the development of guidance for the harmonization and unifying of the publication of ATM measures and restrictions would support in rectifying the above reported issues;
  c) invited IATA and ICAO to address the subject to the ATFM Task Force and AIM SG; and
  d) urged States to take necessary measures to ensure the establishment of ATFM service at the national level.

- ICAO MIDANPIRG/18 meeting (Virtual, 15 – 22 Feb 2021) agreed with the ATFM TF/4 and endorsed:

  a) conclusion 18/28 the MID ATFM CONOPS version 1.1; and
  b) conclusion 18/29 the MID ATM Operational Data Exchange process.

- ICAO MID ATFM TF/5 meeting (Virtual, 25-27 May 2021):

  a) agreed to develop MID ATFM Framework; and
  b) conducted virtual breakout meeting to brief MID States focal points regarding ICAO MID Data Exchange process.

<u>Training and Competencies for ATFM Personnel</u>

3.64 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.

3.65 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.

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

Note: *in addition of the above, States may consider EUROCONTROL training courses for Air Traffic Flow and Capacity Management (ATFCM) in the following link.*

EUROCONTROL Training Zone - ATFCM Basic [NMO-ATFCM-BASIC]

4. Current Situation

MID ATFM CORE TEAM - ACT/1

4.1 ICAO MID ATFM TF/1 (Muscat, Oman, 23 – 25 September 2018) made a decision to establish MID ATFM CORE TEAM. The first meeting (Abu Dhabi, UAE, 22 - 24 January 2019) reviewed the responses to the survey received from 10 MID States out of 15 as per the consolidated table at ***Attachment C***. It was recognized that the MID Region is still in the first steps related to the establishment of ATFM capabilities. Accordingly, supporting States with the qualification of experts in ATFM as well as raising awareness should be given high priority.

4.2 The meeting discussed all the scenarios for the implementation of ATFM at the regional level and agreed to consider only four scenarios to be presented to the ATFM TF/2 meeting.

4.3 The meeting agreed to a set of criteria to be used for the evaluation of the scenarios based on the severity of the challenge to achieve the criteria as well as its weight/importance on the success of the scenario. The scenarios and their evaluation results are at ***Attachment D***.

4.4 The meeting emphasized that establishing a centralized ATFM Unit would be the optimal solution followed by the scenario in having 2 Centres for 2 participating areas, then a centralized scenario through a third party providing the ATFM service and the last one would the Multi-Nodal. However, considering the challenges, feasibility and time and efforts required, the Multi Nodal Scenario achieved the highest Score.

4.5 The meeting noted that for Asia Pacific Multi Nodal project; three document have been prepared and agreed upon by the States: CONOPS, Regional Framework and Common Operating Procedures, which would be used as basis for the development of the MID Region Documentation.

4.6 The meeting agreed that in order to start working on the ATFM CONOPS a decision should be made related to the framework to be implemented. In this respect, the meeting agreed to the following high level outline to be considered during the development of the CONOPS:

Phase I- Building State's National ATFM Capabilities:

1- Raising awareness related to ATFM
2- Establishing the regulatory framework for ATFM at national level
3- Establishment of ATFM Services within the ATS organizational structure (FOC, FMP, FMU, etc.)
4- Human resources
5- Training
6- Operating Procedures
7- National ATFM Team to ensure Collaborative Decision Making (CDM)
8- Tools to be used
9- Determine and declare Airspace and airports capacity
10- Establishment of State's National ATFM CONOPS

Phase II – Establishment of Regional Framework

1- Setting up the concept/framework for Cross border ATFM in the MID Region
2- Define which ATFM Measures would be required including GDPs (where applicable to be defined by States)
3- Agreement on the Format of the ATFM Messages
4- Means to be used for Communication between adjacent States ATFM FOC

5- Development of Common Operating Procedure (COP)
6- Agreement on LoA template for ATFM (***Appendix H***)
7- Agreement on the coordination procedures
8- Signature of LoAs between adjacent ATFM FOC
9- Establishment of platform to be used for sharing of information

Note: ICAO MID ATFM CONOPS based on the Multi Nodal Scenario has been developed and endorsed by MIDANPIRG/18.

Phase III- Implementation of Cross border ATFM

1- Exchange of information through the established platform and/or periodic daily teleconferences
2- Sharing of the ATFM Daily Plan
3- Implementation of the ATFM/CDM process for regulating traffic when required (regional and later inter-regional)
4- Post Implementation Review
5- Research and future development

<u>MID Regional Activities for Implementation of ATFM</u>

4.7 ANSPs in the MID Region currently have limited ATFM/CDM procedures in place to manage the traffic flows within their Flight Information Regions (FIRs). There is also lack of regional agreement to manage traffic flows between ANSPs. Some MID States do have some tools and processes to monitor and predict resource utilization, but the predictions are not always accurate, automated, or cross-border shared.

4.8 Strategic balancing of capacity at airports in the MID Region is currently undertaken through the airport slot allocation process or the application of Minimum Departure Intervals (MDIs). During the pre-tactical and tactical ATFM phases1, balancing of arrival demand with the available capacity at airports is mostly reactive in nature. Planning ATFM measures ahead of time is difficult because the demand data are not generally accurately predicted and there is limited control of departures. As a result, most of the demand balancing is carried out by ANSPs within their own area of responsibility through tactical flow management in some FIRs with the support of arrival management systems (AMAN). This reactive management of demand often results in inefficient means of balancing flows, such as airborne holding and vectoring.

4.9 A challenge in terms of implementing an advanced ATFM system within the Region is the high percentage of international traffic. This characteristic poses a challenge to implementation due to the cross-border effect of ATFM measures such as Ground Delay Programs (GDPs) that assign flights with Calculated Take-Off Times (CTOTs) to comply with. Current, flights departing from airports outside of the ANSP's controlling authority operate as they originally intended, without absorbing all or even some of the delay. Accordingly, a new cross-FIR boundary concept is proposed to overcome this challenge and effectively apply ATFM measures to flights operating into constrained airports and airspace, while operating from airports or in the airspace of a different control authority.

4.10 There are, however, several ANSPs in the MID Region controlling significant domestic traffic, such as Egypt, Iran, Iraq and Saudi Arabia, where GDPs might be effective with only domestic traffic operating in accordance with assigned slots.

[1] Strategic, Pre-Tactical and Tactical ATFM Phases are defined in ICAO Doc 9971 – *Manual on Collaborative Air Traffic Flow Management*

4.11 Taking into consideration the advantages of the XMAN, the MIDANPIRG meeting urged States to support the implementation of the initiative in the Region, wherever it is possible.

Note: The Cross Border Arrival Management (XMAN) is a operational procedure utilized by Air Traffic Service Units of multiple States that aims to improve and optimize arrival management operations for major airports. XMAN reduces the drawbacks of pro-longed holding in stacks, such as, fuel burn, CO_2 emissions and noise. With XMAN procedure the holding time of an aircraft is cut by reducing their cruising speed during the final en-route phase of flight, several hundred miles away from the airport.

Status of Implementation of a Collaborative ATFM in the UAE

4.12 As it was reported to ATFM TF/1, the UAE is committed to implement enhanced and Collaborative ATFM to allow a holistic approach for balancing demand and capacity. The implementation will be based on the principles of:

a) Involvement of aviation stakeholders like ATSUs, airspace users, airports and military.
b) Network View – A holistic view of flights including the business assessment of the airspace users to support decision making.
c) Predictability – Only high-quality real-time information allows for maximum efficiency and effectiveness of flow measures.
d) Transparency – All stakeholders shall have access to the same set of information.
e) Compliance Monitoring – to demonstrate the effectiveness and aiming for continuous improvements.
f) Equity – All Airspace Users will be treated fairly and equally.

4.13 The air traffic flow challenges in the UAE are predominantly determined by international departures and arrivals at UAE airports. Together these constitute almost 80% of the traffic. During peak hours the traffic demand exceeds the arrival capacity on a daily basis while departing traffic needs to be restricted due to regional constrains not under the control of UAE. Environmental circumstances such as adverse weather, holiday seasons, and regional events may cause excessive overload situations and flow disruptions.

4.14 As of today, two ATFM system components are available in the Emirates FIR to respond to excessive traffic demands for arriving and departing traffic. No ATFM measures are imposed to en-route traffic by the UAE.

Outcome of ICAO MID ATFM Survey

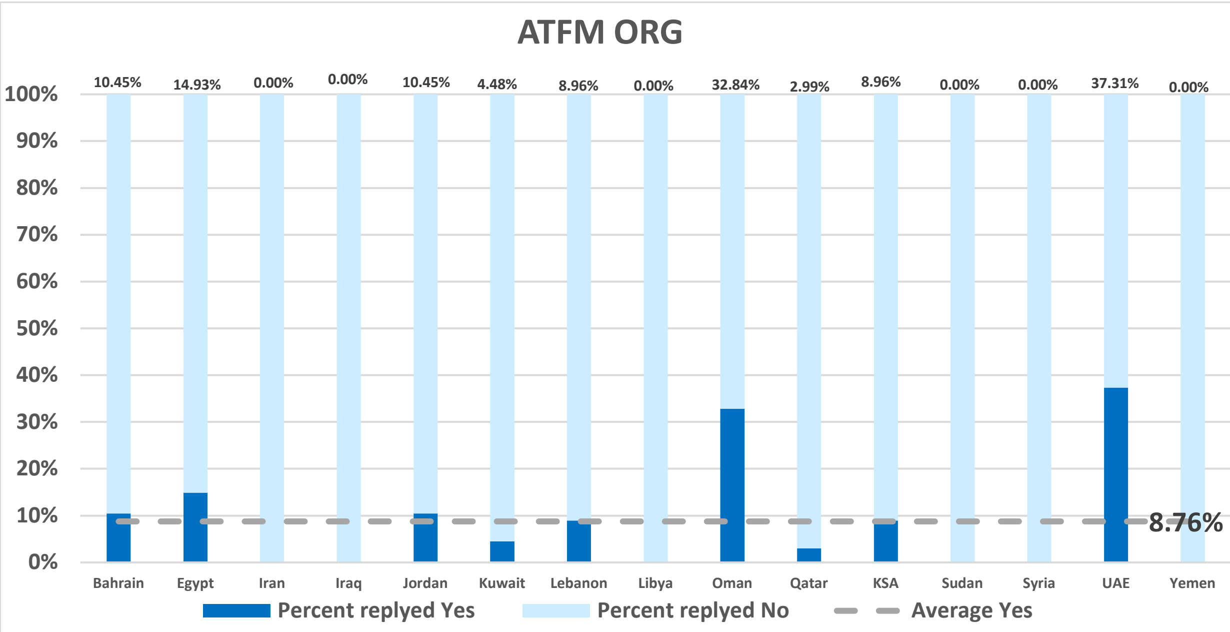
4.15 This survey has been done by ICAO MID office based on ICAO MID ATFM Seminar, (Dubai, UAE, 13-15 December 2016) recommendation. The outcome of survey, has explained the situation of ATFM in the MID region in the following aspects:

Note: 10 MID States including Bahrain, Egypt, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Sudan and UAE replied to ICAO MID Questioner.

a) ATFM Structure and Organization

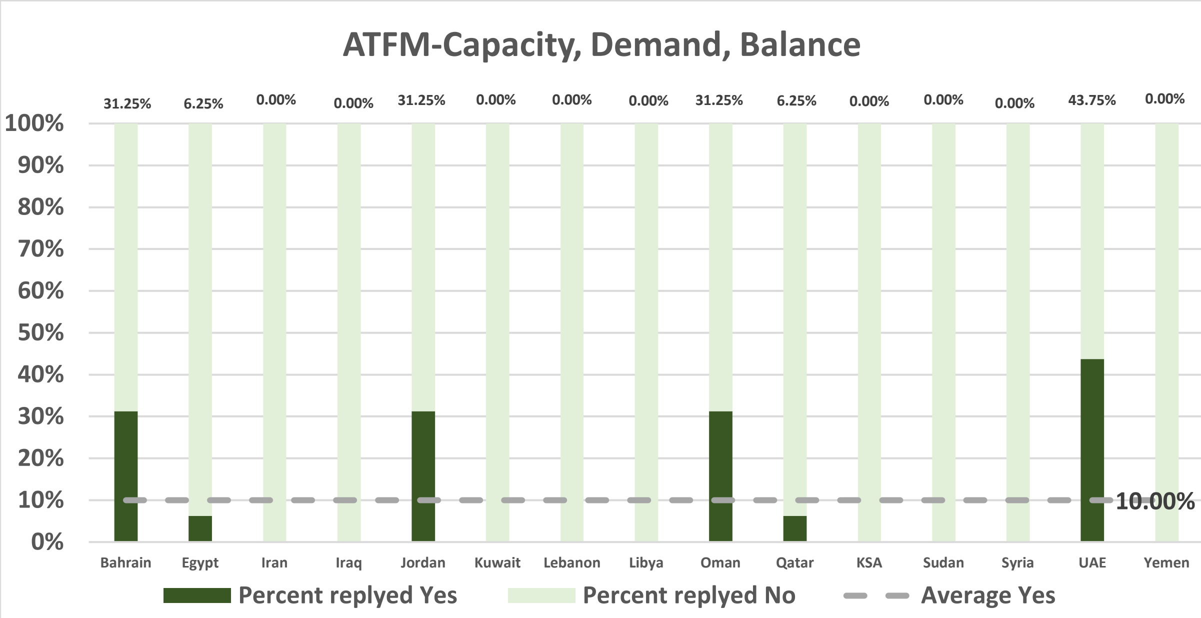
- 5 States implemented regulatory requirement for ATFM
- 6 States implemented operational requirement for ATFM
- 6 States implemented/planned to implement ATFM initiatives
- 3 States implemented/planned to implement organizational facilities for provision of ATFM services

- None of the MID States dedicated resources for ATFM function and position
- None of the MID States established Letter of Agreement with adjacent FIR(s) and Stakeholders regarding implementation of ATFM
- 3 States implemented/planned to implement CDM procedure among stakeholders
- 5 States implemented/planned to implement ATFM Daily Plan and collect, analyse, coordinate and dissemination of ATFM information.
- 4 States implemented/planned to implement CDM participation process through teleconference and web based interfaces to update flight plan intent information
- 2 States planned ATFM training for their relevant personal and stakeholders
- 2 States planned Electronic ATFM display system Shared with adjacent FIRs and stakeholders.



b) ATFM - Capacity, Demand, Balance

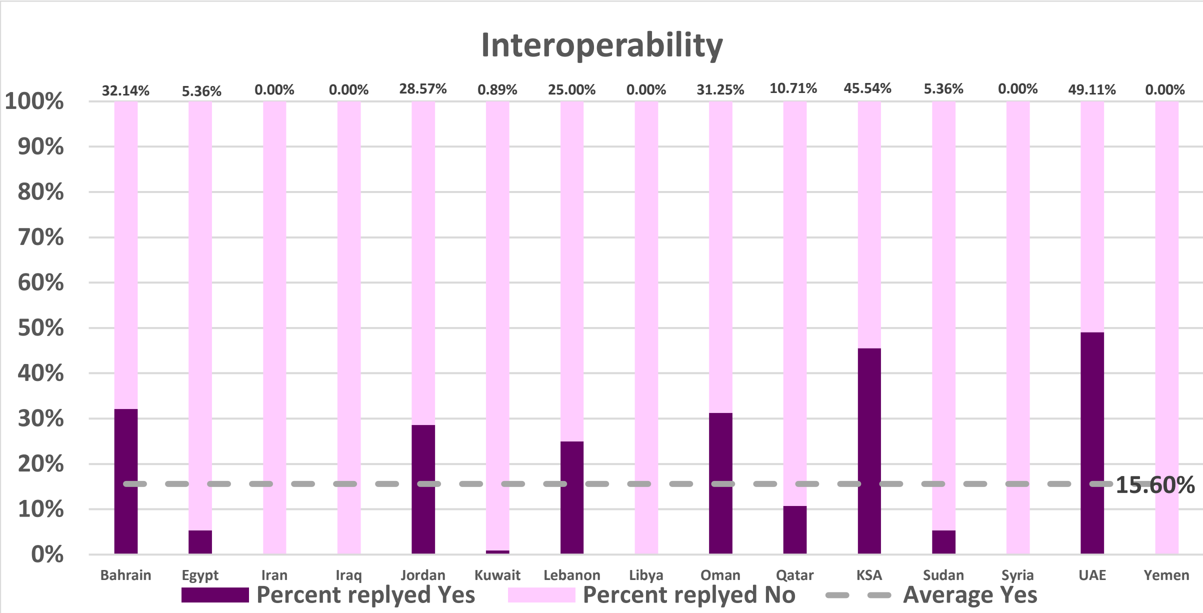
- 5 States declared/planned to declare ATC strategic capacity values for airspace, waypoint and airport
- 2 States determined declared capacity values
- 3 States have strategic airport arrival/departure slots
- 3 States have a methodology to balance demand and capacity in different phase of ATFM
- 5 States implemented/planned to implement procedures review and tools to identify available capacity, compare capacity to forecast demand and establish performance targets including airspace design review, ATFM support tools, procedure review, staffing resources to workload/traffic review, ATFM Training completed and forecast demand



c) Interoperability

- 9 States complete automated exchange of ATS messages (e.g. FPL, CHG, CNL, DEP, DLA, EST, ARR, CPL) with any, all adjacent FIRs or other non-adjacent FIRs.
- 8 States have plans to complete automated exchange of ATS messages with any or all adjacent FIRs or other non-adjacent FIRs.
- 2 States exchange Airport Acceptance Rate (AAR) information for primary airports with other FIRs.
- 1 State share adjacent sector capacity information with other FIRs.
- None of the State have automated Pre-tactical demand monitoring capability for airport, sector and ATS route.
- 1 State has automated Tactical demand monitoring capability for airport, sector, ATS route and arrival management.
- 2 States have Strategic, Pre-tactical and Tactical planning agreements with other FIRs.
- 4 States identified airports, sectors of airspace or routes which are regularly requiring ATFM Measures to balance demand and capacity.
- 9 States initiated/implemented the ATFM Measures internally
- 7 States determining ATFM measure based on demand exceed capacity, weather, military exercises, resource, maintenance/outage and VIP movement.
- None of the State declared that military airspace/activity cause the use of ATFM Measures
- 3 States declared that military airspace/activity included in strategic planning
- 4 States declared the effectiveness of ATFM Measure analyse
- 5 States declared airport, sector and ATS route capacity as primary demand-capacity imbalance reasons for the ATFM Measures.
- 6 States initiate the ATFM Measures with adjacent FIRs.
- 3 States/ANSPs carry out any post-operations analysis.
- 4 States ATFM Measures included in their LOAs.
- 6 State communicate ATFM Measures through automated or verbal communication with adjacent FIRs.

- 2 States have future ATFM initiatives planned with other FIRs.
- Until December 2018, the status of implementation of related ATFM ASBU threads in MID states is as follows:
  - 1 State implemented and 5 States planned to implement B0-A-CDM.
  - 1 State implemented and 4 States planned to implement B0-RSEQ (Improved Traffic Flow through Runway Sequencing (AMAN/DMAN)).
  - 1 State implemented and 5 States planned to implement B0-FICE (Increased Interoperability, Efficiency and Capacity through Ground-Ground Integration).
  - 2 States implemented and 4 States planned to implement B0-DATM (Service Improvement through Digital Aeronautical Information Management).
  - 1 State implemented and 5 States planned to implement B0-FRTO (Improved operations through Enhanced En-Route Trajectories).
  - 5 States planned to implement B0-NOPS (Improved Flow Performance through Planning based on a Network-Wide view).
  - 3 States planned to implement B1- A-CDM (Optimized Airport Operations through A-CDM Total Airport Management).
  - 4 States planned to implement B1-RSEQ (Improved Airport operations through Departure, Surface and Arrival Management).
  - 4 States planned to implement B1-FICE (Increased Interoperability, Efficiency and Capacity through FF-ICE/1 application before Departure).
  - 4 States planned to implement B1-DATM (Service Improvement through Integration of all Digital ATM Information).
  - 4 States planned to implement B1-SWIM (Performance Improvement through the application of System Wide Information Management (SWIM)).
  - 4 States planned to implement B1-NOPS (Enhanced Flow Performance through Network Operational Planning).
  - 5 States planned to implement B1-AMET (Enhanced Operational Decisions through Integrated Meteorological Information).
  - 4 States planned to implement B1-TBO (Improved Traffic Synchronization and Initial Trajectory-Based Operation).



5. 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

5.1 Regional collaborative ATFM performance objectives are arranged in Regional ATFM Capability phases aligned, where practicable, with Priority I and II of the ICAO MID Strategy Plan (MID Doc 002).

Phase Priority I – expected implementation by 31 December 2022; and

Phase Priority II – expected implementation by 31 December 2024.

5.2 Recognizing the short lead time between the finalization of the Framework and Phase I, Regional ATFM Capability Phase I is divided into sub-phases A and B, with expected implementation 31 December 2021 and 31 December 2022 respectively.

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

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

ATFM Program Airports

5.4 ATFM Program Airports, referenced in the performance objectives, are:

a) The busiest MID Region aerodromes as defined in the MID Strategy plan (MID Doc 002);
b) Airports where strategic slot allocation is implemented under these performance objectives; and
c) All other airports designated by the relevant authority as requiring or potentially requiring ATFM implementation.

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 duration, 1 year)

ATFM Regulations

5.5 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

5.6 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 MID city pairs, including consideration of:

a) CNS systems;
b) ATC resources and capability;
c) ATC separation standards and techniques;
d) runway occupancy times;
e) seasonal schedules; and
f) historical traffic data and traffic growth forecasts.

5.7 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;

Pre-Tactical Capacity and Demand Monitoring and Analysis

5.8 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 MID city pairs, including consideration of:

a) expected runway and airspace configurations;
b) forecast meteorological phenomena;
c) ATC resources, facilities and equipment;
d) other known or expected capacity constraints; and
e) updated flight schedule and flight plan information.

Pre-Tactical ATFM Execution

5.9 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:

a) Web-based ATFM network; or
b) Web-pages hosted by each participating ANSP; or
c) Email distribution.

Note: relevant stakeholders include:

a) Neighbouring ATFMUs or, where not provided, ATSUs
b) ATSUs supported by the originating ATFMU;
c) Relevant airport operators; and
d) Participating aircraft operators.

5.10 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

5.11 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 duration, 1 year).

ATFM Systems

5.12 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.

5.13 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.

5.14 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.

5.15 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.

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

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

Note: FIXM version 3.0 or later, extended where necessary is the agreed format for exchange of ATFM information in the MID Region. 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

5.18 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.

5.19 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

5.20 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

5.21 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

5.22 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

5.23 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

5.24 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.

5.25 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;

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.

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

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

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

Post-Operations Analysis

5.29 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.

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

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

REGIONAL ATFM CAPABILITY PHASE II (Expected implementation duration, 3 years).

ATFM Systems

5.31 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.

5.32 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

5.33 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 MID Region city pairs and high density major traffic flows.

Tactical Capacity and Demand Monitoring and Analysis

5.34 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

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

5.36 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.

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

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

6. Research and Future Development Possibilities

Research and Development

6.1 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 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.

6.2 Further research and development of the distributed multi-nodal ATFM network concept will largely be conducted by ATFM/TF participating States through their operations trial programs, consistent with Principle of the ICAO MID Strategy Plan (Doc 002). The outcomes of trials and lessons learned from operational deployment will be considered by ATFM/TF for the improvement and updating of the Framework.

ATFM Interface Control Document

6.3 The ATFM Core Team will develop an operational requirements document and an ICD for networked, cross-border multi-nodal ATFM information exchange, to be delivered to ATFM/TF for consideration before then being referred to the 7th Meeting of the ATM Sub-Group of MIDANPIRG (ATM/SG/7) in November 2021.

Collaborative ATFM Concept Developments

6.4 The following concepts should be researched, and developed, for implementation in the MID Region:

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.

FIXM Extension – may be required for implementation of any MID Region ATFM practices or procedures that are not covered in FIXM version 3.0 or later versions deployed by States.

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.

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.

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 Gulf region, 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.

Note: The development of a collaborative trajectory options program in the MID Region 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 ICAO MID Strategy Plan (Doc 002).

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.

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.

7. Milestones, Timelines, Priorities and Actions

Milestones and Timelines

7.1 ***Section 6*** of this document (Performance Improvement Plan) provides milestones and timelines for a number of elements generally aligned with the ICAO MID Strategy Plan (Doc 002) Phase I and II.

7.2 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 MIDANPIRG.

7.3 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

7.4 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 MID Regional Priorities adopted by MIDANPIRG, including GANP (ASBU), and the Annex 11 requirement for States to implement ATFM where there is a current or expected imbalance of demand and capacity.

Actions

7.5 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/TF, 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/TF is the development of a Regional Interface Control Document (ICD) for ATFM, which is expected to be completed for consideration by ATM/SG, then presented to the MIDANPIRG in February 2022.

APPENDIX A - MID ATFM Action Plan

ACTION PLAN FOR IMPLEMENTATION OF ATFM IN THE MID REGION (DATE)

Last version

Key Activities	Action		Deliverable
	No	**Description**	
Key Activity 1 Agreement on the ATFM Regional Framework	**1.**	Recommending the best Scenario for a regional ATFM framework	Recommendation
	2.	Presentation to the ACAO ANC/40	Support
	3.	Preparing a Working Paper to MIDANPIRG/17	WP
	4.	Agreement on the regional ATFM framework by MIDANPIRG	MIDANPIRG Conclusion
	5.	Presentation to the ACAO Executive Council	For support
	6.	Notifying States about MIDANPIRG/17 Conclusion and that the development of ATFM CONOPS started	State Letter
Key Activity 2 Development of Draft CONOPS	**7.**	Development of a Draft ATFM CONOPS	Draft ATFM CONOPS
	8.	Circulating the Draft ATFM CONOPS to States	State Letter
	9.	Feedback form States on the Draft ATFM CONOPS	Feedback
	10.	Consolidation of the Draft ATFM CONOPS for presentation to the ATM SG/5 meeting	Consolidated version of ATFM CONOPS
	11.	Agreement on the Draft ATFM CONOPS	Draft ATFM CONOPS
	12.	Circulating the Draft ATFM CONOPS	State Letter
	13.	Presentation to DGCA-MID/5	For Info and Support
	14.	Presentation to ACAO Executive Council	For Info and Support

Key Activity 3 Development of ATFM Regional Framework and draft Common Operating Procedures based on the agreed CONOPS	**15.**	Development of Initial Draft ATFM Regional Framework and draft ATFM Common Operating Procedures	Initial Draft ATFM Regional Framework and draft Common Operating Procedures
	16.	Agreement on the Draft Regional Framework and draft Common Operating Procedures	Draft ATFM Regional Framework and draft Common Operating Procedures
	17.	Circulating the Draft Regional Framework and draft Common Operating Procedures to States	State Letter
	18.	Feedback form States on the Draft ATFM Regional Framework and draft Common Operating Procedures	Feedback
	19.	Consolidation of a Draft Regional Framework and draft Common Operating Procedures for presentation to the MSG/7 meeting	Consolidated version of Draft ATFM Regional Framework and draft Common Operating Procedures
	20.	Presentation to ACAO Executive Council	For Info and Support
	21.	Endorsement of the ATFM CONOPS, Regional Framework and Common Operating Procedures including agreement on a roadmap for the implementation	ATFM CONOPS, Regional Framework and Common Operating Procedures
	22.	Circulation of the CONOPS, Regional Framework and Common Operating Procedures and posting them on the ICAO MID Website	State Letter
	23.	Presentation to ACAO Executive Council	For Info and Support
Key Activity 4 Implementation of the MID ATFM Regional Framework and Common Operating Procedures based on the agreed CONOPS	**24.**	Implementation of the MID ATFM Regional Framework and Common Operating Procedures	Implementation of ATFM Regional Framework and Common Operating Procedures
	25.	Implementation of ATFM framework at national level	National ATFM framework
Key Activity 5 Post Implementation	**26.**	Post implementation review	Post Implementation review
	27.	Improvement of the ATFM Regional Framework and Common Operating Procedures	Proposal for improved ATFM Regional Framework and Common

Review of the MID ATFM Regional Framework			Operating Procedures
	28.	Review and continuous improvement of the ATFM Implementation in the MID Region with consideration of establishment of centralized ATFM system for the MID Region	Continuous improvement
Key Activity 6 Training and raising awareness related to ATFM	**1.**	Development of Training Programme Template for qualifying ATFM Specialist	Training Programme Template for ATFM Specialist
	2.	Development of working arrangement for the ATFM Visits to States that would include ATFM Workshop and/or training courses	working arrangement for the ATFM Visits
	3.	Organizing an ATFM Workshop with the planned A-CDM Workshop	A-CDM/ATFM Workshop
	4.	Organizing of ATFM Training Courses	ATFM Training Courses
	5.	Conduct ATFM Support visits to States	ATFM Support visits
	6.	Conduct familiarization visits to CADENA, Singapore, India, EUROCONTROL, FAA, etc.	ATFM Familiarization Visits

Note: The Action Plan will be periodically reviewed and updated by the ATFM TF, ATM SG, and reported to MIDANPIRG; including time lines, champion and status of each activity.

APPENDIX B - MID Region ATM Operational Data Exchange Process

INTRODUCTION

1. The intention of this Operational Data Exchange process is to provide effective process for Air Navigation Service Providers (ANSPs) in order to carry out cross-border coordination with their adjacent ANSPs. taking into consideration the circumstances that would have impact on traffic flows.

2. The main objective of the procedures, is to provide a better collaborative platform for the coordination and management of traffic. during events that might cause disruption of normal traffic flows. These procedures would also support a smooth and less challenging normal operations. In this regard, the templates at Appendices A and B were developed to support coordination between adjacent area control centers (ACCs).

3. The procedures are most suitable for those States that have not implemented or established an ATFM structure yet; as well as in the ICAO Regions where no regional/sub-regional ATFM solutions had been implemented. The well-established regional or sub-regional ATFM solutions would normally ensure collaboration between their members, however, it is recognized that coordination with their adjacent States/Regions might remain a challenge.

Note 1: The procedure is not intended to replace in any form the guidance in Manual on Collaborative Air Traffic Flow Management (Doc 9971) or provisions in other ICAO documentation related to ATFM/CDM or Regional ATFM/CDM plans or guidance.

4. The procedure outlined in this process requires several layers of collaboration and coordination as follows:

a. National Level.
b. Cross border between adjacent States.
c. Multi-States Collaboration (Optional).
d. Regional level.

National Level

5. At National level, where no ATFM system is in place, a National Collaborative Decision Making (CDM) Committee should be established to coordinate the ATM issues (en-route and terminal). The Committee should be composed of representatives from entities that have involvement/impact on ATM operations (ATS, MET, AIS, CNS, SAR, PANS-OPS, regulator, airspace users, airport operators, military authorities, etc.).

6. In cases where a State already have an established Committee or other mechanism is in place, measures should be taken to ensure that it addresses ATM operations-related issues and contingency planning as well as the optimization of airspace management.

7. The CDM Committee should hold frequent (preferable daily) coordination meetings/telecoms to address the operational status and agree on the measures that should be implemented to mitigate the associated challenges.

8. A-CDM, at the airports where it is implemented, will facilitate the work of the CDM Committee, as well as for effective optimization of flight operations at the airports and relevant terminal airspaces.

9. An ATM/CDM Coordinator should be appointed to lead the communication between all stakeholders at national level, including airports, who will also act as the point of contact for cross-border coordination with the adjacent ANSPs/ACCs. It is recommended that the coordinator is an active/dynamic en-route air traffic controller/supervisor knowledgeable of the airspace with high level tactical skills, able to discuss, coordinate and explore solutions to traffic flows. Where an ATFM structure is in place, the ATFM Manager would play this role.

Cross-border Coordination

10. The relevant communication and exchange of operational information among stakeholders on a real-time basis forms the backbone of CDM. This exchange may be accomplished by a variety of means including telephone calls, web conferences, e-mail messages, and electronic data exchange including, but not limited to web page displays. The purpose of the information exchange is to increase stakeholder situational awareness, improve operational decision-making, and enhance the efficiency of the ATM system.

11. It is a significant advantage if a tool is in place to exchange information between the adjacent ACCs. Nevertheless, operational issues for discussion could be coordinated by emails and discussed via telephone. In addition, the use of web-conference applications should be considered, which improve the exchange/sharing of information through view-my-screen options.

12. It is recommended that the OPSDataEx Coordinators from adjacent States communicate together at least once daily on a suitable time for both parties that ensure all matters related to operations are addressed in a timely manner. Timing of daily teleconference should be based on either traffic distribution of associated shift changes.

13. The objective of daily teleconferences between adjacent ACCs is mainly to address the operations outlook and any factor affecting normal operations so as to agree on ATM measures to overcome challenges impacting traffic flows and operational requirements agreed upon via the ATS Letters of Agreement (LoAs).

14. The sharing of information and coordination at national, cross-border and regional levels between stakeholders provides the following tangible and measurable operational benefits:

- reduction of unnecessary delays and airborne holding due to, better planning, increased situational awareness and solutions developed via the coordination process;
- reroute flights in collaboration with neighboring ANSPs, taking into account airspace user needs;
- fuel savings due to better-coordinated tactical air traffic management;
- communicating in a timely manner the impact of special events, contingency and crisis including weather, national disaster, disruption of services, etc.;
- advance planning for the events and for post-events recovery;
- top management kept briefed and informed; and
- optimized implementation of ATFM measures due to improved view of demand and capacity predictions.

15. The Table at Form A presents Template for Daily Teleconferences between Adjacent ACCs or ATFM unitsTelecom Template to facilitate the daily discussions between adjacent ACCs or ATFM units using Form A and preparation for the resumption of normal operations. A more detailed Template for teleconferences during normal situation (after the pandemic) is provided at Appendix B. The Table Templates would form the basis for the development of ATFM Daily Plans.

Multi States Conference Calls:

16. Instead of having one-to-one daily conferences, several States may decide to organize joint teleconferences to address the topics outlined in Appendices A or B. For better management of joint teleconferences, follow-up, monitoring and reporting, a lead State/ANSP would be nominated that will ensure communication between the States members of the joint teleconferences as well as communicating and reporting as deemed necessary to the relevant ICAO Regional Office/CCT.

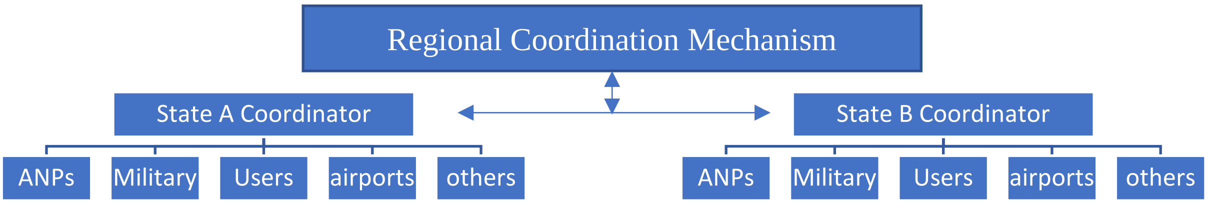
Regional Level

16. ICAO Regional Offices consolidate the inputs received from their relevant States or Group of States as well as those provided by the airspace users and share it as required for regional/inter-regional consideration through the CCT framework or any other mechanism for discussion and agreement on necessary ATM measures to mitigate the identified challenges.

17. Regional Offices organize periodic teleconferences, as deemed necessary, with States and Organizations concerned. During these regional discussions, the relevant ICAO State Letters as well as the matters reported by States and the challenges reported by airspace users should be addressed.

Note: A State could be assigned as a Collection Point for a group of States to consolidate the updates/inputs and provide them to the accredited ICAO Regional Office.

18. The chart below illustrates the coordination process:



19. The outcome of the process, is to have an idea about the expected traffic demand according to the collected data, **Form C** is provides Hourly Distribution of traffic on Entry/Exit points FIR; that could be compared to the capacity.

20. reference is made to the following guidance materials related to ATFM and A-CDM and a regional cross-border initiative:
https://www.canso.org/implementing-air-traffic-flow-management-and-collaborative-decision-aking
https://www.canso.org/guidelines-airport-collaborative-decision-making-cdm-key-performance-measures
https://www.cadenaois.org/index.html

Appendix B - Form A

Template for Daily Teleconferences between Adjacent ACCs or ATFM units

	Telecom #.			
1	Covering period (date and time)	From:	To:	*i.e. coming 12h, 24h, 5, 7 days*
2	Between State/ANSPs	State/ANSP A: [title] [Coordinator name] [email] [Telephone/mobile]	State/ANSP B: [title] [Coordinator name] [email] [Telephone/mobile]	
3	Greetings	---	----	
4	Brief Overview of the situation			
5	Describe the issues that may have impact on traffic flow during the coming period:			
	a) Weather: current or forecasted weather that would have impact on en-route or aerodrome operations such as reduced visibility, hurricanes, sandstorms, turbulence, thunderstorm activities, volcanic ash, etc.			
	b) Infrastructure (NAVAID outage, GNSS signal interference, planned maintenance, radar outage, direct COM issues, etc.) NOTAMed or planned to take place.			
	c) Military activities			
	d) Special movements			
	e) Special events			
	f) Pandemic-related issues			
	g) Others			

6	Aerodromes issues			
	a) Airport capacity			
	b) Projected terminal demand;			
	c) Anticipated ATFM measures (MDI, MIT, GSt, GDP, MINIT, etc.)			*Refer to Doc 9971 Chap 4 Section 4.5*
	d) Other			
7	En-route issues			
	a) Airspace capacity (Sector capacity)			
	b) Changes to traffic flow with highlight on relevant Entry/Exist Points.			
	c) ATS Routes status (available, closed, CDR, DCTs, etc.)			
	d) Anticipated ATFM measures (MDI, MIT, MINIT, Re-route, etc.)			*Refer to Doc 9971 Chap 4 Section 4.5*
	e) Other			
8	Coordination Process/Communication			
	a) Discuss changes to way of communication and exchange of info and coordination, of traffic between the 2 ATS units, if any. This would include, Direct Speech, AIDC/OLDI, AFTN Messages, etc.			
	b) Transfer of control points			
	c) Flight level restrictions at entry/exit points			
	d) Expected frequency changes in case of Sector opening/closure or combining sectors.			
	e) Other			
9	Other topics of mutual interest			
10	Required follow-up actions till next telecom			
11	Agreement what and who will report any relevant information or decisions to the relevant ICAO Regional Office and/or CCT			
12	Summary			

Appendix B - Form B

Template for Daily traffic demand between Airspace users and ANSPs

No	Flt No.	DEP	ARR	ETD	ETA	Operating Days							FR1-FR2			FR2-FR3			FR3-FR4			FR4-FR5…			Priority/phase	Remarks
						Sundays	Mondays	Tuesdays	Wednesdays	Thursdays	Fridays	Saturdays	WP/Fix	Time	FL	WP/Fix	Time	FL	WP/Fix	Time	FL	WP/Fix	time	FL		
1																										
2																										
3																										
4																										
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Appendix B - Form C

Hourly Distribution of traffic on Entry/Exit points FIR

Note	*Declared Capacity:*	*Defined number of traffic that could be accepted on each point taking into consideration the available FLs, separation, ATCO workload, airspace complexity, etc.*
	No. of traffic:	*Based on inputs received form airlines or FPLs (Appendix C)*
	The spreadsheet could also be used to analysis the distribution of traffic and impact of rerouted traffic due to contingency situation.	
	% columns and Total column are formulas based for automatic calculation	

No.	**Way Points**	**E=Entry X=Exit B=both**	**0:00z**			**1:00z…**		
			Declared Capacity	**No. of Traffic**	**%**	**Declared Capacity**	**No. of Traffic**	**%**
1								
2								
3								
4								
5								
6								
7								
8								
9								

APPENDIX C - Calculation of the Aerodrome Acceptance Rate (AAR) used by the FAA

Administrative considerations

a) identify the organization responsible for the establishment and implementation of AARs at select airports;
b) establish optimal AARs for the airports identified; and
c) review and validate the airport primary runway configurations and associated AARs at least once each year.

Determining AARs

Calculate optimal AAR values for each airport runway configuration for the following weather conditions:

a) visual meteorological conditions (VMC): weather allows vectoring for visual approaches;
b) marginal VMC: weather does not allow vectoring for visual approaches, but visual separation on final is possible;
c) instrument meteorological conditions (IMC): visual approaches and visual separation on final are not possible; and
d) low IMC: weather dictates Category II or III operations.

Calculate the optimal AAR as follows:

a) determine the average ground speed crossing the runway threshold and the spacing interval required between successive arrivals;
b) divide the groundspeed by the spacing interval to determine the optimum AAR;
c) formula: ground speed in knots at the runway threshold divided by spacing interval at the runway threshold in miles.

Note: When the quotient is a fraction, round down to the next whole number, as shown in the example below, or use Table II-App C-1.

Example:

130 kt/3.25 NM = 40 Optimum AAR = 40 arrivals per hour
125 kt/3.0 NM = 41.66 round down to 41
Optimum AAR = 41 arrivals per hour

Table II-App C.1. Optimum AAR

	NM between aircraft at the runway threshold									
	3	**3.5**	**4**	**4.5**	**5**	**6**	**7**	**8**	**9**	**10**
Ground speed at the runway threshold	Potential AAR									
140 kt	46	40	35	31	28	23	20	17	15	14
130 kt	43	37	32	28	26	21	18	16	14	13
120 kt	40	34	30	26	24	20	17	15	13	12
110 kt	36	31	27	24	22	18	15	13	12	11

Identify any conditions that may reduce the optimum AAR, including:

a) intersecting arrival and departure runways;
b) lateral distance between arrival runways;
c) dual use runways — runways that share arrivals and departures;
d) land and hold short operations;
e) availability of high-speed taxiways;
f) airspace limitations and constraints;
g) procedural limitations (noise abatement, missed approach procedures);
h) taxiway layouts; and

i) meteorological conditions.

Determine the adjusted AAR using the factors listed above for each runway used in an airport configuration:

a) add the adjusted AARs for all runways used in an airport configuration to determine the optimal AAR for that runway configuration;
b) real-time factors may require dynamic adjustments to the optimal AAR, including:
    1) aircraft type and fleet mix on final;
    2) runway conditions;
    3) runway/taxiway construction;
    4) equipment outages; and
    5) approach control constraints;
c) formula: potential AAR – adjustment factors = actual AAR, expressed as shown in Table II-App C-2

Table II-App C-2. Example of actual AAR

Runway configuration	AAR for VMC	ARR for marginal VMC	ARR for IMC
RWY 13	24	21	19
RWY 31	23	20	17

APPENDIX D - Steps to Estimate Runway Capacity in Brazil

CALCULATING RUNWAY PHYSICAL CAPACITY

The following sequence of events shall be followed to estimate runway physical capacity:

Step 1: Data collection:

Runway occupancy time (ROT):
Recording in specific forms, constant values in Tables 1 and 2, respectively, Runway Occupancy Time during Take-Off (ROTT) data collection form, and Runway Occupancy Time during Landing (ROTL) data collection form, the runway occupancy times during take-off and landing operations distributed in their respective categories:

TABLE 1				
COLLECTION OF RUNWAY OCCUPANCY TIMES DURING TAKE-OFF (ROTT)				
SITE:	**DATE:**		**RUNWAY:**	
REGISTARY	**TYPE**	**CAT**	**TIME**	**REMARKS**

TABLE 2				
COLLECTION OF RUNWAY OCCUPANCY TIMES DURING LANDING (ROTL)				
SITE:	**DATE:**		**RUNWAY:**	
REGISTARY	**TYPE**	**CAT**	**TIME**	**REMARKS**

Note 1: These data shall be collected next to the control tower or ATS unit of the aerodrome under study. Note 2: The "remarks" column shall contain any data relevant to the validation of the collected data. For example: through which TWY has the aircraft cleared the runway after landing; or how long has the aircraft remained aligned after being cleared for take-off.

Step 2: Estimating the runway occupancy time arithmetical mean: Each of the thresholds of the aerodrome shall be taken into account by inserting the referred data in Table 3 (Form to Calculate the Mean Runway Occupancy Times (ARR/DEP) by Aircraft Category). After collecting runway occupancy times, the arithmetical mean, inter alia, is estimated by aircraft category:

TABLE 3		
ARITHMETICAL MEAN OF RUNWAY OCCUPANCY TIMES DURING LANDING (MROTL), BY AIRCRAFT CATEGORY		
AERODROME	**RUNWAY**	
	CAT	**TIME (sec)**
	A	
$\sum ROTL_{CATX}$/ N^{o} $ACFT_{CATX}$	**B**	
	C	
	D	
	E	
ARITHMETICAL MEAN OF RUNWAY OCCUPANCY TIMES DURING TAKE OFF (MROTT), BY AIRCRAFT CATEGORY		
	CAT	**TIME (sec)**
	A	
$\sum ROTT_{CATX}$/ #$ACFT_{CATX}$	**B**	
	C	
	D	
	E	
ARITHMETICAL MEAN OF RUNWAY OCCUPANCY TIMES (AMROT), BY AIRCRAFT CATEGORY		
AERODROME	**RUNWAY**	
	CAT	**TIME (sec)**
	A	**AMTOTA**
($\sum$ MROTL + $\sum$ MROTT)/2	**B**	**AMTOTB**
	C	**AMTOTC**
	D	**AMTOTD**
	E	**AMTOTE**
AMROTA= $\frac{MROTTA+MROTLA}{2}$	**AMROTB=** $\frac{MROTTB+MROTLB}{2}$	
AMROTC= $\frac{MROTTC+MROTLC}{2}$	**AMROTD=** $\frac{MROTTD+MROTLD}{2}$	
AMROTE= $\frac{MROTTE+MROTLE}{2}$		

Step 3: Estimating aircraft mix Based on total daily movement records obtained from any recognised statistical source that truly reflects the total movement of aircraft at the aerodrome, a weekly sample is obtained for estimating aircraft mix, and the resulting values are inserted in Table 4 (Form for Collecting Airport Percentage Utilisation Data by Aircraft Category - Mix).

TABLE 4			
AERODROME PERCENTAGE UTILIZATION BY AIRCRAFT CATEGORY (MIX)			
AERODROME:			
MONDAY		**TUESDAY**	
CAT	**# Aircraft (%)**	**CAT**	**# Aircraft (%)**
A		**A**	
B		**B**	
C		**C**	
D		**D**	
E		**E**	
WEDNESDAY		**THURSDAY**	
CAT	**# Aircraft (%)**	**CAT**	**# Aircraft (%)**
A		**A**	
B		**B**	
C		**C**	
D		**D**	
E		**E**	
FRIDAY			
CAT	**# Aircraft (%)**		
A			
B			
C			
D			
E			
TABLE 4 (CONT.)			
		MIX	
		CAT	**# Aircraft (%)**
		A	
$\sum \#ACFT_{CATX} / \#DAYS$		**B**	
		C	
		D	
		E	

The value of the mix shall be determined by comparing the percentages, by day of the week, of the total number of aircraft in the respective day and the total number of aircraft in each category.

The following table illustrates aircraft mix calculation:

	MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY	
CAT	**ACFT**	**%**	**ACFT**	**%**	**ACFT**	**%**	**ACFT**	**%**	**ACFT**	**%**
A	32	8.42%	29	7.63%	25	6.51%	39	9.86%	25	6.31%
B	55	14.47%	57	15.00%	61	15.89%	73	18.11%	66	16.67%
C	283	74.47%	283	74.47%	286	74.48%	282	69.98%	297	75.00%
D	6	1.58%	11	2.89%	11	2.86%	8	1.99%	8	2.02%
E	4	1.05%	0	0.00%	1	0.26%	1	0.25%	0	0.00%
Total	**380**	**100%**	**380**	**100%**	**384**	**100%**	**403**	**100%**	**396**	**100%**

Arithmetical	
CAT	**MIX**
A	7.71%
B	16.03%
C	73.68%
D	2.27%
E	0.31%
TOTAL	**100%**

Step 4: Calculating Mean Runway Occupancy Time (MROT) The values corresponding to runway occupancy times, by aircraft category, the constant values in Table 3, and the respective constant mix in Table 4 shall be taken to Table 5 (Calculating Mean Runway Occupancy Time), where the mean runway occupancy time (MROT) will be estimated using the weighted arithmetical mean.

<table>
<tr><th colspan="7">TABLE 5</th></tr>
<tr><th colspan="7">Calculating mean runway occupancy time (MROT)</th></tr>
<tr><th colspan="5">Aerodrome</th><th colspan="2">Runway</th></tr>
<tr><th colspan="2">AMROT</th><th rowspan="7">X</th><th colspan="2">MIX</th><th rowspan="7">=</th><th>MROT</th></tr>
<tr><th>CAT</th><th>TIME (sec)</th><th>CAT</th><th>#ACFT (%)</th><th>TIME (sec)</th></tr>
<tr><td>A</td><td></td><td>A</td><td></td><td rowspan="5"></td></tr>
<tr><td>B</td><td></td><td>B</td><td></td></tr>
<tr><td>C</td><td></td><td>C</td><td></td></tr>
<tr><td>D</td><td></td><td>D</td><td></td></tr>
<tr><td>E</td><td></td><td>E</td><td></td></tr>
<tr><td colspan="7">MROT=∑ (AMROT $_{CATX}$. MIX $_{CATX}$) / 100</td></tr>
</table>

Step 5: The physical capacity PER runway (PCR) shall be calculated for a one-hour period, taking into account each threshold, by dividing the cited interval, translated to seconds (3600 sec), by the mean runway occupancy time, expressed in seconds.

PCR = 3600 / MROT

Step 6: Aerodrome physical capacity calculation
It shall be based on the mean annual utilization of each runway, in terms of percentage, together with data on total monthly movements obtained from any recognized statistical source, which truly reflect the total movement of aircraft at the aerodrome from which the desired sampling will be obtained.

Runway utilization percentage (UP):
An index calculated from the total monthly movement, obtained from a sampling containing data fora one-year period. Percentages are weighted against the capacity of each runway, the end result being a single value. The following tables illustrate how to calculate runway utilization percentages:

MONTHLY MOVEMENT OF AIRCRAFT			
MONTH	**RWY A**	**RWY B**	**MONTHLY MOVEMENT**
JAN	7622	2631	10253
FEB	6364	3229	9593
MAR	9239	2409	11648
APR	9965	1184	11149
MAY	10811	896	11707
JUN	11280	291	11571
JUL	11637	620	12257
AUG	12145	263	12408
SEP	11687	273	11960
OCT	9177	2184	11361
NOV	7765	2936	10701
DEC	7487	3665	11152
TOTAL	115179		
RWY		**% UTILIZATION (UP)**	
A		86	
B		14	
TOTAL		**100**	

The mean annual percentage values per runway and the respective physical capacity values are weighted in order to obtain the physical capacity of the aerodrome, as defined in Table 6.

TABLE 6				
AERODROME PHYSICAL CAPACITY (APC) CALCULATION				
PCR		**% OF RWY UTILISATION**		**AERODROME PHYSICAL CAPACITY**
RWY A	**X**	**% RWY A**	**=**	
RWY B		**% RWY B**		
APC = ∑ (PCR $_{RWYX}$. %UTIL $_{RWYX}$) / 100				

THEORETICAL RUNWAY CAPACITY CALCULATION

Theoretical runway capacity is calculated for a sixty-minute interval, based on the mean runway occupancy time, taking into account ***regulatory aircraft separation, as well as the planning factors and landing and take-off operational factors*** of the aerodrome under study:

Runway occupancy times, aircraft mix, mean runway occupancy time, and annual runway utilization percentage, will be used to calculate aerodrome and runway physical capacity, constant values in Tables 1 to 6.

Step 7: Flight time between the OM and the THR (T)

Flight times between the OM and the THR of the runway under study shall be collected and inserted in Table 7A (flight time between the OM and the THR), taking into account the various aircraft categories operating in the aerodrome. After calculating the respective mean values, they must be inserted in Table 7B (mean flight time between the OM and the THR), so as to calculate the mean speeds in the final approach for all thresholds.

TABLE 7A				
FLIGHT TIME BETWEEN THE OM AND THE THR……….(T)				
OM/THR DISTANCE…………				
REGISTRY	**TYPE**	**CAT**	**TIME (SEC)**	**TIME (MIN)**

TABLE 7B		
MEAN FLIGHT TIME BETWEEN THE OM AND THE THR…………..(MT)		
OM/THR DISTANCE………….		
CAT	**TIME (SEC)**	**TIME (MIN)**
A		
B		
C		
D		
E		
MT = $\sum$ T $_{CAT\ X}$. /# AIRCRAFT $_{CAT\ X}$		

Note 1: Time is measured from the moment the aircraft crosses the outer marker until it crosses the runway threshold, or, in the absence of an outer marker, from the start of the final approach segment until crossing the runway threshold.

Note 2: Consider the distance between the OM and the THR, in NM.

Note 3: If there is no OM, we must select a point of a known distance in the final approach that determines the impossibility for any other aircraft to enter the runway while the landing aircraft is crossing it or is in any other segment between the referred point and the threshold under study.

Step 8: Estimating the landing approach speed between the OM and the THR (V)

With the data obtained from Tables 7A and 7B, we can estimate, for each runway, the landing approach speeds between the OM and the threshold and the final approach segment (FAS)—taking into account each aircraft category--and record the values found in Table 8 (mean speed between the OM and the THR).

Note: This speed is obtained by dividing the length of the final approach segment by the mean flight time, by aircraft category, between the outer marker and the runway threshold (MT).

AVA= $\frac{FAS}{MTA}$	**AVB=** $\frac{FAS}{MTB}$	**AVC=** $\frac{FAS}{MTC}$	**AVD=** $\frac{FAS}{MTD}$	**AVE=** $\frac{FAS}{MTE}$
TABLE 8				
MEAN SPEED BETWEEN THE OM AND THR…………				
CAT		**SPEED (KT)**	**SPEED (NM/MIN)**	**SPEED (NM/SEC)**
A				
B				
C				
D				
E				
SPEED (KT) = DIST (NM)/T FLIGHT $_{OM/THR}$ (H) **SPEED (NM/MIN) = DIST (NM)/T FLIGHT $_{OM/THR}$ (MIN)** **SPEED (NM/SEC) = DIST (NM) / T FLIGHT OM/THR (SEC)**				

Step 9, Mean speed in the final approach (MV):

The weighted mean of final approach speeds, taking into account the aircraft mix.

$$MV = \frac{MIXA*AVA+MIXB*AVB+MIXC*AVC+MIXD*AVD+MIXE*AVE}{100}$$

Step 10, Determination of safety separation (SS):

The study foresees the possibility of having a take-off between two consecutive landings, but without affecting the regulatory separation minima (RSM) between incoming and outgoing aircraft that, in Brazil, are established in ICA 100-12. This requires the calculation of a safety distance to be added to the regulatory separation minima between aircraft in the approach phase in order to allow an aircraft to take off after the first has landed, without compromising its regulatory separation with the second aircraft in the approach phase.

By estimating the distance flown by the second aircraft in the final approach while the first aircraft is on the runway, and by adding the calculated distance to the adopted regulatory separation minima, we obtain the separation required between two consecutive landings.

This flown distance is obtained by multiplying the mean speed in the final approach by the mean weighted runway occupancy time.

$$SS = MV * MROT$$

Step 11, Determination of total separation between two consecutive landings (TS):

The total separation is obtained by adding the safety separation and the regulatory separation minimum. Thus:

$$TS = SS + RSM$$

There are cases in which SS can be left out. Normally, this can happen at airports that have two or more runways, where operation dynamics can be enhanced by leaving an aircraft aligned on the runway while waiting for another aircraft to land on the other runway.

Step 12, Calculation of the mean weighted time between two consecutive landings, taking into account total separation (MTTS).

The mean weighted time it takes to cover the total separation between two consecutive landings is obtained by dividing this distance by the mean weighted speed of the aircraft mix.

$$MTTS = TS/MV$$

Note: The mean time must be calculated for each threshold in the aerodrome, based on the different taxiway configurations for each threshold in use.

Step 13, Determination of the number of landings in a one-hour interval (P):

The resulting mean weighted time it takes to cover the total separation between two consecutive landings, in seconds, shall be the denominator for the number of seconds contained in an hour (3600 sec). The result will be the number of possible landings with the separation proposed for the threshold under study, according to Table 9.

TABLE 9
NUMBER OF POSSIBLE LANDING
3600 / MTTS = NUMBER OF LANDINGS
P = 1 hour / MTTS

Step 14, Determination of the number of take-offs in a one-hour interval (D):

Based on the total separation obtained, it is possible to insert a take-off between two consecutive landings. By subtracting one aircraft from the total number of landings, we obtain the possible number of take-offs within the time interval under study, according to Table10.

TABLE 10
NUMBER OF POSSIBLE TAKE-OFFS
NUMBER OF LANDINGS - 1 = NUMBER OF TAKE-OFFS
D = P - 1

Step 15, Determination of theoretical runway capacity:

Add the resulting number of landings and take-offs in the sixty-minute interval for each threshold to obtain the theoretical operational capacity for the respective threshold, according to Table 11.

TABLE 11
THEORETICAL RUNWAY CAPACITY (TRC)
THEORETICAL RUNWAY CAPACITY = NUMBER OF LANDINGS + NUMBER OF TAKE-OFFS
TRC = Landings + Take-offs

CALCULATION OF THE DECLARED RUNWAY CAPACITY

The declared capacity is estimated taking into account the percentage annual utilisation of each runway, the same as the constant value in Table 6.

Step 16, Determining the declared capacity of the runway set (DCR)

The declared capacity of the runway set is the capacity that is fully sustainable from the operational point of view, taking into account the percentage annual utilisation of each runway.

Accordingly, the weighted arithmetical mean between the utilisation percentage and the respective theoretical runway capacities is estimated.

Thus:

$$\mathbf{DCR=} \frac{\mathbf{UPA*TRCA+UPB*TRCB+ \ldots\ldots\ UPN*TRCN}}{\mathbf{UPA+UPB\ldots\ldots UPN}}$$

Note: It should be noted that, as stipulated in DOC 9426, an ATC unit can not operate at full capacity throughout the whole operating shift, since there are several variables that significantly reduce capacity at certain times. Therefore, it is advisable to adopt percentages between 80% and 90%, thus giving more flexibility to capacity values, that is, an ideal interval that preserves the safety of air operations.

CONCLUSION

In order to maintain air traffic flow close to optimum conditions, avoiding possible system overloads, the CGNA has conducted studies to standardize the methods for estimating runway capacity, in the hope of analyzing demand/capacity evolution at each airport, and to make recommendations to the airports involved for the sake of operational harmony.

The method presented herein is intended to show the use of the runway capacity calculation model in a general and simplified manner, and does not contemplate the many peculiarities of the aerodromes where it will be applied. Therefore, when conducting studies to determine aerodrome runway capacity, all factors that might affect the indices should be taken into account.

APPENDIX E - Determining Sector Capacity based on FAA Methodology

Sector capacity is determined using the average sector flight time in minutes from 7 a.m. to 7 p.m., Monday through Friday, for any 15-minute time period.

The formula used to determine sector capacity is:

$$\frac{(\textbf{average sector flight time in minutes}) * (\mathbf{60}\ \boldsymbol{seconds})}{\textbf{36 seconds}} = \boldsymbol{sector\ capacity\ value\ optimum}$$

The steps to follow are:

a) manually monitor each sector, observe and record the average flight time in minutes;
b) after that time is determined:
    1) multiply that value by 60 seconds in order to compute the average sector flight time in seconds;
    2) then divide by 36 seconds because each flight takes 36 seconds of a controller's work time; and
    3) the result is the sector capacity value (optimum).

Example:

a) 20 flights are observed in the sector in 15 minutes;
b) Add the flights individual sector times together 120 minutes;
c) Divide 120 minutes by the 20 flights to obtain the average 120 minutes = 6 minutes / flight;
d) The quotient is the average sector flight time, in minutes 6 minutes;
e) Next, multiply the average sector flight time by 60 seconds (6 minutes / flight) X (60 seconds) = 360 seconds / flight. The product is the average sector flight time, in seconds;
f) Next, divide the average sector flight time, in seconds, by 36 seconds;
   Note: 36 seconds is a value established for use in the United States by human factor experts. It represents the average time a controller interacts with a flight while it is in the sector.
g) The average sector flight time from above is 360 seconds per flight;
h) Divide 360 seconds per flight by 36 seconds (the time a controller interacts with a flight) 360 seconds per flight = 10 flights
i) The quotient, 10, is the optimum sector capacity value for the 15 minute period.

Adjustments:

The optimum value for a sector is then adjusted for factors such as:
a) airway structure;
b) airspace volume (vertically and laterally);
c) complexity;
d) climbing and descending traffic;
e) terrain, if applicable;
f) number of adjoining sectors that require interaction;
g) military operations; or h) use Table II-App D-1.

OPTIMUM SECTOR CAPACITY VALUE plus/minus +/- ADJUSTMENT FACTORS equals SECTOR CAPACITY VALUE

Table II-App D-1. Simplified method

Average sector flight time (in minutes)	**Optimum sector capacity value (aircraft count)**
3	5
4	7
5	8
6	10
7	12
8	13
9	15
10	17
11	18
12 or more	18

APPENDIX F - ATC Sector Capacity Calculation Model Used in Brazil

This methodology consists in obtaining a value based on a mathematical formula. The basic data for such formula are derived from an investigation carried out by a special working group at the ATC unit, taking into account a busy period in which controller actions and availability to manage control sector traffic are observed and timed; this provides a data sample to be used in the ATC sector capacity calculation methodology.

The number of aircraft that can be controlled simultaneously by a single controller (N) in a given sector is estimated using the following formula:

$$N = \Phi * \delta * (\eta * \tau_m * V_m)^{-1}$$

Factors directly proportional to ATC capacity:

Φ (availability factor):

The controller availability factor, defined as the percentage of time available for planning aircraft separation procedures;

Based on this model, controller workload is the summation of times spent on:

1) communication (transmission/reception);
2) manual activities (filling out flight progress strips) and coordination; and
3) traffic planning and distribution.

This availability factor normally falls between a minimum value of 40% of ATCO time for non-radar control, and 60% for radar control (ICA 100-30). It is thus clear that efforts need to focus on increasing the “availability factor” φ.

The latter can only be achieved by applying measures to reduce the level of controller intervention in the activities mentioned in 1 and 2 above.

The percentage accounted for by this φ factor could increase if the “Man/Machine Interface –MMI” is enhanced; that is, when increasing the level of automation in some tasks.

δ (average distance):

Average distance flown by aircraft in the sector, which is a function of the paths and en route or terminal procedures established for each sector;

Factors inversely proportional to ATC capacity:

η (number of communication):

Number of communications for each aircraft in the sector, which must be limited to the least possible number required for an understanding between the pilot and the controller. This number can be minimized by issuing a complete clearance sufficiently in advance for flight planning;

τm (mean communication duration):

mean duration of each message. This factor can be minimized by issuing messages objectively, without long explanations that are detrimental for an understanding between the pilot and the controller; and

vm : mean speed of aircraft in the sector.

If δ and vm are replaced with the average flight time of the aircraft in the sector (T), this formula can be replaced with a simpler version:

$$N = \Phi * T * (\eta * \tau_m)^{-1}$$

It is advisable to make at least 30 observations of each parameter (δ, η, τm and vm) for each controller, during peak traffic, respecting the minimum number of controllers specified by the sampling technique used.

Example:

Consider **T** (average flight time in sector) = 12 minutes, **τm** (mean communication duration) = 9 seconds which is required to express in minutes 9/60=0/15 , **φ** (availability factor) = 60%, **η** (average number of communication for aircraft) = 6, which gives a number of aircraft **N** = 8 simultaneously controlled by the controller in the given sector. In other words, in this sector and under these conditions, a controller would simultaneously control 8 aircraft.

$$N = 60\%*12* (6*9/60) = 8$$

APPENDIX G - Capacity Planning and Assessment Process

1. A PERFORMANCE-DRIVEN PROCESS

1.1 The overriding objective is to develop a capacity assessment process that contributes to the requirement to: "provide sufficient capacity to accommodate the demand in typical busy hour periods without imposing significant operational, economic or environmental penalties under normal circumstances."

1.2 To address this, an annual capacity planning and assessment process — a cyclical process that identifies and quantifies the capacity requirements for the short- and medium-term — should be put in place.

1.3 To effectively determine future capacity requirements, it is necessary to monitor current capacity performance using the following indicators:

a) *average ATFM delay per flight:* the average ATFM delay per flight is the ratio between the total ATFM delay and the number of flights in a defined area over a defined period of time; and

   The ATFM delay is described as the duration between the last take-off time requested by the aircraft operator and the take-off slot allocated by the ATFM function, in relation to an airport (airport delay) or sector (en-route delay) location; and

b) *effective capacity:* effective capacity is defined as the traffic volume that the ATM system in the area concerned could handle with one minute per flight average en-route ATFM delay. This capacity indicator is derived from a linear relationship between delay variation and traffic variation.

2. METHODOLOGY TO ASSESS FUTURE CAPACITY REQUIREMENTS

2.1 The objective of a medium-term planning and assessment exercise is to provide predictions of the capacity requirement for the ATM system. This can be done in different ways, but preferably through the use of a future ATM profile (FAP) involving a combination of different modelling and analysis tools (see Figure II-App E-1).

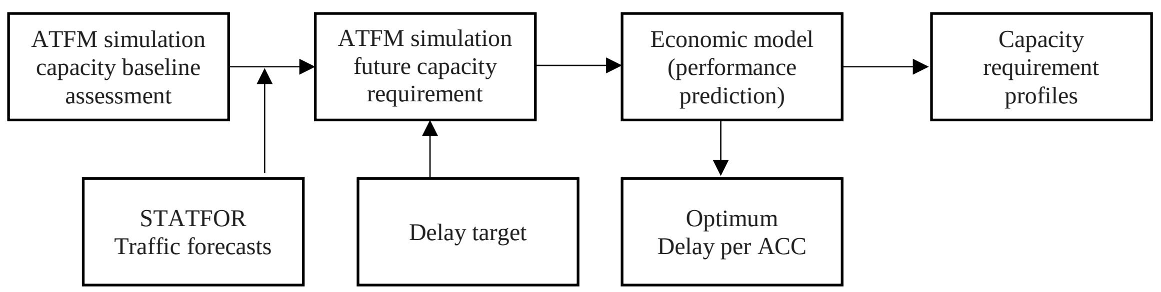

Figure II – App E-1. Key FAP processes

2.2 FAP comprises ATFM simulation facilities as well as spreadsheet and macro-based analysis and reporting tools that assess and quantify how much capacity is delivered by specific airspace volumes within the current ATM system, and evaluate the current and future capacity requirements at ACC and sector group levels. This is done according to the following steps:

Step 1: In order to provide an accurate prediction of the capacity requirements of the concerned area, it is necessary to know the **current capacity offered**. FAP should establish a **capacity baseline** for each ACC and defined sector group.

Step 2: The next task is to provide a **prediction of the future demand** on each ACC (and defined sector group) over the next 5 years, according to the expected traffic growth and distribution over the future route network.

Step 3: FAP should carry out **an economic analysis**, balancing the cost of capacity provision and the cost of delay, on the assumption that each ACC is operating at or close to its economical optimum, and that the target level of delay has been achieved.

Step 4: FAP should then produce, for each ACC in the area concerned (if more than one) and each of the defined sector groups, a **5-year capacity requirement profile**. Percentage increases with respect to the measured capacity baseline are provided.

3. EXPECTED DEMAND ON THE FUTURE ROUTE NETWORK

Medium-term capacity requirements

3.1 Medium-term capacity requirements at the ACC or sector group level can only be assessed once one has an idea of the expected traffic volume and distribution over the future route network in the area concerned. The expected demand at the ACC or sector group level should be assessed by the FAP tool from:

a) the forecast traffic growth;
b) the future route network evolution and traffic distribution, simulated by an airspace modelling tool; and
c) airport capacity constraints, assessed from information gathered from various sources on current and planned airport capacities.

Future route network evolution and traffic distribution

3.2 The capacity requirement for an ACC or sector group is clearly dependent on the distribution of traffic over the network in the area concerned, horizontally and vertically. The demand to be accommodated in the future is determined taking into account the desire of users to fly the most direct routes and optimum vertical profiles, in the context of the anticipated evolution of the route network.

3.3 Changes to the route network and traffic distribution can induce significant changes in terms of the demand (and therefore the required capacity) at individual ACCs, even during periods of reduced traffic growth.

3.4 It is assumed that aircraft will follow the shortest routes available on the network between city pairs according to the future route network, on essentially unconstrained vertical profiles. Nevertheless, some existing structural traffic distribution scenarios are retained. There is no “dispersion” of flights between equivalent routes between city pairs.

3.5 Traffic flows respecting these assumptions should be simulated by the appropriate tools and serve as an input to the FAP simulations. The result of these simulations should be a horizontal and vertical traffic distribution over the future route network, allowing the determination of the unconstrained demand in each ACC.

4. COST DATA AND ECONOMIC MODELLING

4.1 Capacity has a cost, but insufficient capacity, which in turn generates delay, has an even larger cost. Both capacity and delay costs are borne by AUs. It is therefore necessary to determine the level of ATC capacity which can be justified from a cost point of view, i.e. the optimum trade-off between delay and cost of ATC capacity.

4.2 The cost of capacity and the cost of delay are regional parameters depending on:

a) total capacity provided;
b) marginal capacity cost (ATC complexity, price index, equipment, etc.);
c) total delay generated;
d) delay sensitivity (network effects, hourly traffic distribution); and
e) cost per minute of delay (traffic mix).

4.3 Consequently, each ACC has its own capacity cost and delay cost curves. These curves interrelate as network effects within the area concerned change according to changes in capacity offered at other ACCs.

4.4 The total cost curve (the sum of the delay cost and the capacity cost) determines the optimum cost model capacity for each ACC for the current traffic demand. However, to assess capacity requirements for the future, it is necessary to incorporate the future demand into the model in an updated total cost curve for each ACC.

4.5 After the economic analysis or cost optimization for the future traffic demand is carried out, the final step in the process takes place. FAP carries out another iterative ATFM simulation by increasing capacity at the ACC offering the best return on investment (ROI), until the overall delay target is reached (see Figure II-App E-2).

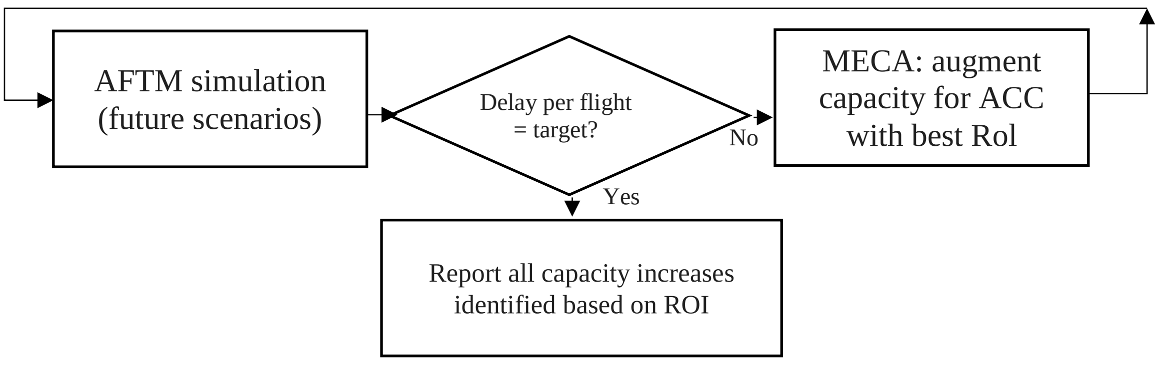

Figure II-App E-2. Iterative ATFM network simulations with best ROI to achieve target delay

4.6 When the agreed target delay is reached, the capacity target for each ACC is expressed in terms of the capacity increase that was necessary in order for the convergence to be achieved. Simulations are carried out for the final year of the planning cycle and for any year that there are changes to ACC or sector group configurations. Capacity levels are interpolated for intermediate years.

4.7 The capacity target level corresponds to the cost optimum delay for the ACC to meet the overall delay target adopted by the appropriate authority and represents the ACC capacity required to cover:

a) the expected demand; and (if appropriate)
b) the current capacity shortfall, i.e. the difference between the optimum capacity and the current capacity (as described in section 2 of this appendix)).

4.8 Figure II-App E-3 shows an ACC with an optimum capacity (green), an ACC with a capacity shortfall (red) and an ACC with a surplus capacity (blue). For the ACC with optimum capacity, the requirement is only to cover the forecast traffic increase. For the ACC with a capacity shortfall, the requirement is to cover both the shortfall and the traffic increase, and for the one with a surplus, the requirement is to achieve the optimum capacity in the medium term, without costly over-provision.

4.9 If the network delay is close to the target delay, the optimum delay at ACC level is an effective tool to identify areas that still have a capacity gap.

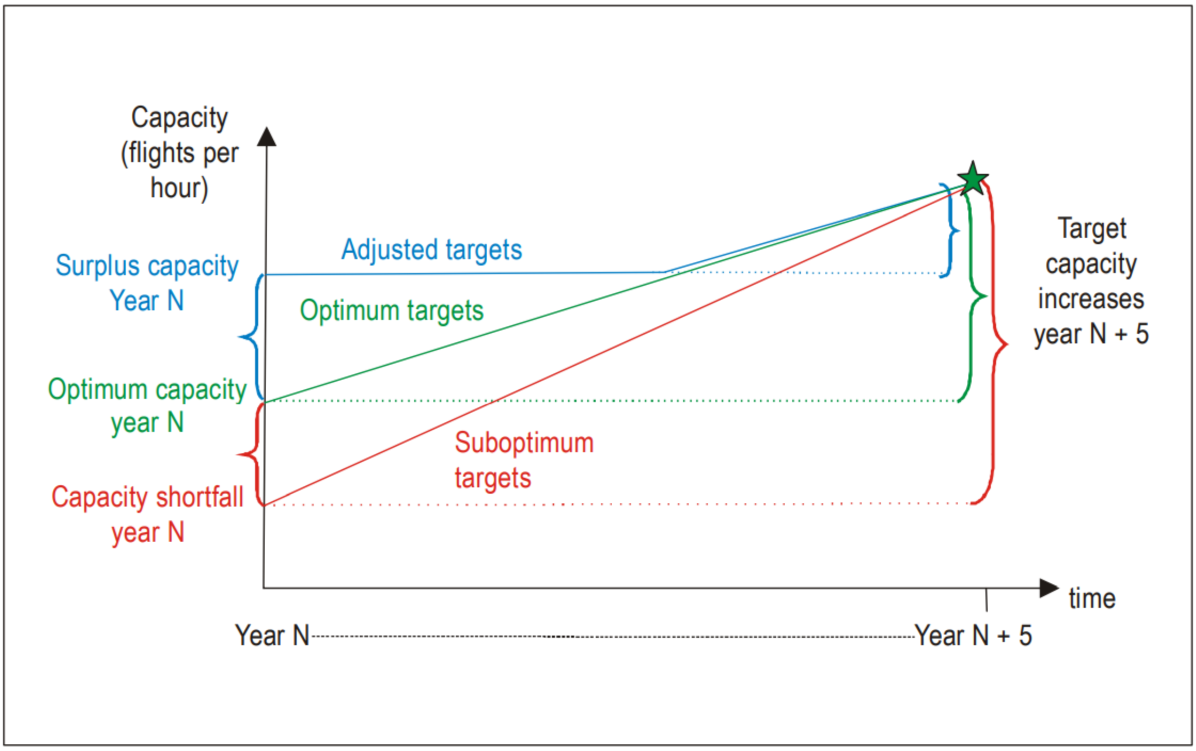

Figure II-App E-3. ACC current versus target capacity

5. THE CAPACITY PLANNING WORK PROGRAMME

5.1 Table II-App E-1 describes the different phases of the annual work programme and lists the required actions and responsibilities.

Table II-E-1. Actions, deadlines and responsibilities		
Date/Event	**Action ATFM function**	**Action ANSPs**
October–December Capacity planning meetings for the short- and medium-term	Provide all relevant data to enable the ANSP to prepare a first draft of the local capacity plan: – as data becomes available; and – at least 2 weeks before the meeting	Prepare the draft capacity plan prior to the meeting with capacity enhancement function (CEF). Ensure the participation of both planning and operational staff at the meeting.
November–December Completion of the capacity plan	Complete the capacity chapter: – by end of December	Finalize the capacity plan: – by end of November
November–February ATFM and capacity report for previous year	Coordinate and agree with ANSPs on the content with respect to the analysis of ACC performance: – by end of January Finalize report: – by end of February	Review and agree on the ACC performance analysis content provided by ATFM function: – by end of January
January Agreement and development of the medium-term capacity profile scenarios	Prepare the airspace scenario data for profile calculation following coordination with ANSPs: – by end of February	Provide ATFM function with details of configuration changes (planned or proposed) during the 5-year planning cycle for ACCs and requested sector groups: – by end of January
February Release of short- and medium-term traffic forecasts	Convene meetings and provide the forum for all relevant information to be included in the short- and medium-term forecast: – during the calendar year Provide the new medium-term traffic forecast: – by end of February Merge the short- and the medium-term traffic forecasts.	Attend the user group meetings to ensure that all information relevant to the traffic forecast is provided to the ATFM function: – by the end of December
March Calculation of medium-term capacity profiles (including optimum delay per ACC)	Calculate the optimum delay for each ACC: – by mid-March Calculate the capacity requirement profiles for ACCs and requested sector groups: – by mid-March	Agree on the capacity profiles and optimum delay per ACC for use as a basis for the local capacity plan: – by end of April
March Calculation of the delay forecast for the coming vacation season and next 2 years	Make the delay forecast for the coming vacation season and the next 2 years: – by mid-March	Ensure that the local capacity plan is up to date and accurate and communicate any changes to the ATFM function: – before mid-February
March The annual meeting of a capacity planning task force	Organize the task force meeting, invite contributions, compile the agenda and write the report.	Attend the meeting with the appropriate planning and operational participation and be prepared to share best practice capacity planning.
April Publication of the operations plan for the coming vacation season	Incorporate the vacation capacity plans into the plans: – by mid-March	Ensure that up-to-date capacity information for the coming vacation season is made available

	Release the first version of the vacation plan: – by mid-March	and that any changes are communicated to the ATFM function for inclusion in the plan: – by end of February – as they occur, throughout the vacation season
May Coordination and agreement of medium-term capacity profiles	Coordinate bilaterally with ANSPs and agree on the profiles that will be used as the basis for local capacity planning in the medium term: – by end of March Present the capacity profiles to the next meeting of the appropriate authorities for approval: – May meeting	
June Publication of the medium-term ATM capacity plan	Collect and consolidate all the local medium-term capacity plans and complete an analysis of the expected situation at network and local levels: – by end of April	
July ACC capacity requirement profiles published	Release document: – by end of July	
July–August ACC/sector group capacity baseline assessment period	Inform ANSPs of the reference dates and request confirmation of data quality: – by end of June Calculate the baselines for ACCs and requested sector groups according to the airspace structure scenarios defined for the capacity profiles: – by end of August In addition to the baseline assessment, calculate the capacity baselines using appropriate simulation and calculation tools: – by end of August	Confirm that fully accurate sector capacity and opening scheme data will be provided to the ATFM function: – 1 week before the reference period Ensure that the sector capacity and opening scheme data are sufficiently accurate for the baseline assessment: – two AIRAC cycles before the start of the AIRAC containing the measurement period
September–October ACC capacity baselines coordinated with the ANSPs	Communicate the baseline results to ANSPs on a bilateral basis for discussion and agreement: – by mid-September Present the agreed ACC baselines to the next meeting of the appropriate authorities – at October meeting	Agree on the capacity baselines for the next planning cycle: – prior to meeting of the appropriate authorities

Capacity planning meetings

5.2 Once per year, the ATFM function should visit the majority of ANSPs in the area concerned to collect information on capacity plans for the next 5 years and the coming vacation season. It is essential to the improvement of ATM capacity at the overall network level for each ACC to have a robust capacity planning process and a realistic capacity plan.

5.3 ANSP capacity plans for each ACC should be published in a local implementation plan, together with other relevant capacity information (e.g. capacity delivered during the previous vacation season, future capacity requirements, expected performance in the medium term and the current and expected capacity of major airports).

5.4 Prior to each meeting, the ATFM function provides the ANSP with a set of data to enable them to prepare the preliminary capacity plan, tailored to local conditions. The data set should include the following:

a) a report and analysis of capacity delivered during the previous vacation season;
b) the value of the (vacation) capacity baseline indicator for each ACC and requested sector group;
c) the optimum delay for each ACC to meet the network target delay;
d) a set of 5-year ACC capacity requirement profiles for high, low and medium traffic growth (shortest available routes over the future route network) and for the current route network;
e) similar capacity requirement profiles for requested sector groups;
f) detailed medium-term traffic forecast;
g) the latest short-term traffic forecast per State;
h) short- and medium-term delay forecast for each ACC;
i) differences in demand between current routes and shortest routes, and current routes and cheapest route scenarios; and
j) other relevant capacity information.

5.5 ANSPs prepare a first draft of the capacity plan for the meeting, which is discussed and updated in an interactive session, using appropriate simulation and calculation tools. To facilitate the discussion and ensure a realistic capacity plan, ANSPs should ensure the presence of both planning and operational staff.

5.6 The plan should detail the capacity enhancement actions planned each year of the capacity planning cycle, together with a realistic assessment of the contribution of these initiatives to the overall annual capacity increase.

APPENDIX H - TEMPLATE FOR LETTER OF AGREEMENT (LOA)

LETTER OF AGREEMENT (LOA)

Effective date:

Subject: Air traffic flow management (ATFM) collaboration

ANSP1 and ANSP2 enter into this LoA to facilitate the safe and efficient movement of air traffic between and over both countries.

1. PURPOSE

The purpose of this LoA is to establish continuity of operations and ATFM procedures between the flow management unit 1 (FMU1)/ACC1 in (city/country) and FMU2/ACC2 in (city/country). This LoA is not intended to replace any local agreements between ANSP1 area control centres (ACCs) and ANSP2 ACCs. This LoA will promote coordination and collaboration between FMU1/ACC1 and FMU2/ACC2 regarding traffic management measures and the routing of aircraft into and out of ANSP1 and ANSP2 airspace. FMU1/ACC1 and FMU2/ACC2 will be the primary points of contact for coordinating traffic management (TM) measures and operations between ANSP1 and ANSP2.

2. SCOPE

The procedures outlined are for use by FMU1/ACC1 and FMU2/ACC2 to provide normal air traffic services (ATS).

3. BACKGROUND

a) ANSP1 and ANSP2 have established operational agreements creating cross-border communications and a seamless operational atmosphere. This agreement incorporates FMU1/ACC1 and FMU2/ACC2 operational procedures and practices.
b) traffic flow management continues to evolve as new procedures and technologies are developed. ANSP1 TM measures may include departures from ANSP2 airports. Likewise, ANSP2 TM measures may include departures from ANSP1 airports. The TM measures coordinated by either FMU may include MIT, MINIT, ground delay measures, ground stops and re-route initiatives.

Note: This list is not all-inclusive and other TM measures may be developed and coordinated to meet operational needs either between two adjacent FIRs or during regional coordination meeting.

4. RESPONSIBILITIES

a) Responsibilities of FMU1/ACC1 Operations:

   1) FMU1 is responsible for the flow management of traffic to ANSP1 destinations and through ANSP1 airspace as follows:
      i. FMU1/ACC1 will coordinate with FMU2/ACC2 before implementing TM measures that may impact ANSP2 airports;
      ii. when ANSP2 airports are included in a TM measure, advise FMU2/ACC2:
         – before implementing the TM measure;

– what the TM parameters are; and

– when the TM measure is cancelled;

iii. FMU1/ACC1 will coordinate with FMU2/ACC2 before implementing aircraft reroutes affecting departures from ANSP2 airports or airspace;

iv. FMU1/ACC1 must include FMU2/ACC2 TM measures in the ATFM operations plan (OP) when it is likely that ANSP1 stakeholders will be affected by these measures;

2) FMU1 will ensure FMU2 is informed of situations and conditions in ANSP1 airspace that may require implementing TM measures affecting ANSP2 traffic;

b) Responsibilities for FMU2 Operations:

1) FMU2 is responsible for traffic flow management of ANSP2 destinations and through ANSP2 airspace;

i. FMU2 will coordinate with FMU1 before implementing TM measures that impact departures from ANSP1 airports;

ii. when ANSP1 airports are included in a TM measure, advise FMU1:

– before implementing the TM measure;

– what the TM parameters are; and

– when the TM measure is cancelled;

iii. FMU2 must include FMU1 TM measures in the ATFM OP when it is likely that ANSP2 stakeholders will be affected by these measures;

iv. FMU2 must coordinate with FMU1 before implementing aircraft re-routes impacting departures from ANSP1 airports or airspace;

2) FMU2 will ensure FMU1 is informed of situations and conditions, in ANSP2 airspace that may require implementing TM measures affecting ANSP1 traffic;

c) Responsibilities for FMU1 and FMU2:

1) to streamline coordination, FMU2 will be FMU1's sole point of contact with ANSP2 and FMU1 will be FMU2’s sole point of contact with ANSP1 in regard to cross-border TM measures and routing of aircraft;

2) FMU1 and FMU2 will implement and manage TM measures, as necessary, to relieve congestion and to ensure the orderly flow of air traffic consistent with an equitable distribution of delays;

3) FMU1 and FMU2 will make every effort to limit the impact of TM measures on stakeholders and implement only those measures that will adequately address the system constraint;

4) the principal TM measures to be implemented will consist of MIT, MINIT, re-routes, en-route spacing measures, ground delay measures and ground stops;

Note: This list is not all-inclusive, and other TM measures may be developed and coordinated to meet operational needs.

5) FMU1 and FMU2 will collaborate on the design of preferred routes and severe weather avoidance routes that involve the use of both ANSP1 and ANSP2 airspace or resources; and

6) FMU1 and FMU2 will provide feedback and share data on the impact and assessment of joint TM measures, as required.

5. IMPLEMENTATION

The procedures outlined in this LoA will be implemented by operational personnel at FMU1 and at FMU2. The telephone numbers for FMU1 and FMU2 personnel can be found in Attachments 1 and 2, respectively.

6. REVIEW PERIOD

FMU1/ACC1 and FMU2/ACC2 agree to participate in a yearly review of this document.

Original signed by:

ANSP1-----------------------	**ANSP2 -----------------------**
Date: ------------------------	**Date: ------------------------**
FMU1------------------------	**FMU2 -----------------------**
Date: ------------------------	**Date: ------------------------**

LOA-Attachment 1

TELEPHONE NUMBERS FOR FMU1/ACC1

FMU1 Phone number(s): xxx xxx xxx

LOA-Attachment 2

TELEPHONE NUMBERS FOR FMU1/ACC2

FMU1 Phone number(s): xxx xxx xxx

APPENDIX I - ATFM Terminology and Phraseology

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
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 nonsurveillance 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

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

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)

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			TLTD	CLTD	ELTD	ALTD
In-Block Time (IBT)	SIBT				CIBT		AIBT

ATFM 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 (time)
Change to CTOT resulting from a Slot Revision.	REVISED SLOT (time)
CTOT cancellation resulting from a Slot Cancellation	SLOT CANCELLED, REPORT READY
Flight suspension until further notice.	FLIGHT SUSPENDED UNTIL FURTHER NOTICE, DUE (reason)
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
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 (time), REQUEST START-UP AT (time)

APPENDIX J - ATFM Training Requirement

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 neighbouring 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 MID developed MID Air Navigation Strategy (ICAO MID Doc 002), kept it up to date along with ICAO GANP changes including the 6th edition which was endorsed by MIDANPIRG/18 for the propose of CDM/ATFM development to support Seamless ATM Operations in the region.

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.

	Operation management	Supervision	Planner	Execution	Support	CDM partner	General ATM 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

<u>General</u>

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;
- 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.

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 J – 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** national and international regulatory context of ATM in general and ATFM.	
Content		Reference Documents
• International Aviation Structure and Organization		Chicago Convention, Annex 11, Local legislation and role, Doc 4444, Doc 9971
• National Aviation Structure		
• National Aviation regulations		
• Structure on 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		
• Structure on ANS and ATS		
• ATFM Introduction		
• Airspace Management		
• Altimetry and Level allocation		
• Separations		
• ATM Data o ICAO designators o Other designators		
• Flight Plan processing		

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, AIDC/OLDI,		
• AMAN, DMAN, ASMGS		

Airport Operations

Phase	Ab-Initio	
Subject	Airport Operations	
Objective	Learners shall understand 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 understand 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 **understand** 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		

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 J – ATTACHMENT B: Modules to be covered during the Basic Training phase

Foundational objectives and principles of ATFM

<table>
<tr><td>Phase</td><td colspan="6">Basic</td></tr>
<tr><td>Subject</td><td colspan="6">Foundational objectives and principles of ATFM</td></tr>
<tr><td>Objective</td><td colspan="6">• 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.</td></tr>
<tr><td colspan="4">Content</td><td colspan="3">Reference Documents</td></tr>
<tr><td colspan="4">• 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</td><td colspan="3">• ICAO Doc 4444,
• ICAO Doc 9971,
• Local ATFM doc.</td></tr>
<tr><td>Role</td><td>Operations management</td><td>Supervision</td><td>Planner</td><td>Execution</td><td>Support</td><td>CDM partner</td></tr>
<tr><td>Level</td><td>2</td><td>5</td><td>5</td><td>4</td><td>3</td><td>2</td></tr>
</table>

ATFM Institutional and Regulatory Background

<table>
<tr><td>Phase</td><td colspan="6">Basic</td></tr>
<tr><td>Subject</td><td colspan="6">ATFM Institutional and Regulatory background</td></tr>
<tr><td>Objective</td><td colspan="6">• know the regulatory background, both global and local, for the application of an ATFM service.</td></tr>
<tr><td colspan="4">Content</td><td colspan="3">Reference Documents</td></tr>
<tr><td colspan="4">• 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)</td><td colspan="3">• ICAO Annex 11 and 15
• Doc 4444
• AIP and other local documentation</td></tr>
<tr><td>Role</td><td>Operations management</td><td>Supervision</td><td>Planner</td><td>Execution</td><td>Support</td><td>CDM partner</td></tr>
<tr><td>Level</td><td>2</td><td>5</td><td>5</td><td>4</td><td>3</td><td>2</td></tr>
</table>

The CDM Process in the context of ATFM

Phase	Basic
Subject	The CDM Process in the context of ATFM
Objective	• 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

• CDM organization and structure o Support to ATFM stakeholders
• Means of communication o 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
  o ATFM Operations and airports o ATFM Operations and aircraft operations
  o ATFM Operations and meteorology
• CDM requirements and benefits
• Link to A-CDM
	• Doc 4444
	• Doc 9971
	• Local ATFM documentation

Role	**Operations management**	**Supervision**	**Planner**	**Execution**	**Support**	**CDM partner**
Level	2	5	5	4	3	2

ATM Planning

Phase	Basic
Subject	ATM Planning
Objective	• understand the process to optimize available capacity, and how to use other available capacities; • be aware of factors impacting capacity.

Content	Reference Documents

• ATM Planning
  o Quantify imbalance between demand and capacity
  o How to address the imbalance at the strategic phase
• Capacity assessment models
  o Monitoring values
  o Intervention values
• ATC Capacity
• Staffing schedules and opening schemes of the component ATC Units
• Capacity optimisation
• Factors reducing capacity
• Coordination with ASM
	• 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

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
• Strategic Phase o Strategic to pre-tactical • Pre-tactical Phase o Pre-tactical processes o Building a pre-tactical plan o The concept of a rolling plan o Airport role during pre-tactical o Aircraft operator role during pre-tactical o Special events planning o Slot allocation process, incl. principles, computer assisted or manual allocation process, and change process • Tactical Phase o Re-routing flights o Manual actions on a flight o Tactical management of the daily plan • Post-Ops o Requirements for a good post-ops analysis o Feedback and evaluation o Operational feedback o Incident reporting	• Doc 4444 • Doc 9971 • Local ATFM documentation

Role	**Operations management**	**Supervision**	**Planner**	**Execution**	**Support**	**CDM partner**
Level	2	5	5	4	3	2

ATFM Demand

Phase	Basic
Subject	ATFM Demand
Objective	• 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	Reference Documents

• Establishing demand o Establishing demand for a sector/airport o Establishing demand along predefined major traffic flows • Determining Traffic Volumes based on defined demand o Determine reference locations o Occupancy counts/duration o 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	• Local ATFM doc

Role	**Operations management**	**Supervision**	**Planner**	**Execution**	**Support**	**CDM partner**
Level	2	4	5	4	3	2

ATFM Measures

Phase	Basic
Subject	ATFM Measures (Traffic management Initiatives)
Objective	• know the different measures available and how to apply them in the ATFM service; • understand the role of the stakeholders in the process

Content	Reference Documents
• 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	• Doc 4444 • Doc 9971 • Local ATFM doc

Role	**Operations management**	**Supervision**	**Planner**	**Execution**	**Support**	**CDM partner**
Level	2	5	5	4	3	2

ATFM Contingency procedures

<table>
<tr><td>Phase</td><td colspan="6">Basic</td></tr>
<tr><td>Subject</td><td colspan="6">ATFM Contingency procedures</td></tr>
<tr><td>Objective</td><td colspan="6">Full understanding of procedures to be applied in the case of a contingency.</td></tr>
<tr><td colspan="4">Content</td><td colspan="3">Reference Documents</td></tr>
<tr><td colspan="4">• Contingency procedures
  o Management of industrial actions
  o Non-availability of airspace/airports
• Adverse weather situations
  o Convective weather
  o Low visibility
  o De-icing conditions</td><td colspan="3">• Local ATFM documentation</td></tr>
<tr><td>Role</td><td>Operations management</td><td>Supervision</td><td>Planner</td><td>Execution</td><td>Support</td><td>CDM partner</td></tr>
<tr><td>Level</td><td>2</td><td>5</td><td>5</td><td>4</td><td>3</td><td>2</td></tr>
</table>

ATFM data and tools

<table>
<tr><td>Phase</td><td colspan="6">Basic</td></tr>
<tr><td>Subject</td><td colspan="6">ATFM Data and Tools</td></tr>
<tr><td>Objective</td><td colspan="6">• 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.</td></tr>
<tr><td colspan="4">Content</td><td colspan="3">Reference Documents</td></tr>
<tr><td colspan="4">• ATFM Support tools
  o Main functionalities of tools used
  o Pre-tactical tools used
  o Building a plan in a pre-tactical tool
• Environmental data in ATFM support tools
  o Static, semi-static and dynamic data
• Flight data in ATFM support tools
  o Traffic load monitoring (types of traffic counts)
  o Flight activation monitoring
  o Data exchange and sharing</td><td colspan="3">• ICAO Doc 9971
• Local ATFM documentation</td></tr>
<tr><td>Role</td><td>Operations management</td><td>Supervision</td><td>Planner</td><td>Execution</td><td>Support</td><td>CDM partner</td></tr>
<tr><td>Level</td><td>2</td><td>4</td><td>5</td><td>4</td><td>3</td><td>1</td></tr>
</table>

APPENDIX J – 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:

OJT check sheet			Phase A B C	Month			Starting date of the phase A				B				C		
ATFM			Crew / Graduating Class / Name	Number of mark "4" earned by previous month	Date Hour SV	Date Hour SV	Date Hour SV	Date Hour SV	Date Hour SV	Date Hour SV	Date Hour SV	Date Hour SV	Date Hour SV	Date Hour SV	Date Hour SV	Date Hour SV	Date Hour SV
phase				4	d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12	d13
			Monitoring traffic volume														
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/ending the initiatives														
	B		able to evaluate EDCT flow controls including a ground stop														
	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														

			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 ground stop 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 colomn. 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

ATFM

phase				4	d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12	d13
			Cross Border ATFM														
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														

			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 make flow controls on inflight aircraft (i.e. assigning inflow intervals, specifying airspeed/altitude/route, assigning airborne holding)														
			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 colomn. 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 K - 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.

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/OLDI systems for timely ATM and ATFM system updates of trajectory data, including preferred implementation of advanced AIDC/OLDI messaging and configuration of systems for early delivery of AIDC/OLDI 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.

30. ATFM communications via existing internet/telecommunications networks.

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.

APPENDIX L - 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-Trail

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

APPENDIX M - ATFM Daily Plan Sample Template

<table>
<tr><td>ATFM Daily Plan</td><td>[Name of ATFM Unit]</td><td colspan="2">[UTC DATE] [APPLICABLE TIME]</td></tr>
<tr><td colspan="4">CAPACITY and CONSTRAINTS</td></tr>
<tr><td>Location
(AD or SECT)</td><td>Applicable Period</td><td>AAR
(landings per hour)</td><td>CONSTRAINT/REMARK</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
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<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="4">ATFM MEASURES</td></tr>
<tr><td>Location
(AD or SECT)</td><td>Applicable Period</td><td colspan="2">MEASURE REMARKS</td></tr>
<tr><td></td><td></td><td colspan="2"></td></tr>
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<tr><td></td><td></td><td colspan="2"></td></tr>
<tr><td></td><td></td><td colspan="2"></td></tr>
<tr><td colspan="4">POSSIBLE/DEVELOPING ISSUES</td></tr>
<tr><td>Location
(AD or SECT)</td><td>Applicable Period</td><td colspan="2">MEASURE REMARKS</td></tr>
<tr><td></td><td></td><td colspan="2"></td></tr>
<tr><td></td><td></td><td colspan="2"></td></tr>
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<tr><td></td><td></td><td colspan="2"></td></tr>
</table>

EXAMPLE ATFM DAILY PLAN:

<table>
<tr><td>ATFM Daily Plan</td><td colspan="2">RJJJ</td><td>1504022000-1504031959</td></tr>
<tr><td colspan="4">CAPACITY and CONSTRAINTS</td></tr>
<tr><td>Location (AD or SECT)</td><td>Applicable Period</td><td>AAR (landings per hour)</td><td>CONSTRAINT/REMARK</td></tr>
<tr><td>RJCC</td><td>2100-2300</td><td>04-06</td><td>LVP</td></tr>
<tr><td>RJTT</td><td>0200-0300</td><td>10</td><td>RWY34L/16R CLSD 0200 – 0245 CONST</td></tr>
<tr><td>RJTT</td><td>0300-0500</td><td>14</td><td>FLTCK RWY22 ILS</td></tr>
<tr><td>SECT 1</td><td>0130-UFN</td><td>-</td><td>Developing CB</td></tr>
<tr><td colspan="4">ATFM MEASURES</td></tr>
<tr><td>Location (AD or SECT)</td><td>Applicable Period</td><td colspan="2">MEASURE REMARKS</td></tr>
<tr><td>RJTT</td><td>2330-0140</td><td colspan="2">CTOT DEST RJCC</td></tr>
<tr><td>SECT 12</td><td>2300-0005</td><td colspan="2">3 MINIT DEP RJAA/RJTT</td></tr>
<tr><td>SECT 12</td><td>0130-UFN</td><td colspan="2">G585 8 MINIT AT [WAYPOINT] WB FOR ZMUB REGARDLESS OF FL</td></tr>
<tr><td colspan="4">POSSIBLE/DEVELOPING ISSUES</td></tr>
<tr><td>Location (AD or SECT)</td><td>Applicable Period</td><td colspan="2">MEASURE REMARKS</td></tr>
<tr><td>RJAA</td><td>0300-0500</td><td colspan="2">15 MIT, 250KT AT [WAYPOINT] [WAYPOINT]</td></tr>
<tr><td>RJTT</td><td>0300-0500</td><td colspan="2">CTOT</td></tr>
</table>

APPENDIX N - State ATFM Capability Monitoring and Reporting Form

ATFM PERFORMANCE INDICATORS

The following indicators are based on the Performance Improvement Plan of the MID 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 32**

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

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	Performaned 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
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

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

ATTACHMENT A - Guidelines for Improving Capacity

1. In order to improve the capacity of the system as a whole, it is advisable to analyse and identify the factors that may result in a reduction of airport and ATC sector capacity. Each factor has a weight in the capacity value, which varies according to the specific characteristics of the airport under study.

2. Some of the factors--not all factors are present in all systems--that may contribute to a reduction in capacity are as follows:

Longitudinal and Lateral Aircraft Separation Minima

3. Separation is established for safety reasons, both to avoid collisions and to prevent an aircraft from entering the wake turbulence of another aircraft, which is usually more critical when close to landing or during take-off, due to the low speeds applied. Runway configuration--the relative position and distance between runways--determines the interference that movements in one runway have on the other airport runways.

Procedures and Practices in Use

- Most airports are designed to serve the most common operation based on prevailing winds.
- Taxiways and parking aprons are built to serve the primary operation of the airport.
- Approach and departure procedures are designed to serve the primary operation of the airport
- Changes in the runway-in-use during traffic peaks may cause congestion.
- Changes in runways may create disadvantages for certain instrument departure or arrival procedures.

Weather conditions

4. Under adverse weather conditions (low ceiling and visibility), pilots and controllers work “more cautiously” and separations are extended, resulting in reduced capacity.

Aircraft Mix

5. Aircraft category and performance determine the time between two consecutive operations. It has been shown that the interval between the landing of a heavy aircraft and the landing of a light aircraft is much greater if the heavy aircraft lands first. This fact suggests the possibility of having an optimum sequencing of the aircraft waiting to land at a given airport. The aircraft sequencing problem is typically formulated as an issue of restricted optimisation, with a view to finding sequences that maximise the runway service ratio without excessively penalising some types of aircraft.

Typical demand (take-off and landing mix)

- Large concentrations of take-offs or landings can upset airport traffic flow.
- Delays in take-off can cause taxiway occupancy and approach problems.
- Landing sequencing may be affected by runway and taxiway configuration.

Type of operation (landing/take-off ratio)

6. The spacing between movements depends on the types of operations covered; that is, a landing performed following a take-off requires a different spacing compared to a take-off performed following another take-off. Capacity varies according to landing-to-take-off ratio. Consequently, a

single capacity indication makes no sense, in contrast with a capacity indication based on the operation mix.

Quality and performance of navigation, surveillance, and control systems

7. Reliable and precise systems allow for a reduction in aircraft spacing, thus increasing capacity. The use of decision-support software to assist the controller, for instance, to foresee the optimum sequencing for aircraft approaching a given airport, provides for safe and rational operations.

Controller and pilot performance

8. More experienced controllers and pilots make for more agile operations. A good example is the Congonhas airport, where controllers use the two runways for landings and take-offs; pilots conduct take-offs without stopping at the runway threshold (immediate take-off); pilots in slower aircraft try to maintain speeds that are consistent with those of commercial aircraft; etc.

Location and types of runway exits

9. Landing runway exits, when properly located, allow pilots to leave the landing runway towards the taxiway system as soon as they have slowed down enough. If the exit is a fast exit, that is, at an angle of less than 90º with the landing runway, there is no need to reduce speed too much, thus reducing runway occupancy time.

Environment

10. Noise can restrict operations on certain inhabited areas or fauna protection areas, generating additional restrictions to be considered when determining exit routes.

Restricted, prohibited, and dangerous areas

11. The existence of many restricted, prohibited and dangerous areas close to airports that do not apply procedures for coordination and flexible use of airspace constitutes an additional restriction to aircraft departure capacity.

12. Some of these factors may be of a temporary or permanent nature, depending on conditions. If they are considered permanent, they must be included in capacity calculations. Temporary factors, such as atmospheric conditions that can have a temporary impact on ATC sector capacity or airport operation, are managed by the ATC entity.

13. All these factors have an impact on the methodology used to determine capacity, and thus the importance of conducting a delay analysis.

14. This activity considers the available data coming from the recurrent delay monitoring process, but a more in-depth analysis of local circumstances is performed. The following is considered:

- Historical evaluation of delays;
- Actual reason(s) for delays;
- What is meant by ATC/Aerodrome delays?
- Who is involved in the capacity declaration process and is there a buy-in from all the stakeholders (the capacity declaration should reflect ATC/Aerodrome limits)?
- What are the reasons for additional traffic over and above the capacity declaration?
- How is extra traffic such as General Aviation accommodated?
- How many off-slot operations are experienced and how these are dealt with?
- Is there an (efficient) slot monitoring committee?

15. Airport delays should not be considered in isolation. Capacity at a number of airports is limited and action is required to ensure that capacity is not exceeded by demand at a particular moment on the day of operations.

16. Maximum airside capacity is not solely reliant on runway capacity. Aprons and taxiways must be capable of maintaining sufficient traffic throughput to match runway capacity. Terminal area capacity, arrivals and departures, the terminal building, ATC staff levels, and equipment should not be neglected during the capacity declaration process.

17. The demand-to-capacity ratio provides insight into the potential for delays at an airport. Together with the demand-to-capacity ratio used for defining traffic levels, medium-term annual demand data, based on airport-specific high, baseline and low forecasts for each of the selected airports are considered in this activity.

18. Some airports publish detailed demand and capacity analyses, taking into account hourly and seasonal variations, while others only publish an overall declared hourly capacity.

19. As general guidance, a plan to optimise capacity could include the following steps:

Step 1 – Establish a capacity baseline;

Step 2 – Determine future demand;

Step 3 – Determine if there will be a capacity reduction;

Step 4 – Identify all limitations that affect capacity;

Step 5 – Quantify the impact of limitations;

Step 6 – Identify possible corrective actions and best practices;

Step 7 – Identify the impact and cost of corrective actions;

Step 8 – Establish priorities; and

Step 9 – Develop the capacity improvement plan.

ATTACHMENT B - MID Region AIDC/OLDI Applicability Area

(Priority 1 and 2 for Implementation)

MID Region AIDC/OLDI Applicability Area (Priority 1 and 2 for Implementation)
As of July 2018

ACC	Adjacent ACCs						
Amman	Cairo (1)	Baghdad (2)	Damascus (2)	Jeddah (1)	Tel Aviv (2)		
Baghdad	Amman (2)	Ankara (1)	Damascus (2)	Jeddah (2)	Tehran (2)	Kuwait (1)	
Bahrain	Doha (1)	Emirates (1)	Jeddah (1)	Kuwait (1)	Riyadh (1)	Tehran (2) AFTN MSG	Dammam (2)
Beirut	Damascus (2)		Nicosia (1)				
Cairo	Amman (1)	Athena (2)	Jeddah (1)	Khartoum (1)	Nicosia (1)	Tel Aviv (2)	Tripoli (2)
Damascus	Amman (2)	Ankara (2)	Baghdad (2)	Beirut (2)	Nicosia (2)		
Doha*	Bahrain (1)	Emirates (1)	Jeddah (2)	Riyadh (2)			
Emiratis	Bahrain (1)	Doha (1)	Jeddah (1)	Muscat (1)	Tehran (2) AFTN MSG		
Jeddah	Amman (1)	Asmara (2)	Baghdad (2)	Bahrain (1)	Cairo (1)	Doha (2)	Emirates (1)
	Khartoum (1)	Kuwait (2)	Muscat (1)	Riyadh (1)		Sana'a (2)	
Riyadh	Bahrain (1)	Doha (2)	Kuwait (2)	Jeddah (1)			
Khartoum	Addis (1)	Asmara (2)	Brazzaville (2)	Cairo (1)	Entebbe (2)	Jeddah (1)	Juba (1)
	Kinshasa (2)	N'Djamena (2)	Nairobi (2)	Tripoli (2)			
Kuwait	Baghdad (1)	Bahrain (1)	Jeddah (2)	Tehran (2)			
Muscat	Emirates (1)	Jeddah (1)	Karachi (2)	Mumbai (1)	Sana'a (2)	Tehran (1)	
Sana'a	Addis Ababa (2)	Asmara (2)	Jeddah (2)	Mogadishu (2)	Mumbai (2)	Muscat (2)	
Tehran	Ankara (1)	Ashgabat (2)	Baghdad (2)	Bahrain (1)	Baku (2)	Emirates (2) AFTN MSG	Kabul (2)
	Karachi (1)	Kuwait (2)	Muscat (1)	Yerevan (2)			
Tripoli	Algiers (2)	Cairo (2)	Khartoum (2)	Malta (2)	N'Djamena (2)	Niamey (2)	Tunis (2)

(1) = Priority 1 for implementation based on the number of traffic movements and/or operational needs (green color means already implemented)

(2) = Priority 2 for implementation based on the number of traffic movements or if other solution is in place such as exchange of information via AFTN

ATTACHMENT C - Consolidated MID States Response to ICAO MID ATFM Questionnaire

Note: this report was presented in ATFM Core Team meeting - ACT/1 Summery of Discussion Appendix A.

Question			Bahrain	Egypt	Jordan	Kuwait	Lebanon	Oman	Qatar	Saudi Arabia	Sudan	UAE
ATFM Structure and Organization												
1. Does your State have a regulatory requirement for ATFM to be implemented in your Flight Information Region (FIR)?			YES	YES	NO	YES	NO	YES	NO	YES	NO	NO
2. Does your State have an operational requirement (e.g. demand exceeding capacity) for ATFM in your FIR?			YES	HECA, HEGA. HESH& ACC Sectors	NO	NO	NO	YES. Operational LoA with UAE ACC, Appendix G : Air Traffic Flow Management	YES	YES	NO	YES
3. Does your State have future plans or initiatives for ATFM in your FIR?			YES	YES. Aerodromes TFC LOAD MONITOR &AMAN	NO	NO	Waiting for regional initiatives	YES. The CONOPS has not been developed.	YES	YES	NO	YES
4. Does your State have an organizational structure including the following facilities and/or working positions? If future organizational structure is planned, please include date.	ATFM Services		NO	YES	NO	NO	NO		NO	Q4/2019	NO	YES
	ATFM Operational Manager		NO	YES	NO	NO	NO	Dec-19	NO	2019 - 2020	NO	YES
	ATFM positions located in the following	National ATFM center	NO	YES CANC	NO	NO	NO		NO	2021-2022	Not Answer	Q4 2022
		Area control center(s)	NO	YES. CHMI EUROCONTROL	NO		NO	Dec-19	NO	Q4/2019	NO	YES
		Approach control(s)	NO	NO	NO	NO	NO		NO	Q1/2020	NO	NO
		Control tower(s)	NO	NOPs EUROCONTROL	NO	NO	NO		NO	Q1/2020	NO	NO

Question			Bahrain	Egypt	Jordan	Kuwait	Lebanon	Oman	Qatar	Saudi Arabia	Sudan	UAE
ATFM Structure and Organization												
5. If there is existing ATFM functions performed, are there dedicated resources for these ATFM functions/positions or are these functions provided by another operational position? If provided by another operational position, please identify in the comments section.	Dedicated resource		NA		NO	Not answered	NO			Currently, there is no dedicated resources for ATFM	Not Answered	Flow Operator (Departure)
	Another Operational Position		NA	Delegated to ATC units	NO	Not answered	Receive CTOT from NM for traffic departing to EUR	Muscat ACC Planner controller			Not Answered	
6. Does your State have Letters of Agreement (LOA) that include ATFM with any of the following stakeholders? If so, please provide a copy or relevant excerpt of the LOA(s) with the survey response:	1. FIR(s)		OMAE & OEJD	NO	NO	NO	YES. Nicosia	OMAE	NO	Muscat, Bahrain, Cairo, Jordan, Khartoum, Sanaa and Doha Center	NO	YES. OOMM, OBBB, OEJD
	2. Stakeholders	- Airport Operators	NO	NO	NO	NO	NO		NO	Jeddah Airport within hajj season	NO	NO
		- Aircraft Operators	NO	NO	NO	NO	NO		NO	NO	NO	NO
		- Military	NO	YES. MIL reservation	NO	NO	NO		NO	AirForce within hajj season	NO	NO
		- General Aviation	NO	NO	NO	NO	NO		NO	NO	NO	NO
		- ATFM Units	NO	YES.	NO	NO	NO		NO	NO	NO	NO
		- National ATFM center	NO	NO	NO	NO	NO		NO	NO	NO	NO
		- Area control center	NO	NO	NO	NO	NO		NO	Q4/2019	NO	NO
		- Approach control	YES- DOHA	NO	NO	NO	NO		NO	Q1/2020	NO	YES. OMDB, OMAA, OMRK, OMFJ
		- Control tower	NO	NO	NO	NO	NO		NO	Q1/2020	NO	NO
		Comments						Operational LoA with UAE ACC, Appendix G : Air Traffic Flow				
7. Does your State have existing CDM procedures (planned or Ad-Hoc Teleconferences,) and/or tools with the following stakeholders? If future CDM procedures and/or tools are planned, please add the date.	Airport Operators		YES		NO	YES. Close coordiantion by system	NO	Oman airports by 2020	NO	NO	NO	NO
	Aircraft Operators		NO		NO		NO		NO	NO	NO	YES. UAE, ETD, FDB, ABY
	Military		NO		NO		NO		NO	NO	NO	NO
	General Aviation		NO		NO		NO		NO	NO	NO	NO
	Area control center		NO		NO	YES. Close coordiantion by system	NO		NO	NO	NO	Yes. OMAE
	Approach control		NO		NO		NO		NO	NO	NO	YES. OMAA, OMDB, OMRK, OMFJ
	Control tower		NO		NO		NO		NO	NO	NO	YES. OMSJ, OMRK, OMFJ
	Other ANSP ATFM Units		NO		NO		NO		NO	NO	NO	NO
	Other ANSP ATC		NO		NO		NO		NO	NO	NO	NO

Question			Bahrain	Egypt	Jordan	Kuwait	Lebanon	Oman	Qatar	Saudi Arabi	Sudan	UAE
ATFM Structure and Organization												
8. Does your State's ATFM unit(s) perform the following tasks? If future implementation planned, please add the date.	1. Create and distribute an ATFM daily plan		NA	Planned 2020	NO	NO	NO	NO	NO	2021-2022		Q4 2022
	2. Collect the following relevant information	- meteorological conditions	NA	Planned 2020	NO	NO	NO	YES	NO	Q4/2019		YES
		- capacity constraints	NA	Planned 2020	NO	NO	NO	YES	NO	Q4/2019		Q4 2022
		- equipment outages	NA	Planned 2020	NO	NO	YES	YES	NO	Q4/2019		YES
		- runway closures	NA	Planned 2020	NO	NO	YES	YES	NO	Q4/2019		YES
		- procedural issues	NA	Planned 2020	NO	NO	NO	YES	NO	Q4/2019		YES
	3. Analyze and distribute relevant information		NA	Planned 2020	NO	NO	NO	YES	NO	Q4/2019		YES
	4.Coordination procedures with stakeholders (indicate method(e.g., voice meetings, email) and frequency) in the comments section		NA	Planned 2020	NO	NO	YES. In case of special events coordination is carried out with all stakeholders	YES. Voice meetings	NO	TBD		YES
	5. Structured information dissemination process, i.e. website		NA	Planned 2020	NO	NO	Via letters/aeronautical publication	NO	NO	2019-2020		YES
		- ATFM Units	NO	YES.	NO	NO	NO		NO	NO	NO	NO
		- National ATFM center	NO	NO	NO	NO	NO		NO	NO	NO	NO
		- Area control center	NO	NO	NO	NO	NO		NO	Q4/2019	NO	NO
		- Approach control	YES- DOHA	NO	NO	NO	NO		NO	Q1/2020	NO	YES. OMDB, OMAA, OMRK, OMFJ
		- Control tower	NO	NO	NO	NO	NO		NO	Q1/2020	NO	NO
		Comments						Operational LoA with UAE ACC, Appendix G : Air Traffic Flow				
9. Are the following CDM elements included as part of your stakeholder's participation in the ATFM process?	1.Provide updated flight plan intent information (e.g., plans, changes, delays) provided by:	- Aircraft Operators	NO		YES	NO	NO	YES	NO	NO	NO	FPL, CHG, DLA, CNL
		- Military	NO		YES	NO	NO	YES	NO	NO	NO	FPL
		- General Aviation	NO		YES	NO	NO	YES	NO	NO	NO	FPL, CHG, DLA, CNL
	2.Telephone conferences	- Airport	NO		YES	NO	NO	YES	NO	NO	NO	OMAA, OMDB, OMSJ, OMRK, OMFJ
		- Military	NO		YES	NO	NO	YES	NO	NO	NO	NO
		- Aircraft Operators	NO		YES	NO	NO	YES	NO	NO	NO	UAE, ETD, FDB, ABY
		- General Aviation	NO		NO	NO	NO	YES	NO	NO	NO	NO
		- ATFM Units	NO		NO	NO	NO	NO	NO	NO	NO	NO
		- Other FIR ANSP's	NO		NO	NO	NO	YES	NO	NO	NO	NO
	3.Web based interfaces	- Airport	NO		YES	NO	NO	NO	NO	NO	NO	OMAA, OMDB, OMSJ, OMRK, OMFJ
		- Military	NO		NO	NO	NO	NO	NO	NO	NO	NO
		- Aircraft Operators	NO		NO	NO	NO	NO	NO	NO	NO	ETD, UAE, FDB, ABY
		- General Aviation	NO		NO	NO	NO	NO	NO	NO	NO	NO
		- ATFM Units	NO		NO	NO	NO	NO	NO	NO	NO	NO
		- Other FIR ANSP's	NO		NO	NO	NO	NO	NO	NO	NO	NO
	Comments									We are developing working measures and procedures for ATFM to be introduced ATFM system by Q4 -2019		

Question			Bahrain	Egypt	Jordan	Kuwait	Lebanon	Oman	Qatar	Saudi Arabia	Sudan	UAE
ATFM Structure and Organization												
10. Does your State provide standardized and recurrent ATFM training for the following personnel and stakeholders? If standardized training is planned, please add date.	1. Personnel performing ATFM functions	- National ATFM center	NO	NO	NO	NO	NO	2020	NO	NO	NO	Q4 2022
		- Area control center	NO	NO	NO	NO	NO	2020	NO	NO	NO	NO
		- Approach control	NO	NO	NO	NO	NO	2020	NO	NO	NO	NO
		- Control tower	NO	NO	NO	NO	NO	2020	NO	NO	NO	NO
	2. Stakeholders	- Airports	NO	NO	NO	NO	NO	2020	NO	NO	NO	NO
		- Aircraft Operators	NO	NO	NO	NO	NO	2020	NO	NO	NO	NO
		- Military	NO	NO	NO	NO	NO	2020	NO	NO	NO	NO
		- General Aviation	NO	NO	NO	NO	NO	2020	NO	NO	NO	NO
	Comments									SANS Staff in charge of ATFM (ATFCM section under ATM department) are scheduled in specialized training on ATFM and it's expected that all Staff will end the training by 2020-2021		
11. Does your State have an electronic ATFM system that displays airborne traffic? Is this system shared? If not, what is the planned date (if any) for sharing this system?	Electronic ATFM display system Shared with:	1. FIR(s)	YES AMAN not shared	NO		NO	NO	YES	NO		NO	Q4 2022
	2. Stakeholders	- Airport Operators	NO	NO	NO	NO		2020	NO		NO	Q4 2022
		- Aircraft Operators	NO	NO	NO	NO		2020	NO		NO	Q4 2022
		- Military	NO	NO	NO	NO		2020	NO		NO	Q4 2022
		- General Aviation	NO	NO	NO	NO		2020	NO		NO	Q4 2022
	Comments									Long Term Planned but not finalized yet		

Question			Bahrain	Egypt	Jordan	Kuwait	Lebanon	Oman	Qatar	Saudi Arabi	Sudan	UAE
ATFM - Capacity, Demand, Balance												
12. Does your State declare ATC strategic capacity values for the following resources? If capacity value declarations are planned to be completed, please add date.	1.Airspace sectors		YES	YES	YES	NO	NO	2020	NO	Q2/2019	NO	NO
	2.Waypoint(s) or boundaries		NO	NO	YES	NO	NO	2020	NO	Q1/2020	NO	NO
	3.Airport acceptance rate(s) (arrival and departure)		NO		NO	NO	NO	2020	NO	Q1/2020	NO	NO
	Comments									We are validating the ACC sector capacity and then we will move to airport acceptance rate		
13. How are the declared capacity values determined?			Determined by Operations using capacity management studies		Staffing methodology and manning level and procedures (ATM)		NA	Capacity values are not determined		Refer to questionnaire	Not answered	Not Declared
14. Does your State have strategic airport arrival/departure slots? If planned, please indicate the dates:	Airport	Planned date	NA		OJAI & OJAQ (NO-Pending)			OOMS, OOSA 2020			No slots	OMAA, OMDB
	Arrival	Planned date	NA		-						NA	OMAA, OMDB
	Departure	Planned date	NA		-						NA	OMAA, OMDB
15. Does your State have a methodology to balance demand and capacity in the following time frames?	Strategic (more than 1 day before operation)		NO	NO	NO	NO		NO	NO	NO	No methodology	NO
	Pre-tactical (1 day before operation)		NO	NO	NO	NO		NO	NO	NO	No methodology	NO
	Tactical (day of operation)		YES. Tactical oversight of sector volume	NO	NO	NO		YES	NO	NO	No methodology	YES

Question			Bahrain	Egypt	Jordan	Kuwait	Lebanon	Oman	Qatar	Saudi Arabi	Sudan	UAE
ATFM - Capacity, Demand, Balance												
16. Has your administration (and/or State) implemented procedures, review, and tools to identify available capacity, compare capacity to forecast demand and establish performance targets including. If initiatives are planned, please add date							Not answered			NO	NO	
	1.Airspace design review		Yes. Early 2019	NO	NO	NO		NO 2019	Early 2019	NO		YES
	2.ATFM support tools		YES	NO	YES. Statistical tool			YES	NO	NO		Q4 2022
	3.Procedures review		YES	NO	NO	NO		NO 2019	Mid 2019	NO		YES
	4.Staffing resources to workload / traffic review		YES	NO	YES. ATM Procedures	NO		YES	Mid 2019	NO		YES
	5.ATFM Training completed		NO	NO	NO			NO 2020	NO	NO		Q4 2022
	6.Forecast demand		NO	NO	NO			YES	YES	NO		Q4 2022
	Comments									Currently we evaluate the statistical report and compare the last three years to define the traffic growth percentage and defined the peak hour as well to have an image how is the traffic demand will increase and take the initiative to implement flow management		

Question	Bahrain	Egypt	Jordan	Kuwait	Lebanon	Oman	Qatar	Saudi Arabia	Sudan	UAE
Interoperability										
17. Does your State complete automated exchange of ATS messages (e.g. FPL, CHG, CNL, DEP, DLA, EST, ARR, CPL) with any or all adjacent Flight Information Regions (FIRs) or other non-adjacent FIRs?	OMAE-OLDI OIXX-AFTN EST MSGs	LGGG-OLDI	YES. OSTT, OEJN, HECC, LLLL, ORBB	YES. OBBB, ORBB,OEJN, OIXX, OTBD	YES. All	ONLY WITH OMAE: ABI Advanced Boundary Information Message (including revised ABI's) ACT Activate Message LAM Logical Acknowledgement Message PAC Preliminary Activate Message	NO	SANS is implementing an IFPS that will be ready for operation during 2019. A transition roadmap is under development. The NEW ATM System is sharing the information throw OLDI	Yes (All)	**OOMM:** FPL, CHG, CNL, DEP, DLA **OBBB:** FPL, CHG, CNL, DEP, DLA, EST **OEJD:** FPL, CHG, CNL, DEP, DLA **OIXX:** FPL, CHG, CNL, DEP, DLA, EST
18. Does your State have plans to complete automated exchange of ATS messages with any or all adjacent Flight Information Regions (FIRs) or other non-adjacent FIRs?	OKAC-Early 2019-OLDI OEJN-MID 2019-OLDI Doha Approach - OLDI, early 2019; Dammam Approach in conjunction with OEJD	BY 2020 AIDC with all except LCCC-OLDI	*Estimate Over Border* *OSTT, OEJN, HECC, LLLL, ORBB*		Yes. Nicosia and Damascus	Planned 2019: **Mumbai:** AIDC messages : ABI, PAC, CDN, CPL, ACP, REJ, MAC, LAM, and LRM will be established between Muscat ACC and Mumbai OCC **Jeddah:** ABI Advanced Boundary Information Message (including revised ABI's) ACT Activate Message LAM Logical Acknowledgement Message PAC Preliminary Activate Message	YES. OBBB, OEJN, OMAE date TBD	OJAC by 03/2019 Type X AMHS/SITA BY 2020 with OBBB, OKAC, OOMM	Yes	

Question		Bahrain	Egypt	Jordan	Kuwait	Lebanon	Oman	Qatar	Saudi Arabi	Sudan	UAE
Interoperability											
19. Does your State exchange Airport Acceptance Rate (AAR) information for primary airports with other FIRs? If there are plans to exchange AAR information, please provide date.		NO	Yes. EURO CONTROL	NA	NO	NO	2020 with all adjacent FIRs	NO	NO	NO	NO
20. Does your State share adjacent sector capacity information with other FIRs? If there are plans to exchange sector capacity information, please provide date.		NO		NA	NO	NO	2020 with all adjacent FIRs	NO	NO	NO	NO
21. Does your State have automated Pre-tactical (day prior to the operation) demand monitoring capability? If yes, is the information shared with other		NO		NA	NO	NO	NO	NO	NO		NO
	Airport Demand					NO	NO	NO	NO	NO	NO
	Sector Demand					NO	NO	NO	NO	NO	NO
	Route/Airway Demand					NO	NO	NO	NO	NO	NO
22. Does your State have automated Tactical (day of the operation) demand monitoring capability? If yes, is the information shared with other FIRs?		NO		NA	NO	NO	NO	NO	NO		YES
	Airport Demand					NO	NO	NO	NO	NO	YES
	Sector Demand					NO	NO	NO	NO	NO	YES
	Route/Airway Demand					NO	NO	NO	NO	NO	YES
	Arrival Management					NO	NO	NO	NO	NO	YES

Question	Bahrain	Egypt	Jordan	Kuwait	Lebanon	Oman	Qatar	Saudi Arabi	Sudan	UAE
Interoperability										
23. Does your State have Strategic, Pre-tactical and Tactical planning agreements with other FIRs?	NO	NO	NO	NO	NO	Only tactical ATFM operations is implemented between Muscat and UAE FIRs. These take the form of a traffic acceptance rate through affected waypoints, based on take-off times. A figure of 3 (three) flights every 10 minutes per waypoint is used and the 10 minute period will start from the imposition of the flow procedures.	NO	NO	NO	NO
24. Are there plans to initiate these agreements?	NO	NO	NO		NO	NO	Yes at the outcome of the ATFM/TF and for future regional event planning.	After implementation of IFPS, we will implement ATFM procedures with Bahrain FIR with progressive introduction of ATFCM operation covering Jeddah FIR as initial phase. The implementation of ATFM measures cane be extended to adjacent FIRs	NO	NO

Question		Bahrain	Egypt	Jordan	Kuwait	Lebanon	Oman	Qatar	Saudi Arabi	Sudan	UAE
Interoperability											
25. Has your State identified airports, sectors of airspace or routes which are regularly requiring ATFM Measures to balance demand and capacity? If yes, list them		YES Created High/Low splits to manage volume (East High/East Low, Central High/Central, North/North Low)		NO	NO	NO	Yes . OOMS airport.		YES. Refer to questionnaire	NO	OMDB, ACCE, ACCY, ACCR, ACCW, ACCN
26. Does your State initiated/implemented the following Air Traffic Management Measures (ATFM Measures) internally?					NO	YES			YES	Yes	
	Miles-in-trail (MIT)	YES LATSI LoA	NO	YES	NO	YES	YES	YES	NO	NO	YES
	Minutes-in-trail (MINIT)	NO	NO	YES	NO	YES	YES	NO	YES	NO	NO
	Speed restrictions	YES LoA	YES	YES	NO	YES	YES	YES	YES	YES	YES
	Airborne Holding	YES	YES	NO	NO	YES	YES	YES	YES	YES	YES
	Fix balancing	NO	NO	NO	NO	NO	NO	NO	NO		NO
	Altitude/Flight Level capping	YES-AIP	YES	NO	NO	NO	NO	YES	NO		NO
	Tactical alternative routing options	NO	NO	YES	NO	NO	YES	YES	YES		YES
	Fix crossing times	NO	NO	NO	NO	YES	YES	NO	YES	YES	YES
	Airport slot	NO	NO	NO	NO	NO	YES	NO	NO	NO	YES
	Minimum departure intervals (MDIs)	NO	YES	NO	NO	YES	YES	NO	NO	NO	YES
	Published, pre-defined alternative routes	NO	NO	NO	NO	NO	NO	NO	YES	NO	YES
	Ground delay program (GDP) – airport arrival constraint	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES
	Ground delay program (GDP) – airspace constraint (also known as airspace flow program: AFP)	YES- 5 min departure spacing implemented tactically	NO	NO	NO	NO	NO	NO	NO	NO	YES
27. When determining an ATFM Measure, are the following factors considered?	Demand exceeds capacity	YES		NO		YES	YES	YES	YES		
	Weather	YES		YES		YES	YES	NO	YES		YES
	Military exercises	YES		YES		YES	NO	NO	YES		YES
	Resources	YES		YES		YES	YES	NO	YES		YES
	Maintenance / outages	YES		YES		YES	YES	NO	YES		YES
	VIP movements	YES		YES		YES	YES	NO	YES		YES

Question	Bahrain	Egypt	Jordan	Kuwait	Lebanon	Oman	Qatar	Saudi Arabi	Sudan	UAE
Interoperability										
28. Does military airspace/activity cause the use of ATFM Measures? If yes, please explain.	NO		NO	NO	YES	NO	NO	In general, yes, because when Reserved Military Airspace is active, the available airspace for civil flights is impacted leading to apply ATFM measures	NO	NO
29. Is the military airspace/activity included in strategic planning?	YES		YES		NA	NO	NO	Yes, it's included, and the civil military coordination section is working on flow management measure initiatives through Joint-committee		NO
30. How is the effectiveness of the ATFM Measure analyzed?	Periodic procedures review		NA		NA	The use of flexible statistical tools to effectively analyze and report on the metrics	NA	By measuring the degree of implementation		□ Departures: o Monthly DST Compliance and Ground delay □ Arrivals: o Runway throughput and airborne delay

Question			Bahrain	Egypt	Jordan	Kuwait	Lebanon	Oman	Qatar	Saudi Arabia	Sudan	UAE
Interoperability												
31. What are the primary demand-capacity imbalance reasons for the ATFM Measures?	Airport capacity				NO			OOMS		OEJN, OERK, OEMA, OEDF and OEAB		OMDB
	Sector capacity		East High, Central, North - demand exceeds capacity;		YES			Central sector	YES	ACC-West, ACC-northeast upper and lower		
	Route/Airway capacity				NO			TONVO A777 NADSO and LALDO B525 NADSO	YES	L604, L677, L550& UL768		
	Other				NO							
	Comments				procedure includes the formula							
32. Does your State initiate the following ATFM Measures with adjacent FIRs?	Miles-in-trail (MIT)		OMAE		YES	NO	YES	OMAE	NO	YES		OOMM, OIIX, OBBB
	Minutes-in-trail (MINIT)		NO		YES	NO	YES	OMAE	NO	YES. Muscat, Bahrain, Cairo, Jordan, Khartoum, Sanaa and		OEJD
	Speed restrictions		NO		YES	NO	YES	OMAE	NO	YES		OOMM, OIIX, OBBB, OEJD
	Airborne Holding		NO		NO	NO	YES		NO	YES		OOMM, OIIX, OBBB, OEJD
	Fix balancing		NO		NO	NO	NO		NO	NO		OOMM, OIIX, OBBB, OEJD
	Altitude/Flight Level capping		OMAE, OKAC		NO	NO	NO		NO	YES. AMMAN, DOHA, BAHRAIN, KUWAIT & CAIRO		OIIX, OOMM
	Alternative routing options		NO		NO	NO	NO	OMAE	NO	YES		OBBB, OEJD, OOMM
	Fix crossing times		NO		NO	NO	YES	OMAE	NO	YES		OOMM, OEJD
	Airport slot		NO		NO	NO	NO		NO	YES		NO
	Minimum departure intervals (MDIs)		NO		NO	NO	YES		NO	YES		OOMM, OIIX
	Published, pre-defined alternative routes		NO		NO	NO			NO	YES		NO
	Ground delay program (GDP) – airport arrival constraint		NO		NO	NO			NO	YES		OOMM, OEJD
	Ground stop (GSt)		OMAE, OEJD, OKAC		NO	NO			NO	YES		OOMM, OIIX, OBBB, OEJD
	Ground delay program (GDP) – airspace constraint (also known as airspace flow program: AFP)		NO		NO	NO			NO	YES		NO
33. What is taken into consideration when an ATFM Measure is implemented			Volume and sector capacity, weather, outages		Delay action/holding/miles in trail/minutes in trail			ATCO workload, traffic demand/sector capacity, Airspace complexity and weather.	Capacity overload	• Reduction of ATCOs workload to ensure the safe provision of ATS; • Reduction of congestion and operating costs		Demand Exceeds capacity, Weather, Military Exercises, Resources, Maintenance/ Outages, Vip movements

Question	Bahrain	Egypt	Jordan	Kuwait	Lebanon	Oman	Qatar	Saudi Arabia	Sudan	UAE
Interoperability										
34. How is the duration of the selected ATFM Measure determined?	Tactical decision based on real-time information		Regional coordination.			The duration of the selected ATFM Measure is determined based on extent of over demand	By traffic levels	Declared capacity will be the main factor that is considered in the application of ATFM measures. When the capacity is reached, ATFM measures are applied until the capacity is exceeding the demand by at least 10%. Therefore, the timing will vary demanding on the level of traffic		Sector and aerodrome forecast, as well as duration requirements by accepting unit
35. Does your ANSP carry out any post-operations analysis?	NO		NA			PACA carry out any post-operations analysis using the flexible statistical tools to generate report on the metrics	NO	SANS are using the post-analysis to determine the bottleneck, Peak hour, congested airway, waypoint and congested aerodrome. This practice will improve enhance with the implementation of activation of ATCFM section		YES

Question			Bahrain	Egypt	Jordan	Kuwait	Lebanon	Oman	Qatar	Saudi Arabia	Sudan	UAE
Interoperability												
36. How is the effectiveness of the ATFM Measure analyzed?			NA		NO			The use of flexible statistical tools to effectively analyze and report on the metrics	Unknown	Refer to question number 30		Departures: o Monthly DST Compliance and Ground delay Arrivals: o Runway throughput and airborne delay
37. Are the ATFM Measures included in LOAs?			YES		NO	NO	YES	Operational LoA with UAE ACC, Appendix G : Air Traffic Flow Management	NO	No, it will be included in the ATM operation manual and later on LoA		YES
38. Does your State communicate ATFM Measures through automated or verbal communication with adjacent FIRs?	Miles in trail		Automated and verbal with OKAC, OEJD, OMAE		Verbal		Verbal	Verbal OMAE		Verbal: Muscat, Bahrain, Cairo, Jordan, Khartoum,		Verbal
	Speed restrictions				Verbal		Verbal	Verbal OMAE				Verbal
	Holding				Verbal		Verbal			Verbal: Muscat, Bahrain, Cairo, Jordan, Khartoum, Kuwait,		Verbal
	Altitude				Verbal		Verbal	Verbal OMAE		Verbal: Muscat, Bahrain, Cairo, Jordan, Khartoum, Kuwait,		Verbal
	Fix crossing times				Verbal		Verbal	Verbal OMAE		Verbal: Muscat, Bahrain, Cairo, Jordan, Khartoum, Kuwait,		Verbal
	Airport arrival times				Verbal					Verbal: Muscat, Bahrain, Cairo, Jordan, Khartoum, Kuwait,		Verbal
	Ground delay programs – airport arrival constraint				Verbal					Verbal: Muscat, Bahrain, Cairo, Jordan, Khartoum, Kuwait,		Verbal
	Ground stops		Verbal		Verbal					Verbal: Muscat, Bahrain, Cairo, Jordan, Khartoum, Kuwait,		Verbal
	Ground delay program – airspace constraint				Verbal					Verbal: Muscat, Bahrain, Cairo, Jordan, Khartoum, Kuwait,		Verbal
	Comments		Miles in trail by NOT AM		Verbal							

Question			Bahrain	Egypt	Jordan	Kuwait	Lebanon	Oman	Qatar	Saudi Arabia	Sudan	UAE
Interoperability												
39. If your State have future ATFM initiatives planned **with other FIRs** please list them below.			NA		NA							
	Initiative Title							Regional ATFM Implementation with MID Member States			Waiting for regional initiatives	Cross Border Arrival Management (X-MAN)
	Primary Functions											Absorb delay en-route
	Status (Planning, Approved, Implementation, Testing)							Planning				Planning
	Initial Operational Capability Date							TBD				Q2 2019
	Full Operational capability Date							TBD				Q2 2021
	Initiative Title											
	Primary Functions											
	Status (Planning, Approved, Implementation, Testing)											
	Initial Operational Capability Date											
	Full Operational capability Date											
	Initiative Title											
	Primary Functions											
	Status (Planning, Approved, Implementation, Testing)											
	Initial Operational Capability Date											
	Full Operational capability Date											

Question			Bahrain	Egypt	Jordan	Kuwait	Lebanon	Oman	Qatar	Saudi Arabi	Sudan	UAE
Interoperability												
40. If your State have future ATFM initiatives planned, please list them below.					NO							
	Initiative Title							CDM EXCHANGE OF DATA with UAE		SFAC-ATFCM Saudi future airspace concept project and air traffic flow and capacity management system	Waiting for regional initiatives	Airport CDM and Departure Manager
	Primary Functions									Re-structuration of the whole airspace and implementation of ATFM system		Collaborative Departure Sequencing
	Status (Planning, Approved, Implementation, Testing)							Planning		Planning/Tendering		Testing
	Initial Operational Capability Date									2022		Q4 2018
	Full Operational capability Date									2023		Q2 2021
	Comments		Bahrain is in the process of building a new FIC and implementing a new ATM system which will include integration of ATFM functionality such as SWIM capabilities, AMAN/DMAN. Est. completion mid 2020.									
					NO							
	Initiative Title							CDM EXCHANGE OF DATA with UAE		IFPS initial flight plan processing system	Waiting for regional initiatives	
	Primary Functions									Exchange ATS service massages and FPL		
	Status (Planning, Approved, Implementation, Testing)							Planning		In progress, designing phase		
	Initial Operational Capability Date									Q4/2019		
	Full Operational capability Date									Q2/2020		

Question			Bahrain	Egypt	Jordan	Kuwait	Lebanon	Oman	Qatar	Saudi Arabi	Sudan	UAE
Interoperability												
41. ICAO has identified various ATFM and CDM initiatives in the Aviation System Block Upgrades (ASBU) process (Block 0 and Block 1 to be implemented by 2018). Please identify which of the following have been implemented or are planned to be implemented:												
	B0- A-CDM *Improved Airport Operations through Airport-CDM*		End 2019 Planning/Coordination completed. Design/config. In progress		Implemented		Planned	2019	Mid 2019	TBD		Q4 2020
	B0-RSEQ *Improved Traffic Flow through Runway Sequencing (AMAN/DMAN)*		Partially Full by 2020		Not Implemented			2019	Mid 2019	Q3-2019		Implemented
	B0-FICE *Increased Interoperability, Efficiency and Capacity through Ground-Ground Integration*		Partially Full by 2021		Planning no date		Planned	2019		End of 2019 AMHS capability End of 2019 AIDC/ OLDI capability end 2019		Implemented
	B0-DATM *Service Improvement through Digital Aeronautical Information Management*		Implemented		in the process		Planned	2020		Ongoing. Ref questionnaire		Implemented
	B0-FRTO *Improved Operations through Enhanced En-Route Trajectories*		Partially Full by 2020 Current status: Pre Tactical basis		Implemented		Planned	2019		Ongoing. Ref questionnaire		Q4 2020

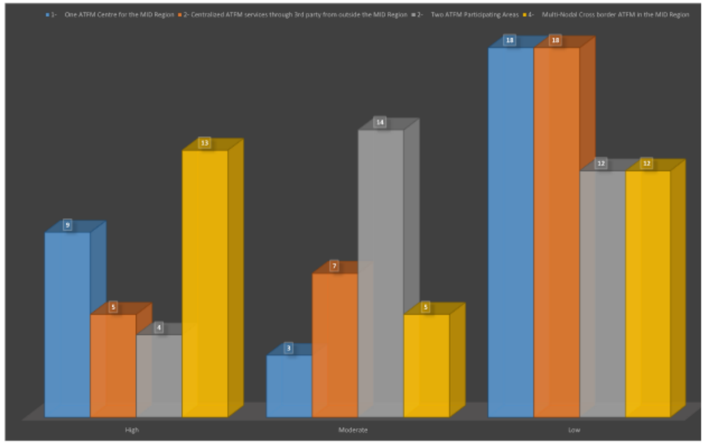
	B0-NOPS *Improved Flow Performance through Planning based on a Network-Wide view*		Partially Established ATFM measures		NO		Planned	2020		2022		Q4 2022
	B1- A-CDM *Optimized Airport Operations through A-CDM Total Airport Management*		End 2019		NO			2020		TBD		Q2 2021
	B1-RSEQ *Improved Airport operations through Departure, Surface and Arrival Management*		Partially full by 2020		NO			2019		2021		Q2 2021
	B1-FICE *Increased Interoperability, Efficiency and Capacity through FF-ICE/1 application before Departure*		Partially Full by 2020		NO			2019		2020		Q2 2021
	B1-DATM *Service Improvement through Integration of all Digital ATM Information*		Partially Full by 2020		NO			2020		2021		Q2 2021
	B1-SWIM *Performance Improvement through the application of System Wide Information Management (SWIM)*		2020		NO			2022		Q4 2020		Q2 2019
	B1-NOPS *Enhanced Flow Performance through Network Operational Planning*		Dependent on Regional agreement Planning phase		NO			2022		2022		Q4 2022
	B1-AMET *Enhanced Operational Decisions through Integrated Meteorological Information*		2020		Ongoing			2022		Q4 2020		Q4 2020
	B1-TBO *Improved Traffic Synchronization and Initial Trajectory-Based Operation*		Partially by 2020		NO			2022		Q4 2020		Q4 2020

ATTACHMENT D - Evaluation of possible MID ATFM Scenarios and their results

	Criteria/Advantages/Challenges	1- One ATFM Centre for the MID Region	2- Centralized ATFM services through 3rd party from outside the MID Region	3- Two ATFM Participating Areas	4- Multi-Nodal Cross border ATFM	Weight (1 to 6)	1- One ATFM Centre for the MID Region	2- Centralized ATFM services through 3rd party from outside the	3- Two ATFM Participating Areas	4- Multi-Nodal Cross border ATFM
1	Institutional Framework (legal, financial, funding mechanism, etc.)	3	3	4	5	6	18	18	24	30
2	Time required for the States to join the project (legal, Financial, etc.)	1	2	3	5	6	6	12	18	30
3	Political issues	1	1	3	5	6	6	6	18	30
4	Agreement on the Location	1	5	3	5	6	6	30	18	30
5	Funds required as a regional project (Centre) (cost)	3	1	2	5	6	18	6	12	30
6	Manpower (Centre)	3	5	1	5	4	12	20	4	20
7	Harmonized ATFM National procedures	5	3	4	3	3	15	9	12	9
8	Centralized Decision Making	5	5	4	2	3	15	15	12	6
9	Regional and cross regional coordination	5	5	4	2	3	15	15	12	6
10	Data Consistency/availability	5	5	4	3	3	15	15	12	9
11	Time needed for establishing the ATFM Framework	2	5	3	5	4	8	20	12	20
12	Third party could provide the service	5	5	5	0	2	10	10	10	0
13	Single system supplier and maintenance	5	2	3	0	2	10	4	6	0
14	Evolution process	5	3	4	3	2	10	6	8	6
15	Concentrated Team	5	5	3	2	2	10	10	6	4
16	Crisis management	5	5	4	4	2	10	10	8	8
17	Effective Airspace Management	5	5	3	2	2	10	10	6	4
18	Integration with regional IFPS	5	5	4	2	2	10	10	8	4
19	Stakeholders simplicity	5	5	3	2	3	15	15	9	6
20	Data collection that would be used by States	5	5	4	2	2	10	10	8	4
21	Centralized Post Assessment process	5	5	4	2	2	10	10	8	4
22	Support optimization of the use of the MID Region available airspace	5	3	4	3	2	10	6	8	6
23	Research and Development at regional level	5	5	5	2	2	10	10	10	4
24	States' willingness for Data Sharing with the ATFM Regional Centre(s) including Military Flights	2	2	2	5	6	12	12	12	30
25	Contingency Operations	1	5	5	5	3	3	15	15	15
26	local customization and integration systems	1	3	2	5	1	1	3	2	5
27	Common ATFM Messages Format	5	5	4	2	2	10	10	8	4
28	Compliance with ATFM Measures	5	5	3	2	2	10	10	6	4
29	Possibility of successful implementation	1	2	3	5	6	6	12	18	30
30	Timeframe to start operation	1	3	3	4	5	5	15	15	20
		306	354	325	378	100	306	354	325	378

Legend: *Rating from 0 to 5 (5 is the best)*

Challenge



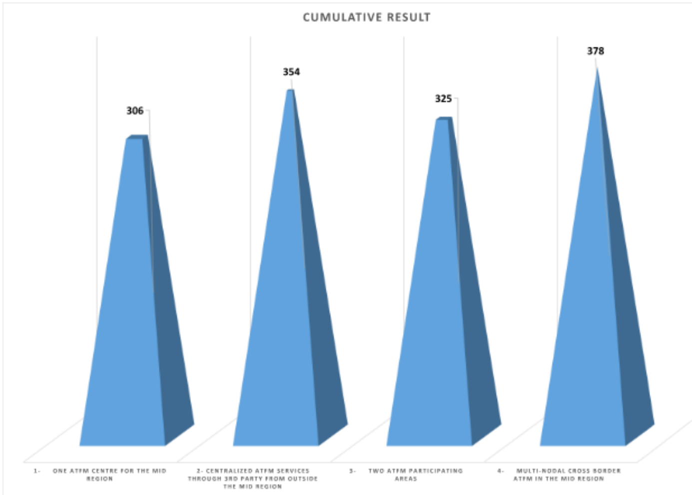


Table of Contents

PART II – MID ATFM CONCEPT OF OPERATION (CONOPS)

PART II

MID ATFM CONOPS

1- Overview

Concept Development and references

1.1 This MID Regional Air Traffic Flow Management (ATFM) Concept of Operations (CONOPS) was developed based on ICAO Doc 9971 and the Asia/Pacific Regional ATFM CONOPS

1.2 The Concept was tested in a series of Human-in-the-Loop (HITL) simulation exercises held at various ANSPs. It is based upon operationally proven *ATFM Measures* used to more efficiently manage delays incurred by all aircraft operating to a constrained resource, such as an airport or a sector of airspace, regardless of their point of departure and including flights controlled by ANSPs outside the control authority of ATC at the constrained resource.

Fundamental Concept of ATFM

1.3 Central to this CONOPS is the fundamental concept of balancing air traffic demand and capacity. While ANSPs and airport operators should strive to increase and optimize airspace and airport capacity to meet demand, traffic growth, surges in traffic and capacity constraining events cause imbalances. ATFM measures that may be utilized include *inter-alia* strategic landing slot allocation, miles/minutes in trail, level capping, re-routing and tactical airport slot allocation.

1.4 Implementation of effective ATFM improves predictability, reduces fuel burn / emissions and operating costs, reduces pilot and ATC workload, improves or maintains safety and equity.

ATFM and Collaborative Decision-Making

1.5 The Collaborative Decision Making (CDM) process, a key enabler of ATFM, allows all of its subscribing members, called CDM stakeholders, to participate in decisions that affect them after all relevant information has been made available to them. This applies to all types of decisions in the strategic, pre-tactical, and tactical phases.

1.6 **Figure 1** illustrates the integration of CDM into ATFM functions. The flow shows the independent evaluation of capacity and demand for the resource, the monitoring of the demand and capacity, the evaluation of ATFM measures, the involvement of stakeholders through CDM, and the execution and updating of the ATFM measures. Core functions of shared situational awareness and post-operations analysis are supported across all functions.

1.7 Using the available data, demand and capacity are monitored throughout the day by close communication and collaboration with other resource managers to identify any imbalances. Flow Managers have tools in order to evaluate various ATFM measures and organize CDM stakeholders participation and agreement before implementation. Once an ATFM measure is implemented, all stakeholders will stick to the plan to optimize their operations while monitoring the effectiveness of the measure implemented.

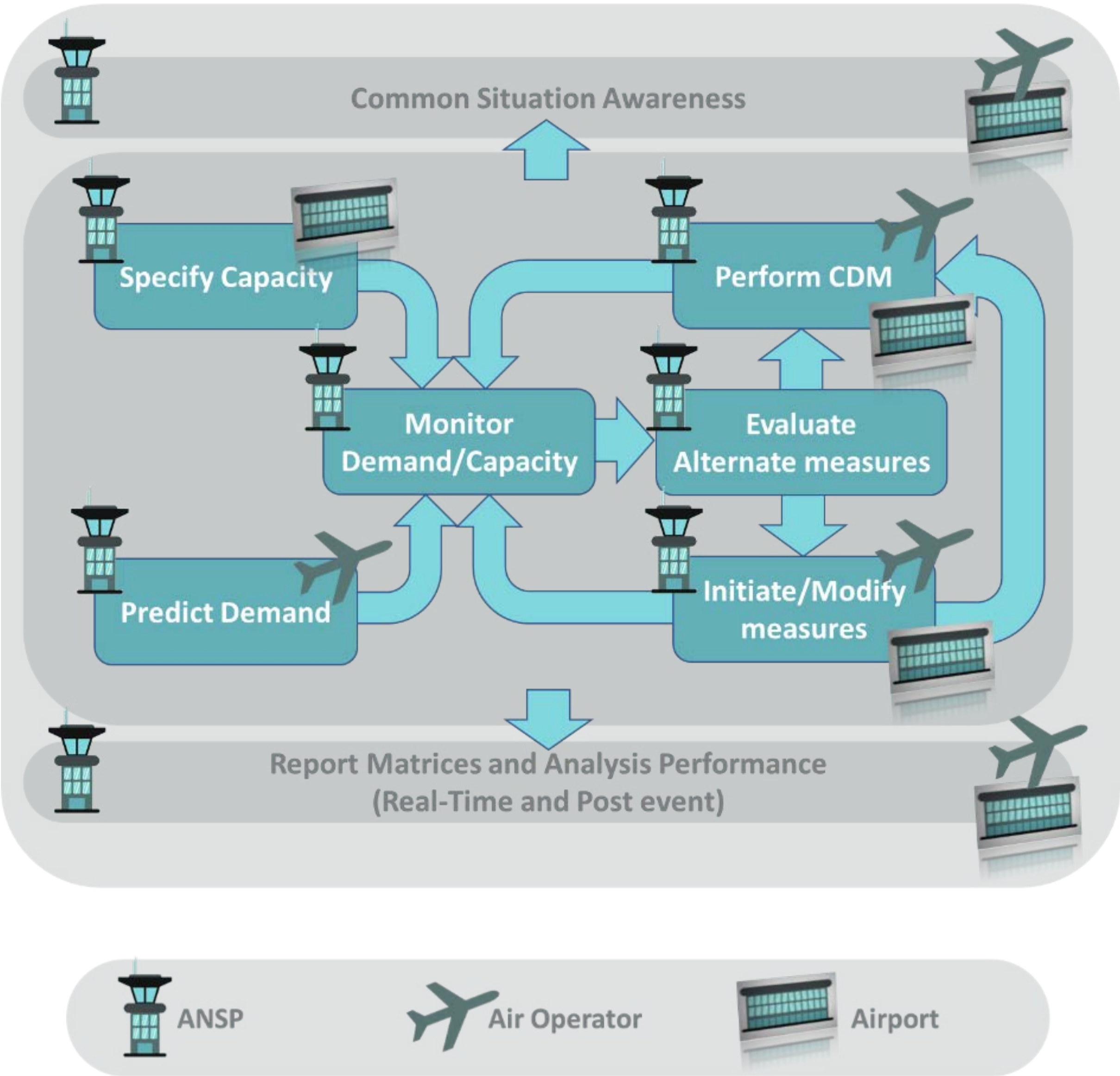


Figure 1: ATFM/CDM Functions

2- Scope

2.1 This document presents the regional ATFM CONOPS, supporting demand and capacity balancing for airports and airspace within the MID Region. The Concept includes existing ATFM/CDM principles that complements the ATFM measures currently in practice, such as conventional Ground Delay Programs (GDPs) or airborne holdings.

2.2 (CDM) is a key component of the CONOPS and is covered throughout this document. The CONOPS may be applied to any airport or airspace within the MID Region or elsewhere, especially in those airports or airspace serving significant number of international flights.

Document Overview

2.3 The document first discusses current operations and providing the justification for the Regional ATFM Concept. The proposed concept is then provided, followed by an operational scenario illustrating the concept, and finally the expected benefits.

2.4 The Concept will affect each stakeholder differently. The specific roles of each stakeholder group are detailed; Flow Management Position (FMP), Aircraft Operators, Airport Operators, ATC Tower, ATC Approach and ATC Area Control Centre roles are explained in Section 4.

The document has the following Sections:

- **Section 3 - Current Operations**, describes the current status of ATFM operations in MID region and the associated need for improvement.

- **Section 4 - Proposed Concept – Regional ATFM**, provides a detailed description of the concept, including assumptions, core capabilities, stakeholder responsibilities, and policy considerations. The section first describes the parts of the concept that must be consistent for any implementation of Regional ATFM. Implementation considerations, adaptable according to the needs of individual ANSPs are also described.

- **Section 5 - Operational Scenario**, illustrates an example of the step-by-step procedures for handling a given capacity reducing event, following the Regional ATFM Concept.

- **Section 6 - Expected Benefits of Proposed Concept**, presents a summary of the expected benefits resulting from the implementation of the proposed concept.

3- Current Operations in the MID Region

3.1 ANSPs in the MID Region currently have limited ATFM/CDM procedures in place to manage the traffic flows within their Flight Information Regions (FIRs). There is also lack of regional agreement to manage traffic flows between ANSPs. Some MID States do have some tools and processes to monitor and predict resource utilization, but the predictions are not always accurate, automated, or cross-border shared.

3.2 Strategic balancing of capacity at airports in the MID Region is currently undertaken through the airport slot allocation process or the application of Minimum Departure Intervals (MDIs). During the pre-tactical and tactical ATFM phases[1], balancing of arrival demand with the available capacity at airports is mostly reactive in nature. Planning ATFM measures ahead of time is difficult because the demand data are not generally accurately predicted and there is limited control of departures. As a result, most of the demand balancing is carried out by ANSPs within their own area of responsibility through tactical flow management in some FIRs with the support of arrival management systems (AMAN). This reactive management of demand often results in inefficient means of balancing flows, such as airborne holding and vectoring.

3.3 A challenge in terms of implementing an advanced ATFM system within the Region is the high percentage of international traffic. This characteristic poses a challenge to implementation due to the cross-border effect of ATFM measures such as Ground Delay Programs (GDPs) that assign flights with Calculated Take-Off Times (CTOTs) to comply with. Current, flights departing from airports outside of the ANSP's controlling authority operate as they originally intended, without absorbing all or even some of the delay. Accordingly, a new cross-FIR boundary concept is proposed to overcome this challenge and effectively apply ATFM measures to flights operating into constrained airports and airspace, while operating from airports or in the airspace of a different control authority.

3.4 There are, however, several ANSPs in the MID Region controlling significant domestic traffic, such as Egypt, Iran, Iraq and Saudi Arabia, where GDPs might be effective with only domestic traffic operating in accordance with assigned slots.

<u>Successful Implementation Example 1: Bay of Bengal Cooperative Air Traffic Flow Management System (BOBCAT)</u>

3.5 International collaboration for demand and capacity balancing has been demonstrated by initiatives such as the Bay of Bengal Cooperative Air Traffic Flow Management System (BOBCAT).

3.6 BOBCAT is a secure web-based computer system used to manage westbound aircraft operating through Afghanistan airspace from South and Southeast Asia to Europe during the busy nighttime period.

3.7 As a result of the lack of Communication Navigation Surveillance (CNS) facilities and military operations aircraft flying through this airspace are subject to restrictive separation requirements. In 2006 ICAO, upon request of IATA, formed a task force to implement a solution to the restrictions placed on aircraft flying through Afghanistan Airspace. AEROTHAI consequently developed a web-based solution which was implemented in July 2007.

3.8 BOBCAT assigns take-off times (departure slots) and levels for flights crossing the Kabul FIR based on Aircraft Operator requests. The request period is specified and the slot allocation occurs based on the existing requests. Aircraft Operators can request adjustments to the slot allocated based on their operational need and availability.

3.9 Some of the benefits realized since implementation of BOBCAT are:

[1] Strategic, Pre-Tactical and Tactical ATFM Phases are defined in ICAO Doc 9971 – *Manual on Collaborative Air Traffic Flow Management*

- Regularity of departures
- Orderly Afghanistan entry
- Optimal FL achieved (80 – 90% in Afghanistan)
- Reroutes and technical stops eliminated
- Reduction of Air Traffic Control Officer and flight crew workloads
- Environmental Outcomes (Annual, based on IATA estimates in 2007):
  - Estimated Airline Cost Savings: US$86 million
  - Estimated Fuel Savings: 85,000 metric tons
  - Estimated Emissions Savings: 356,000 metric tons

Successful Implementation Example 2: ATFM in Australia

3.10 Air services Australia has an automated ATFM system where projected demand and capacity are balanced through the implementation of ATFM measures, predominantly GDPs, and the assignment of ATFM slot times to aircraft. Aircraft Operators are advised of flight-specific off-block times at the domestic departure airports. These off-block times are calculated to deliver aircraft to the destination airport at the allocated arrival slot time. The ATFM system is used for pre-tactical and tactical planning and managing the arrival flows associated with the major Australian airports of Sydney, Melbourne, Brisbane, and Perth. The system offers effective pre-tactical and tactical decision support for managing demand-capacity imbalances and reducing air traffic saturation. CDM is supported through flight schedule updates, shared situational awareness, and schedule management (e.g., substitutions and cancellations).

Successful Implementation Example 3: ATFM in Japan

3.11 In 2005 the Japanese Civil Aviation Bureau (JCAB) established the Air Traffic Management Centre (ATMC) by recomposing the existing ATFM Centre to act as the leading and central function in order to drive forward Japanese Air Traffic Management (ATM). Through this office they are developing and implementing typical ATFM measures such as GDPs with slot swapping capability, re-routing, miles/minutes in trail, and Specifying Calculated Fix Departure Time for Arrival Spacing Program (SCAS). The ATMC has implemented CDM practices through twice-yearly stakeholder meetings and making available dynamic capacity changes every hour using web-based information sharing.

4- Concept – Regional ATFM

4.1 The regional concept was developed specifically for ANSPs in the MID Region based on APAC experience and could also be implemented in other regions. The MID Region is comprised of independent ANSPs, each managing traffic in their respective FIR with no overarching authority for the entire Region such as EUROCONTROL in Europe. The ATFM Concept for the MID Region is based on a model of distributed authority throughout the Region. Each individual ANSP will be responsible for issuing ATFM Measures to balance demand with capacity for airports and airspace within their FIR. Aircraft Operators will adhere to the ATFM policies, rules, and guidelines as defined and shared by the ANSP. Other stakeholders support each ANSP's ATFM measures as further described in this CONOPS.

4.2 The Concept is described from the perspective of a single ANSP managing the flow of traffic to a constrained resource. These individual ATFM systems will communicate to ATFM systems in other ANSPs and continuously update them, providing the authorized stakeholders with a consistent and up to date network-wide information.

<u>Concept Overview</u>

4.3 ICAO Doc 9971 – Manual on Collaborative Air Traffic Flow Management is the foundation of the Regional ATFM concept. While this document provides guidance for harmonizing ATFM concepts across the world, different States and Regions still have the flexibility to devise policies and procedures to best suit their individual circumstances, at the same time keeping a balance between this and a network-wide seamless flow of traffic. The concept for Regional ATFM considers the unique characteristics of the MID Region, such as high international traffic volume from a wide variety of aircraft operators, and the large number of small FIRs.

4.4 Within the MID Region there is a need to balance demand against capacity at airports with a high concentration of international traffic during the pre-tactical and tactical phases. In the majority of ANSPs that have advanced ATFM capabilities implemented, GDPs are used to effectively match the demand with the airport capacity by redistributing the demand by issuing departure times to flights operating within the control authority of the ANSP, in some cases responding to adjacent FIR requirements. This trades airborne holding for ground delay, which is the fundamental benefit of a GDP. The Regional ATFM concept adopts the GDP as the foundation of operations, but with several key differences.

4.5 One of the parameters for a GDP is the scope of non-exempt and exempt flights. Exempt flights are considered in the demand but are not expected to respond to an ATFM control time. Reasons for exempting flights include flights departing outside of a certain distance or international flights. The longer flights are typically exempted when a GDP is implemented due to a capacity reducing event that has potential to be cancelled early; if many flights are airborne at the time the ATFM measure is cancelled, they will have absorbed delay that cannot be recovered. International flights are normally exempted from GDPs because ANSPs do not have the authority to delay flights departing from airports outside of their control, and due to the fact that international flights generally travel longer distances. However, the Regional ATFM concept, which aims to address cross-border ATFM, includes short- and long-haul international flights to achieve optimized demand/capacity balancing at constrained resources.

4.6 When a GDP is implemented, exempt flights are assigned to slots first, followed by non-exempt flights—meaning exempt flights will receive minimal delay. Even though exempt flights are issued a slot, they are not required to absorb any delay assigned by the GDP. As a result, it is important to have sufficient "participation" (i.e. a high volume of non-exempt flights) in order to implement a fair and effective GDP.

4.7 In the region, there are operational models where ANSPs do not allocate slot times for exempted flights and have given the flexibility to aircraft operators to depart at the strategically approved departure times.

4.8 ANSPs set the rules by which flights are exempted based on agreements with airlines, ANSPs, or airports. One of the main challenges is achieving agreements with enough stakeholders to issue effective GDPs. ATFM/CDM models in other parts of the world only include domestic traffic in ATFM measures (GDP and ground stop [GS]). In the majority of the MID States, where majority of traffic is international, this model cannot be applied.

4.9 Data analysis studies were conducted for Singapore's Changi Airport to estimate the percentage of non-exempt traffic needed to implement effective programs. Based on the analysis and operational experience in the U.S., South Africa, and Australia, a participation level of 75% is desirable for effective and equitable AFTM using existing GDP principles (see Attachment B for a summary of the Singapore participation case study).

4.10 The Regional ATFM concept consequently requires participation from many departure airports, ANSPs, and airlines to achieve a high level of non-exempt flights. For this reason, one of the fundamental principles of the Regional ATFM concept is providing Aircraft Operators (i.e. airlines) the ability to specify their delay absorption intent between ground delay and airborne flying time adjustments to achieve their assigned ATFM arrival slot. This overall flexibility is expected to increase participation by giving long-haul flights the ability to take their delay in the air, where the delay can be recovered if the program is cancelled early. Also, flights that are airborne at the time the program is implemented will be able to absorb program delay in this concept, further increasing participation.

<u>Delay Absorption Intent</u>

4.11 One unique aspect of the Regional ATFM concept is that instead of flights being required to take all of the delay on the ground, Aircraft Operators can choose how to distribute the delay assigned via the ATFM measure throughout various phases of flight. The three delay intent fields are described below.

- **Gate Delay Intent:** Delay intended to be taken while parked at the gate. By default, pre-departure flights are assumed to take all program delay at the gate. Before the flight pushes back, the Aircraft Operator has the ability to move all or a portion of the delay to the Airport Surface Delay Intent and/or the Airborne Delay Intent.

- **Airport Surface Delay Intent:** Delay intended to be taken between pushback and takeoff. This allows for flights to plan taking additional ground delay in cases where the airport or ATC requires the parking stand to be vacated prior to the absorption of all intended ground delay.

- **Airborne Delay Intent**: Delay intended to be taken efficiently during the cruise portion of the flight. For flights that are airborne or will soon be airborne when the ATFM measure is implemented, all of the program delay is assigned to the Airborne Delay Intent. The ability to absorb program delay in the air is not part of any current operational ATFM system.

4.12 **Figure 2** illustrates the opportunity for absorbing delay in various phases of flight.

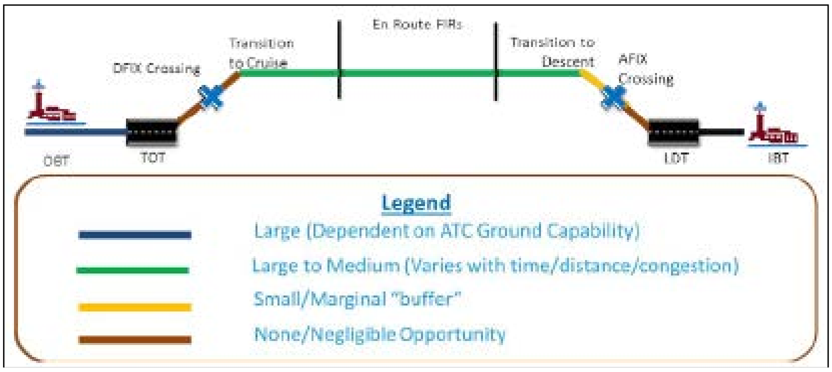


Figure 2: Opportunity for Absorption of Delay per Phase of Flight

4.13 Permitting flights to absorb ATFM program delay in the air can increase the number of flights participating in the program. In current ATFM systems GDPs generally exempt longer distance flights (e.g. flights traveling more than 2000 NM) due to risk of such flights taking unrecoverable delay; these flights could absorb delay on the ground, depart, and then the constraint at the arrival airport does not materialize, meaning that the flight absorbed delay unnecessarily.

4.14 Under the Regional ATFM concept, these longer flights can fly at a slower speed without any increase in fuel burn. For example, one study has shown that a flight between Rome and Paris can decrease its cruise speed by about 6% without changing altitude or fuel burn (**Figure 3**). The risks of long haul flights either taking unrecoverable delay or not participating in the ATFM program are decreased.

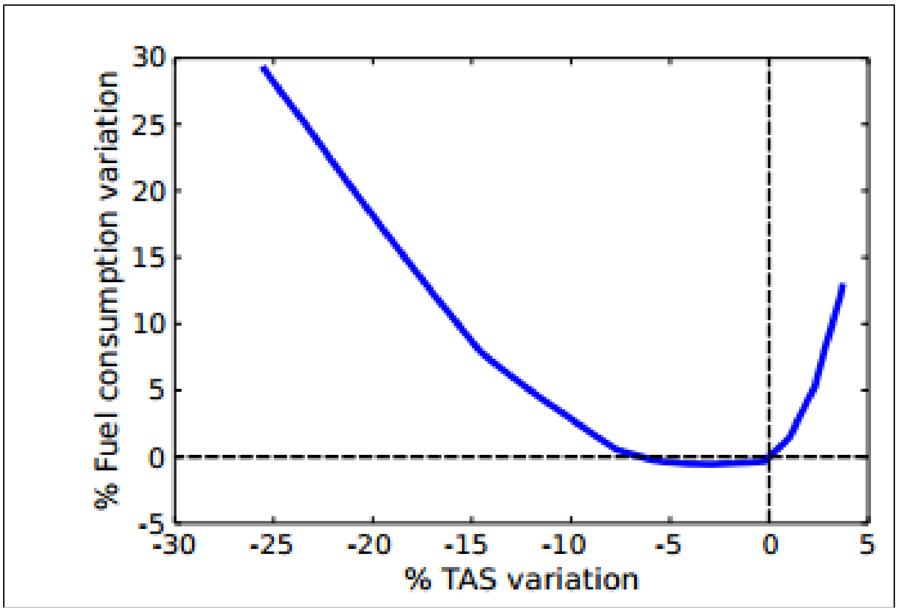


Figure 3: Fuel consumption variation for A320 Rome-Paris, F320, Mach 0.78, Cost Index 25 [Muñoz 2013]

4.15 Aircraft Operators may notify their delay intent by using one of two methods:

- via a web-based interface; or
- via a new flight plan or flight plan amendment.

4.16 When using the web interface, the Aircraft Operator directly enters the delay intent fields demonstrated in **Figure 4**. The aircraft operator may apportion some or all of the total delay to any of the three fields.

4.17 If the flight plan method is used the ATFM system infers the Intended Gate Delay and Intended Airborne Delay based on the filed Estimated Off-Block Time (EOBT) and filed Estimated Elapsed Time (EET) extracted from the new or amended flight plan.

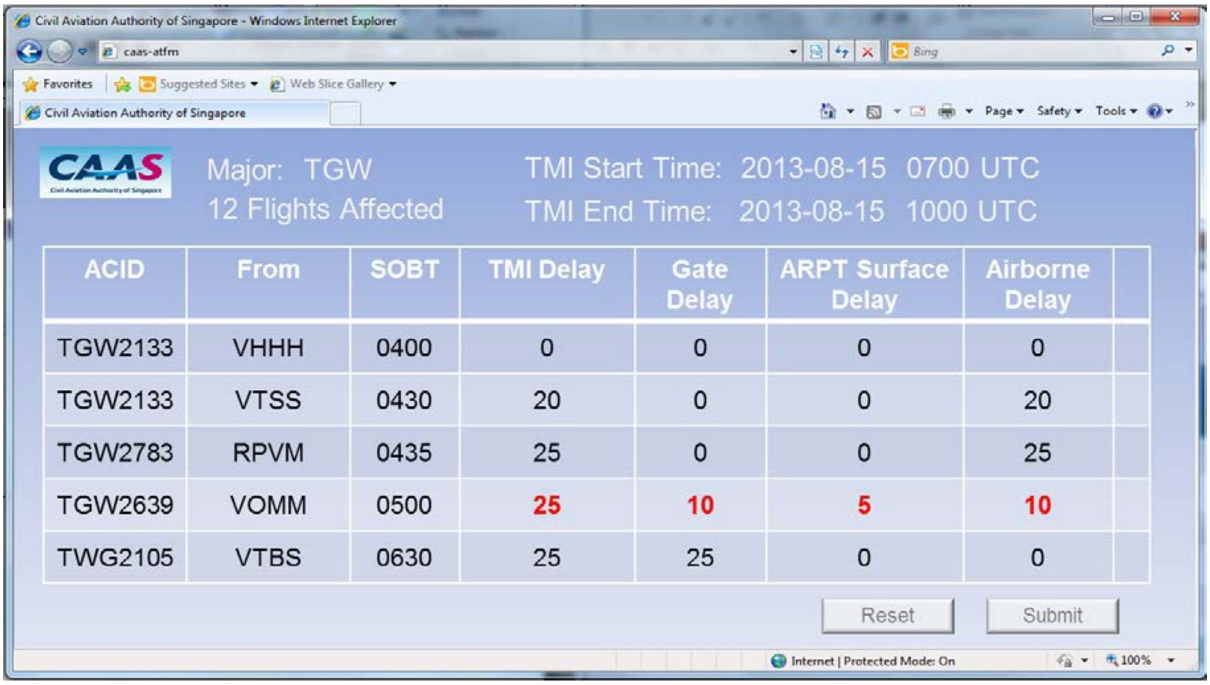


Figure 4: Example of web-based interface for delay absorption intent.

4.18 If the flight plan method is used to submit delay intent, en-route ATC will be aware of the flight-planned cruise speed and will control the flight appropriately. Flights that specify airborne intent via the web interface are expected to communicate their intended cruise speed to en route ATC as a request per current ATC procedures. ATC will continue to control the flight as done in current operations but may assist the pilot in meeting their intended airborne delay. This approach minimizes the required training and involvement of en-route ATC for the deployment of this Regional ATFM concept. Involvement of en-route ATC is a future consideration for the concept.

4.19 Since many of the major airports in the MID Region are IATA level 3 (Slot Controlled Airports), much of the work to balance demand and capacity in the strategic ATFM phase is already taking place. This process requires a rigorous analysis of the airport operations in order to determine the capacity of the airport. The scheduled demand is usually coordinated during bi-annual IATA Slot Conferences.

4.20 Airport Strategic Slot information is used by the ATFM process to transition from the strategic plan to the pre-tactical plan, then to the tactical plan on the day of operations. The flight data from the Strategic Slots is loaded in the ATFM System by the Aircraft Operators or ANSP at least one day prior to the day of operations. **Figure 5** shows a sample of the type of demand graph that should be available to the relevant stakeholders to quickly identify periods of demand-capacity imbalances and decide whether or not an ATFM measure must be implemented.

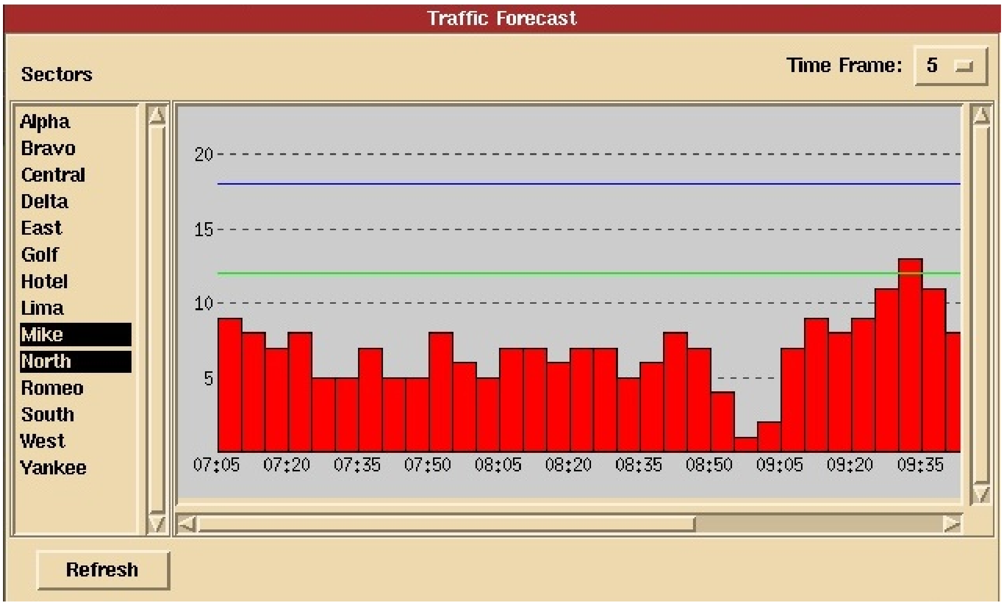


Figure 5: Example of capacity and demand

4.21 The stated capacity may change throughout the day due to operational factors or forecast weather. Capacity rates can be loaded into the ATFM system to reflect the capacity during a specific time period. For example, runway configuration changes could vary the rates in a predictable manner.

Initiating an ATFM measure

4.22 The Flow Management Position (FMP) continuously monitors the demand and capacity. When the current or predicted demand exceeds the capacity, the FMP will determine whether or not an ATFM program is needed based on the severity of the demand-capacity imbalance as well as feedback from CDM stakeholders. Before implementing ATFM measure under an ATFM program, the FMP and CDM stakeholders will have the ability to model with different parameters, including:

- Start and end time
  - Flights with estimated landing times within the start and end time of the program will receive ATFM slots
  - Non-exempt and exempt flight criteria
- Exemption criteria by: airline, airport, distance from arrival airport, or flight
  - Airborne Exemption Horizon: Flights that are airborne when the program is initiated and expected to land within the Airborne Exemption Horizon are exempted from the program
- Airport Acceptance Rate (AAR)
  - Number of aircraft that can land at the airport in a given time bin based on the predicted conditions
- Required Notification Time
  - When an ATFM measure is run, pre-departure flights that are expected to depart sooner than the Required Notification Time will have a default delay intent to absorb all of their delay in the air

4.23 The FMP will evaluate if the demand is sufficiently smoothed and also consider the average delay, maximum delay, and the number of affected flights to determine the impact of the ATFM program. Once the optimal parameters are set, the FMP runs the program and slot times are sent to Aircraft Operators, air traffic control towers, and other stakeholders.

Maximum Delay concept

4.24 Included in the concept it is the acknowledgment that certain flights will have a limited amount of delay that can be absorbed. For example, an active flight cannot absorb any delay on the ground and will only be able to efficiently absorb a limited amount of delay in the air based on remaining flying time. Also, flights may have a limited amount of delay they can absorb on the ground due to constraints of the departure airport. For example, if some airports have very high gate utilization and very few holding areas, the amount of ground delay for a flight will be limited.

4.25 To address this, the concept includes a component termed Maximum Delay. Maximum Delay is made up of three parameters: *Maximum Gate Hold*, *Maximum Surface Hold*, and *Maximum Airborne Adjustment*. The Maximum Gate Hold can be provided by the associated departure Airport Operator and the Maximum Surface Hold can be provided by the departure tower. Both of these parameters can be set by time frame and by departure terminal. The Maximum Airborne Adjustment is estimated by the ATFM system considering the distance between the departure and arrival airports or remaining flying time for airborne flights.

4.26 The use of the Maximum Delay concept can be tailored for implementation based on the needs of individual ANSPs. The considerations for the use of Maximum Delay are presented in paragraphs 4.76 and 4.77.

Collaborative Decision-Making

4.27 Through the ATFM System, stakeholders will be given a broader view of system constraints that might affect their operation with enough lead time to create a plan of action. This increased situational awareness will facilitate stakeholder collaboration in deciding a course of actions.

4.28 Aircraft Operators are given the flexibility to manage their allocated ATFM delays in order to best meet their business objectives. Aircraft Operators will have the capability to substitute slots between any two flights that they operate. This can be done to reduce the delay of a high priority flight or move a delayed flight (e.g., mechanical delay, crew delay, or delay from a prior flight segment) into a slot that it can meet.

4.29 Aircraft Operators also have the ability to substitute flights into a later slot even if they don't have another flight that they operate to swap into the earlier slot. This is called an Inter-Operator Slot Exchange. The flight requesting a later slot submits the earliest time that it can operate and the system automatically selects one or more flights to move forward. Notifications are then sent to the Aircraft Operators that have flights which had their delay reduced, known as *bridged flights*.

Compliance

4.30 Non-exempt flights will be measured for compliance based on their allocated slot times versus actual time of operation. Medium and long-range flights which can absorb some delay in the air are measured for compliance with reference to the calculated time over (CTO) an arrival fix (AFIX). Short-haul flights that cannot efficiently absorb a significant amount of delay in the air may instead be measured for compliance with either their actual off-block time (AOBT) or actual take-off time (ATOT).

4.31 For ATFM measures relating to airspace demand and capacity balancing, compliance may be measured against the CTO at an en-route fix (RFIX).

4.32 Compliance is measured at a fix rather than at landing as flights have more control over meeting a fix crossing time prior to initiated tactical ATC sequencing into the arrival airport. ANSPs specify the fixes that are to be used both for ATFM measures and measuring compliance. Flights will attempt to arrive at this fix within a compliance window.

4.33 Exempt flights are not considered for compliance measurement. These exempt flights are determined by the FMP for a given program and could include flights outside a given radius, flights departing from certain airports, and special case flights, for example, very-very important person (VVIP) flights. These flights will be assigned a slot time, which may involve some delay, but the flights will not be expected to comply with their assigned delay.

4.34 Where an exempted flight is not allocated with a tactical departure slot time, the compliance to strategically approved departure time needs to be measured, in order to avoid over demand.

4.35 Additionally, flights will be filtered from compliance consideration in cases where the Aircraft Operator is not at fault. For example, if the pilot does everything in their control to meet assigned slot times yet the flight arrives early or late due to an ATC constraint, then the flight will not be considered non-compliant.

4.36 ANSPs have the flexibility to develop their own policy and procedures for the handling of non-compliant flights. The considerations for the alternatives are explained in paragraphs 4.71 to 4.75.

4.37 Measuring and sharing of compliance statistics must be part of every implementation of the Regional ATFM concept and shall ensure access to all authorized stakeholders.

4.38 An agreed view of the compliance data needs to be availed to the general public to ensure the transparency of the entire process.

Post-Operations Analysis

4.39 A key component of the ATFM system as a data-sharing platform is the analysis capability enabled to study the effectiveness of ATFM programs and ATFM Measures applied and to establish trends over time. Post-operational analysis is indispensable for the FMPs to improve the parameters in the ATFM measures to achieve the desired outcome. The results of these analyses can be shared among FMPs in the region and “best practices” can be established.

4.40 A proposed metrics used for post operations analysis are listed in the tables below. **Table 1** lists the general scenario metrics, which are used to measure the severity of events that occurred, the ATFM measure parameters selected to resolve the issues, and the impact of the ATFM measure on stakeholders during a given time period. **Table 2** lists the CDM action metrics, which are used to determine how active the Aircraft Operators were in managing their flights.

Metric	Description	Type
Number of Flights	The total number of flights that received calculated times	ATFM measure
Start/Stop Time	The Start and End time of the ATFM measure. The time period when the FMP wanted to control the demand	ATFM measure
Lead Time	The number of minutes the ATFM measure was implemented before the Start Time	ATFM measure

Number of Exempt/ Non-Exempt flights	The number of flights that were exempt from the ATFM measure to the number of non-exempted according to the parameters specified by FMP (percentage)	ATFM measure
Number of ATFM measure Events	The number of FMP actions that reassigned flights in the ATFM measure (i.e. number of revisions and compressions)	Operational Activity
Total Assigned Delay	The sum of the delay assigned by the ATFM measure	Operational Impact
Max/Average Assigned Delay	The maximum and average delay	Operational Impact
Total Gate/Surface/Airborne Delay	The total actual delay taken at the gate, on the airport surface, and in the air	Operational Impact
Number of Cancellations	The number of flights canceled and were part of a given ATFM measure	Operational Impact
Number of Unexpected Flights	The number of flights that appeared after the ATFM measure was already implemented	Operational Impact
Compliance to the assigned times	Percentage of flights complying to assigned departure/fix times	Operational Impact
Utilization of capacity	Percentage of the count difference between the planned flights and the actual flights	Operational Impact
Details of exempted flights	Full details of exempted flights to avoid misuse of this arrangement	Operational Impact
Delay savings	Difference between potential (theoretical) delay and actual delay	Operational Impact
Fuel savings	Fuel savings derived from the delay savings	Operational Impact
Emission savings	Emission savings derived from the fuel savings	Operational Impact

Table 1: General Scenario Metrics

Metric	Description
Number of Evaluations	Total number of CDM stakeholders participation organized before implementation an ATFM measure.
Number of Substitutions	Total number of flights that were substituted
Number of Inter-Operator Slot Exchanges (ISEs)	Total number of ISEs
Number of Bridged Flights	The number of flights that were bridged
Number of Cancellations	Total number of canceled flights for a given time period
Substitution Savings	The amount of the savings in minutes of flights that move forward as a result of a substitution
Bridging Savings	The amount of the savings in minutes of flights that move forward as a result of being bridged

Metric	Description
Number of Delay Modifications	Number of modifications made by the Aircraft Operator to their flight event times to show flight would be delayed
Number of Delay Intent Modifications	Number of modifications made by the Aircraft Operator to their delay intent values
Number of technical support	Number of operational/technical support provided by the FMP for an any other stakeholder to meet an ad hoc operational needs

Table 2: CDM Action Metrics

4.41 Compliance metrics are useful for reviewing the effectiveness of an ATFM measure and identifying systemic hindrances. There are many ways that users can view compliance metrics. For example, in **Figure 6** compliance is compared at various points in flight progress. The different colors in the pie chart show different levels of compliance, where orange and red are different degrees of late and blue and dark blue are different degrees of early.

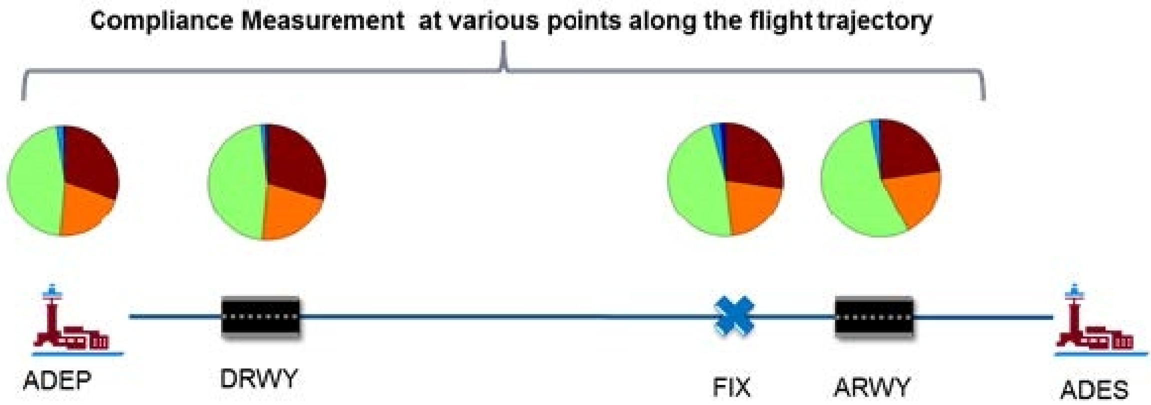


Figure 6: Compliance Metrics

Stakeholder Roles and Responsibilities

4.42 With the exception of the FMP, Regional ATFM stakeholders are the same as in the flight and ATM operations, but with added roles. First of all, stakeholders will collaborate on a daily basis in order to ensure the smoothest operations. This communication is done by sharing data with the ATFM System as well as during virtual/teleconferences organized by the FMP or any stakeholder. This communication will lead to a common view of the most accurate demand and resource capacities. When multiple ANSPs have implemented this concept, the virtual/teleconferences may exist at one or more levels of stakeholder participation to provide the necessary information to all stakeholders in the Region.

4.43 In addition to increased communication among the stakeholders, each stakeholder group has specific changes that result from the concept, described as follows:

Flow Management Position

4.44 Upon implementation of Regional ATFM, an FMP will need to be established within each ANSP. FMPs will be part of a flow management unit that is responsible for managing the operation of the ATFM system and the associated CDM processes within the ANSP.

4.45 The main responsibility of the FMP is to monitor the demand by viewing flight data from the ATFM System and comparing that to the arrival capacity of the airport(s) in their jurisdiction. The FMP collaborates with relevant stakeholders to update the capacity (i.e. AAR) when there is a constraint such as predicted weather or resource maintenance/outage. Whenever the predicted demand exceeds the capacity, the FMP shall organize CDM stakeholder's virtual/teleconferences to determine the best solution for the problem, which will likely involve implementing an ATFM measure. The FMP will have the ability to model various initiatives to smooth the imbalance and, in coordination with local stakeholders, select the solution that suits the best to meet the operational objectives set by the CDM stakeholders. Additionally, if multiple ANSPs in the region have an ATFM system, the FMP may coordinate with FMPs of other ANSPs to establish the best regional solution taking all the regional requirements into consideration. While ANSPs may have different ATFM systems, they will transmit and receive data in a common way, thereby enabling all regional FMPs to share the same operational information.

4.46 Once the ATFM program is running, the FMP will monitor the performance of the program. The FMP has the ability to revise a program if any of the parameters need to be changed. The FMP also has the ability to perform a compression (optimizing slot allocation) on a program to reassign flights to slots and to fill in any empty slots. Both of these actions involve having new slot times assigned and sent to the Aircraft Operators; therefore, these FMP actions are limited to operational need based on updated flight data or capacity information.

4.47 The FMP will also be responsible for organizing scheduled and ad-hoc virtual/teleconferences. Scheduled teleconferences will be held on a regular basis as agreed by the CDM stakeholders. The daily airspace plan will be discussed and could include: demand anticipated during the day, weather forecasts and constraints, resource availability/non-availability, any degradation of the ATS or its supporting services provisions, special use of airspace, Aircraft Operator operations, proposed ATFM measures modeling and implementation, and post-event analysis. Ad-hoc virtual/teleconferences can also be held should circumstances dictate a need.

Aircraft Operators

4.48 Aircraft Operators will participate in CDM stakeholder's virtual/teleconferences and may also organize one in consultation with FMP, when multiple stakeholder's input is required.

4.49 Aircraft Operators will see changes in the way they manage their flights due to the redistribution of inevitable delay. When a demand and capacity imbalance is predicted, an ATFM program will shift the delay from the more costly airborne holding delay to the more efficient ground delay or airborne adjustment. Both the Flight Operations Center (FOC) and pilot need to be aware of the assigned ATFM measure and work to comply with it in order for the concept to be effective and equitable.

4.50 An additional role of the Aircraft Operator is to provide the demand inputs into the ATFM System in the pre-tactical and tactical time frame. These data could include flight schedule uploads and flight plans. As the time to operate the flight approaches, the Aircraft Operator can update flights' EOBT (e.g. flights delayed due to technical issue) through the ATFM System, making the changes visible to all stakeholders.

Note: Delay information input to the ATFM system does not replace the aircraft operator or pilot-in-command obligation to file delay, amendment, or cancellation and new FPL information, as specified in ICAO Doc 4444 PANS-ATM and State AIP.

4.51 When an ATFM program is implemented, Aircraft Operators have the flexibility to prioritize flights within the pool of slots they have been assigned and to specify the intended delay distribution for their flights. The FOC will communicate this delay intent to pilots and the flights will be measured for compliance with the slot times, as described in paragraphs 4.71 to 4.75.

Airport Operators – Departure Airports

4.52 Airport Operators will participate in CDM stakeholder's virtual/teleconferences and may also organize one in consultation with FMP, when multiple stakeholder's input is required.

4.53 Airport Operators will be impacted by implementation of a ATFM measures as a departure flight may elect to take ground delay at the gate or between pushback and departure (Airport surface delay), which affects gate allocations and movement area and apron and taxiway usage. The Airport Operators' main involvement in the regional concept is to coordinate with Aircraft Operators for absorbing delay on the ground whenever necessary.

4.54 Where airport terminal (gate) capacity is constrained, Airport Operators may submit Maximum Gate Delay values to the ATFM system, as described in paragraphs 4.24 to 4.26.

Airport Operators – Arrival Airports

4.55 Airport Operators will participate in CDM stakeholder's virtual/teleconferences and may also organize one in consultation with FMP, when multiple stakeholder's input is required.

4.56 Airport Operators will be responsible for advising the FMP on capacity constraints predicted at the airport. They will be expected to participate in scheduled and ad-hoc teleconferences. The Airport Operator will advise the FMP should the ATFM measures have an adverse effect on operations at the monitored airport.

Airport Collaborative Decision Making (A-CDM) Interface

4.57 A-CDM systems should interface with the ATFM system, using the Regionally agreed terminologies relevant to both ATFM and A-CDM; CTOT and calculated landing time (CLDT).

ATC – Departure Tower

4.58 The ATC Tower will participate in CDM stakeholder's virtual/teleconferences and may also organize one in consultation with FMP, when multiple stakeholder's input is required.

4.59 The Tower ATC can facilitate compliance with ground delay intent as far as operational constraints allow. With access to the flight-specific intended takeoff time, Tower ATC officers can assist flights to have a compliant departure.

4.60 In addition, the Departure Tower ATC can coordinate where to best place the aircraft on the movement area in order to absorb the ground portion of the delay, without affecting the other aircraft movements.

4.61 Lastly, the Tower can submit Maximum Surface Delay values to the ATFM system, as described in paragraphs 4.24 to 4.26. The ATFM system should flag Maximum Surface Delay values input by ATC to identify where ATC or airport surface capacity constraint results in non-compliance with an ATFM measure.

ATC – Arrival Tower

4.62 The ATC Tower will participate in CDM stakeholder's virtual/teleconferences and may also organize one in consultation with FMP, when multiple stakeholder's input is required.

4.63 The ATC Tower supervisor will be required to keep the FMP advised of constraining events at the airport. The Tower supervisor will be required to participate in teleconferences so as to add to the pre-tactical and tactical CDM processes. In addition, the tower supervisor will be required to tactically determine the AAR and advise the FMP if any change in the AAR is required.

ATC – Approach Control Unit (APP)

4.64 The ATC Approach Control Unit (APP) will participate in CDM stakeholder's virtual/teleconferences and may also organize one in consultation with FMP, when multiple stakeholder's input is required.

4.65 Approach Control Unit (APP) will have no requirement to change their operational procedures to accommodate flights subject to an ATFM measure. Pilots may request an altitude or speed change in order to comply with their delay intent distribution. The ATC will follow normal ATC operating procedures before approving these changes. Education on the fundamental principles of the Regional ATFM concept will serve to increase controllers' awareness.

4.66 Terminal Area (TMA) ATC units in certain implementations of ATFM may have the authority to de-prioritize non-compliant flights. This model can be adopted but requires compliance status of flights being available to ATC. Adding this function to the terminal ATC depends on the ANSP's decision made in terms of compliance handling described in paragraphs 4.71 to 4.75.

ATC – Area Control Centre (ACC)

4.67 The ATC Area Control Centre (ACC) will participate in CDM stakeholder's virtual/teleconferences and may also organize one in consultation with FMP, when multiple stakeholder's input is required.

4.68 En-route ATC units and centers will have no requirement to change their operational procedures to accommodate flights subject to an ATFM measure. Pilots may request an altitude or speed change in order to comply with their delay intent distribution. The ATC will follow normal ATC operating procedures before approving these changes. Education on the fundamental principles of the Regional ATFM concept will serve to increase controllers' awareness.

4.69 Terminal Area (TMA) ATC units in certain implementations of ATFM may have the authority to de-prioritize non-compliant flights. This model can be adopted but requires compliance status of flights being available to ATC. Adding this function to the terminal ATC depends on the ANSP's decision made in terms of compliance handling described in paragraphs 4.71 to 4.75.

Proposed Changes Resulting from Implementation

4.70 The following Technology and Policy changes supporting the implementation of the Regional ATFM Concept are proposed.

Technology Changes

4.71 Stakeholders will be able to perform demand and capacity balancing during the pre-tactical and tactical phases with the ATFM system. Through this system the FMP can model ATFM programs with participation of CDM stakeholders and with various parameter values to optimize the solution. When the ATFM measure is acceptable to the CDM stakeholders, then the ATFM measure runs and the slot times are automatically calculated and sent to the appropriate Aircraft Operators as well as shared with all stakeholders using a common platform such as a web interface.

4.72 Common situational awareness for all the stakeholders is essential for implementing effective ATFM measures; the ATFM system will bring this situational awareness to ANSPs, Aircraft Operators, Airport Operators, and other stakeholders. The ATFM system will integrate various data sources with the most accurate and up-to-date operational information. Users can connect to the ATFM system to view pertinent information as well as update any changes to their operations. Efficient sharing of more accurate data leads to better decision making in a timely manner. A CDM platform is required where Aircraft Operators are able to carry out advanced CDM processes to optimize schedules.

4.73 Users will be able to access stored data for post-operation analysis. Stakeholders will be able to view metrics for any previous day of operations (for a list of metrics, refer to paragraph 4.37 Tables 1 and 2). Statistical analysis of post operations data will help identify shortfalls in operations and methods to improve operations.

Policy Changes

4.74 Policy changes associated with Regional ATFM include involvement in teleconferences, which will increase information sharing compared with current-day operations. CDM stakeholders may participate in scheduled teleconferences to discuss the plan for the day as well as to review operations on the previous day. The stakeholders calling into the scheduled teleconferences include the FMP, Aircraft Operators, neighboring ANSP facilities, the ATC tower(s), and the local Airport Operator. If necessary, the FMP will coordinate with the FMPs of other regional ANSPs in a separate teleconference. The FMP may also convene and chair ad-hoc teleconferences to handle unforeseen demand and capacity imbalances.

4.75 Policy in terms of data sharing will have to change with the implementation of ATFM since sharing of data is the foundation of CDM. Aircraft Operators will have the ability to view delay metrics associated with their flights as well as aggregate metrics for all flights. ATC stakeholders will have unlimited situational awareness with regard to slot assignments. Access, security, and data integrity must all be addressed in single ATFM System instances and in the connectivity and data sharing between multiple ATFM System instances.

4.76 Aircraft Operators and third-party agencies generally measure on-time performance (OTP) by comparing flights' actual off-block times (AOBT) with their scheduled off-block times (SOBT). With the implementation of ATFM, the policy for measuring OTP should consider flights impacted by an ATFM measure. For these flights, on-time performance should be determined by comparing flights' actual off-block times and actual landing times with their intended off-block times. This is a challenge for ATFM systems since Aircraft Operator on-time performance is often defined by legislative action. To date, the impact of an ATFM initiative on a departure OTP metric has not been formalized.

Justification for Changes

4.77 Table 3 summarizes the major changes resulting from the Concept, and their justifications.

Change	Justification
Introduce a Flow Management Position	• A smoother transition of strategic demand and capacity balancing to pre-tactical and tactical demand and capacity balancing • A means of evaluating proposed ATFM measures in collaboration with the stakeholders prior to implementation • A communication position within the ANSP to keep stakeholders apprised of the operational conditions
Assign slot times to flights to manage demand-capacity imbalances	• Reduced fuel burn / emissions • Reduced controller workload • Increased predictability of operations • Enhanced safety due to reduced congestion
Aircraft Operators share flight data with ATFM system	• Accurate and common picture of demand
FMP specifies capacity	• Accurate and common picture of capacity
Aircraft Operators specify delay absorption intent	• Increased participation improves ATFM measure effectiveness and results in a more equitable delay assignment • Increased flexibility for Aircraft Operators to manage flights

Change	Justification
	• Reduced risk of absorbing unrecoverable delay
International and airborne flights participate in ATFM measures	• Increased participation improves ATFM measure effectiveness and results in a more equitable delay assignment
Aircraft Operators have the ability to substitute flight slots	• Flexibility for Aircraft Operators to manage flights based on their business models
Airport Operators and ATC Tower specify Maximum Ground Hold	• Increased situational awareness - Aircraft Operators: aware of flights which may have received more delay than they can absorb - FMP: more accurate picture of when flights will actually arrive at the terminal area
Measure compliance at a fix prior to landing	• Ensure a smooth flow of traffic to the constrained airport • Move Aircraft Operator compliance point beyond tactical terminal control area.
Post-Operations Reporting	• Provide a means to discover ways to improve operations
Teleconferences	• Increased situational awareness • Operational data exchange

Table 3: Changes and their Justifications Arising from the Concept

Impacts During Deployment

4.78 The participation of stakeholders has contributed to the development of the concept of operations; this participation will need to continue for successful operational deployments. This participation would include:

- Participation in stakeholder meetings establishing business rules specific to an ANSP's implementation;
- Development of operational procedures;
- Training of staff;
- Participate/organize operational daily and ad-hoc virtual/teleconferences; and
- Active participation in data sharing and ATFM measure execution.

Multi-Nodal Concept

The Regional ATFM concept has been described in the above from the perspective of a single ANSP. The concept readily applies to multiple ANSPs in the same region all implementing this form of ATFM/CDM. A key to the concept is that each ANSP would be responsible for implementing ATFM programs to airports and airspace within their area of responsibility according to the concept illustrated in this document. Information sharing between the ATFM systems would allow the users from any of the systems to have access to network-wide information. This includes Aircraft Operator access to controlled flights arriving at airports within the areas of responsibility of multiple ANSPs, and Air Traffic Control Tower access to ATFM information on departure flights bound to airspace and airports within the areas of responsibility of multiple ANSPs with CTOT and CTO reflecting delay intent from their respective ATFM measures. Details of the concept and procedures could be customized in each ANSP based on their individual operational requirements, but it is strongly recommended to keep the concept as consistent as possible across the region. Refer to paragraphs 4.70 to 4.78 for the details that can be adapted. **Figure 7** provides an example of the networked ATFM nodes under the MID Regional ATFM concept.

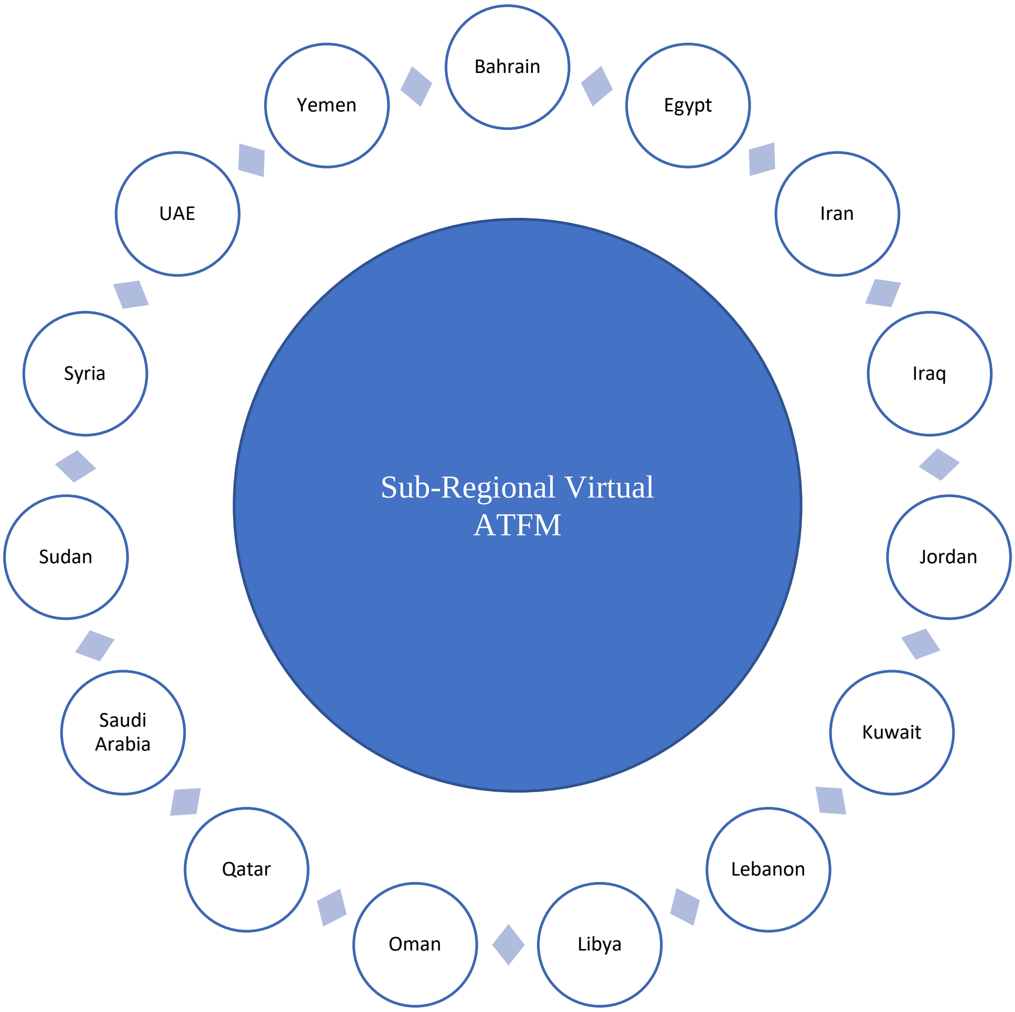


Figure 7: Distributed Multi-nodal ATFM Network

<u>Implementation Considerations</u>

4.79 The following concept elements can be addressed to meet the needs of a specific ANSP. The variations on the elements are described below to provide the full breadth of the concept without indicating a preference for a specific implementation.

<u>Compliance Handling</u>

4.80 High levels of compliance are critical for ATFM measures to have a predictable and efficient flow of traffic. Non-compliant flights could cause bunching in the arrival flow, requiring ATC to impose airborne holding or other tactical interventions on compliant flights. Non-compliance could consequently result in loss of trust among Aircraft Operators in the efficiency and equity of the Concept.

4.81 In current ATFM implementations, ANSPs have developed a range of procedures for preventing non-compliance. The options, together with their advantages and disadvantages are presented below along with their advantages and disadvantages. Note that the options are not mutually exclusive.

- Sharing of compliance statistics with stakeholders
  - Advantages
    - Promotes CDM principles through the transparency of data;
    - Aircraft Operators will strive for high compliance to maintain/improve the airline's reputation;
    - Flights that are unable to absorb delay (e.g. VVIP flights and emergencies) will not be penalized for non-compliance.
  - Disadvantages
    - No direct consequences for non-compliance
- Departure ATC prevents pushbacks or departures if flights will be non-compliant with their assigned CTOTs
  - Advantages
    - Little if any non-compliance with CTOTs
  - Disadvantages
    - Increased workload for ground movement controllers
    - Operational challenges associated with pilots absorbing delay at a holding pad
    - No penalty for non-compliance with intended airborne delay
- Deprioritize non-compliant flights in the arrival airspace
  - Advantages
    - Equitable amounts of delay taken for compliant and non-compliant flights
    - Compliant flights are not penalized when other flights are non-compliant
  - Disadvantages
    - Technical and procedural challenges associated with integrating the ATFM system and AMAN
    - Increased workload for approach controllers

4.82 Tactically deprioritizing flights in the approach airspace would require the ANSP to define fixes outside of the approach area that would be used to measure the compliance. If the ANSP has an AMAN, it would be best to measure compliance prior to the AMAN handoff point. This would ensure smooth delivery of the flow into the AMAN, which would then be used to sequence flights to the runway. It would also provide sufficient time for a Flow Manager or supervisor to decide which flights to deprioritize if the ANSP decides to deprioritize non-compliant flights. Due to the unique geometry of the airspaces, the distance from the airport at which compliance is measured will be adapted to each ANSP.

4.83 The size of the window at which flights are considered compliant is dependent on implementation and stakeholder involvement. An asymmetric (e.g. -5, +10 minutes) window could be used because Aircraft Operators have more control over not arriving early than not arriving late. In other words, Aircraft Operators could be late due to a variety of reasons such as weather deviations or an ATC constraint. Pilots generally have enough control over the flight to prevent an early arrival.

4.84 Individual ANSPs in the region will set compliance standards within their areas of responsibility; however, a standard procedure for handling non-compliance is recommended in the region for operating consistency.

Performance Metrics and Post-Operational Analysis

4.85 The metrics for post-operation analysis described in paragraphs 4.37 to 4.39 should be applied to all the ANSPs in the region because they are metrics related to the broader Regional ATFM concept and not the specific implementations. The common set of metrics will help the international ATFM community develop a method for comparison with operations around the world. In addition to those metrics, the concept allows for ANSPs to develop their own metrics and statistics particular to their operations. Some possible metrics/statistics to consider are:

- Program Delivery – Shows how effective the ATFM measure was at balancing the capacity and demand. It compares the expected demand after the ATFM measure was implemented with the actual demand. This is useful in identifying periods of non-compliance.

- On-Time Performance Metrics – Typically ATFM only considers whether ATFM measures were successful in balancing demand with resource capacity. On-Time performance represents another aspect of national airspace operations that is a good indicator of efficiency and is directly tied with impacts to the passengers. It is important to track the impact on passengers because it gives an insight on whether ATFM measures were able to provide benefits to more passengers rather than more aircraft.

- Environmental Metrics – Shifting air delay to ground delay has a positive impact on the environment through emissions reduction. Fuel burn metrics could be developed to study and track positive impacts of implementing an ATFM measure. The metrics could also support achieving the environmental goals any government may have.

Additional metrics could delve deeper into airport and airspace operations. They would be useful in identifying root causes of inefficiencies that have been exposed by higher-level aggregate metrics.

Maximum Delay

4.86 The implementation of the Maximum Delay to flights will be determined by each ANSP. Three options are:

1. Added as a parameter for the Aircraft Operators to compare to assigned delay
2. Incorporated into FMP demand predictions
3. Maximum Delay is incorporated in slot assignment

4.87 The first use will help Aircraft Operators manage their flights by ensuring the assigned delay is not greater than the Maximum Delay via delay intent adjustments and substitutions. The second use will help the FMP determine the effectiveness of a modeled ATFM measure. For example, if many flights are receiving more delay than their Maximum Delays, the FMP could increase the participation to reduce the average delay of participating flights. Maximum Delay during slot assignment could limit the delay assigned to flights such that their assigned delay is less than or equal to their Maximum Delay. This approach is not recommended for initial implementation, because it requires very accurate calculations of Maximum Delay.

Future Considerations – Role of En-route ATC

4.88 **Role of En-Route ATC**: The Concept of Operations states that the FOC will communicate delays associated with ATFM measures to their pilots. If the pilot needs to absorb some delay in the air in order to be compliant, the pilot will request speed and altitude changes to ATC, and the controller will approve the request if possible. With this tactic, en-route ATC will operate under the same procedures used currently.

4.89 Increasing the involvement of en-route ATC is possible based on ANSP involvement, controller training, and the desire to be actively involved in supporting airborne adjustments. For example, the en-route ATC could be aware of controlled flights' calculated times and actively direct flights to ensure compliance. This involvement increases the workload of en-route controllers but increases the likelihood that flights are compliant with the ATFM assigned delays. Due to the required time to add this role and the large number of stakeholders impacted, this role is not considered for the current concept, but may be considered in the future.

5- Operational Scenario

5.1 The initial conditions for this scenario are illustrated in **Figure 8**. The FMP views the demand and capacity predictions at the arrival airport. The FMP sets the runway configuration and AAR after coordinating with the tower and terminal supervisors. The pre-tactical demand is lower than the nominal capacity, so there is no need for any arrival airport ATFM measures.

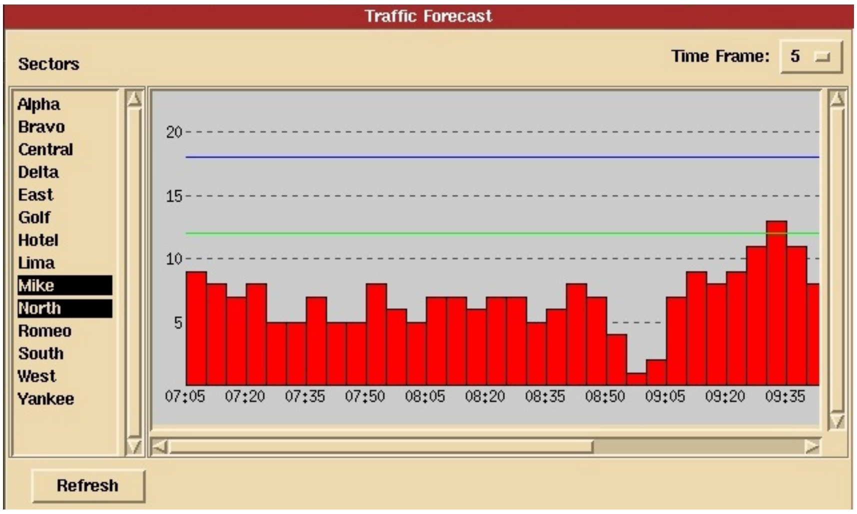


Figure 8: Demand and Capacity Prediction

5.2 At 0000 UTC, the military informs the FMP of a military exercise that will impact the operations at the airport. The reduced capacity will likely cause a demand and capacity imbalance, which can be managed by running an ATFM measure. The parameters for the ATFM measure are selected such that the capacity reducing event will have the least possible impact on all of the stakeholders. The result of the modeled ATFM measure is shown in **Figure 9**, with the parameters listed below:

- AAR based on the capacity reducing event: 25 between 0500 and 1100 UTC
- ATFM measure start time: 0500
- ATFM measure end time: 1100
  - Flights with estimated landing times between the start and time of the program will receive a slot, or Calculated Landing Time (CLDT), at the arrival airport.
- Non-exempt flights: 15 major airlines from the region
  - The major airlines will attempt to comply with their assigned slot times, regardless of their departure airport.
  - The few remaining flights from other airlines are exempt and will receive priority in slot assignments.
  - Exempt/Non-exempt status can also be set for specific airports and flights and based on distance.
- Active Flight Exemption Horizon: 1 hour
  - Airborne flights estimated to land within the next hour will be exempt from the program and receive priority in slot assignments because they will not be able to efficiently absorb any delay.

- Required Notification Time: 1 hour
  - The default intent for pre-departures that are estimated to depart within the next hour is to absorb all of their delay in the air because the FOCs require approximately one hour to notify pilots of the ATFM measure.

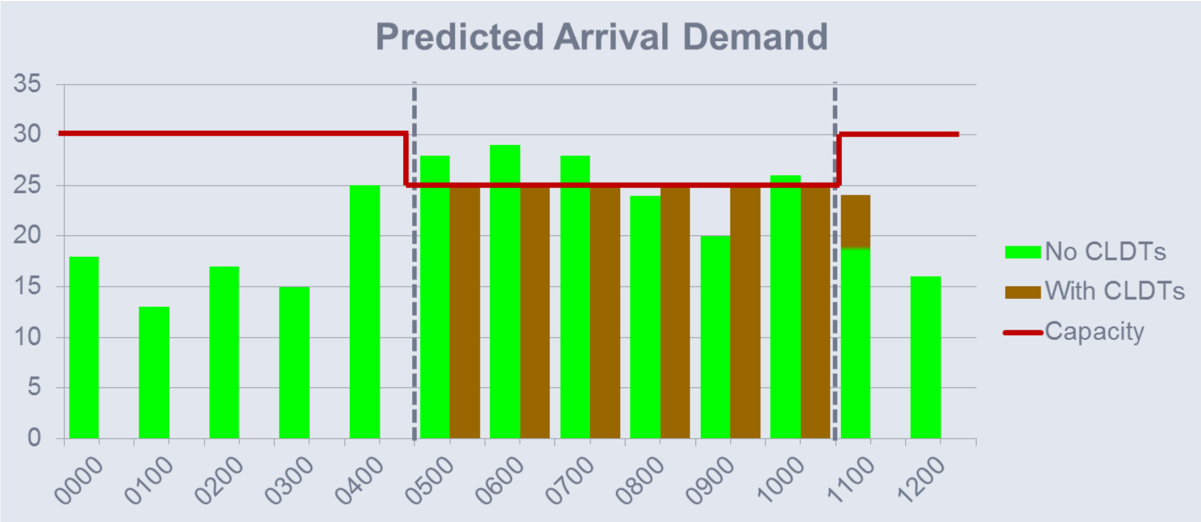


Figure 9: Modelled ATFM program

5.3 The FMP coordinates with CDM stakeholders via teleconference to coordinate the potential impact of implementing the ATFM measure. While all stakeholders can provide input on the program parameters and suggest alternative solutions, the FMP is the ultimate decision-maker.

5.4 The FMP runs the proposed ATFM measure, and slot assignments are sent to Aircraft Operators. The slot assignment event times are prefixed with the letter C for Calculated and include:

- Calculated Off-Block Time (COBT)
- Calculated Take-Off Time (CTOT)
- Calculated Time Over (CTO)
- Calculated Landing Time (CLDT) (arrival slot time)

5.5 Aircraft Operators have the flexibility to distribute the delay intent of pre-departure flights into three attributes: Intended Gate Delay, Intended Surface Delay and Intended Airborne Delay. In certain cases, Aircraft Operators will coordinate gate and surface delay intents with the Airport Operator to manage gate turnaround times and gate conflicts.

5.6 The Thai Airways FOC decides to absorb a portion of the assigned delay of flight THA641 in the air (**Figure 10**). Of the 20 minutes of the assigned delay, THA641 intends to absorb 10 minutes at the gate and 10 minutes in the air. The FOC submits the delay intent to the ATFM system via the web interface. The FOC then informs the pilot of the intended delay.

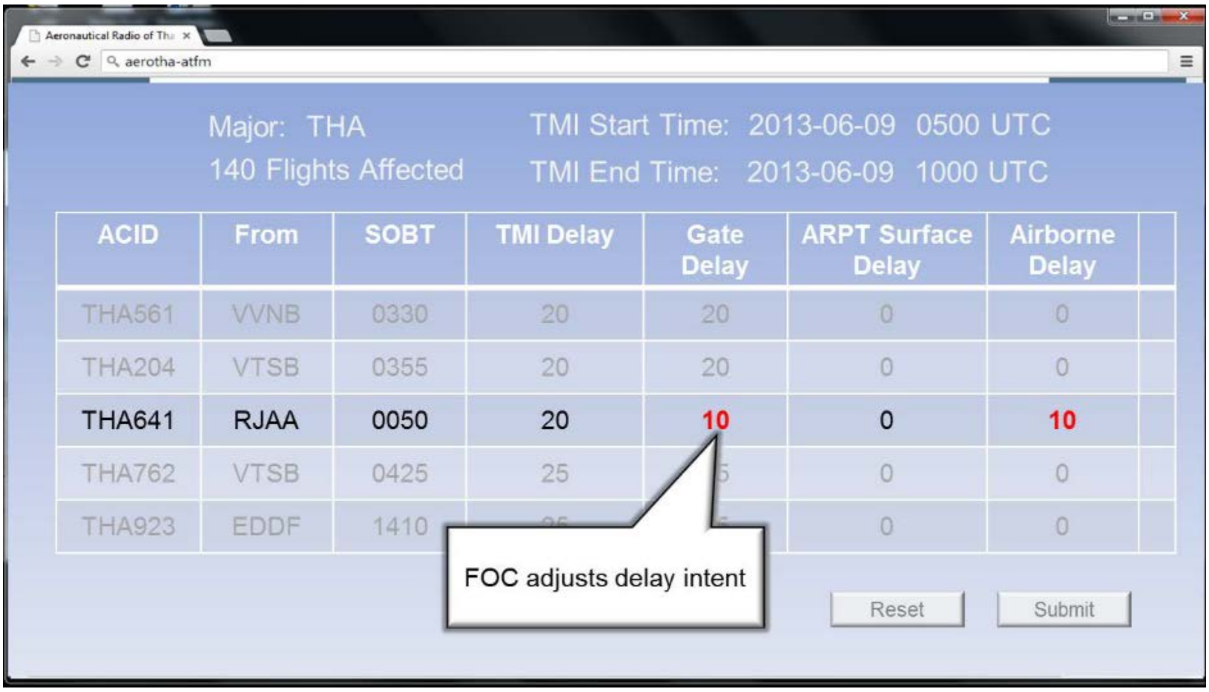


Figure 10: Delay Absorption Intent

5.7 The event times associated with the intended delay are prefixed with the letters "DL". For flights that intend to absorb some delay on the airport surface or the air, their DL Off-Block Time (DLOBT) and DL Take-Off Time (DLTOT) will be different from the Calculated "C" times associated with the slot. **Table 3** shows the updated DL-times for THA641 based on ten minutes of gate delay and ten minutes of airborne delay. Notice the DLOBT and DLTOT are both ten minutes earlier than the COBT and CTOT because the flight intends to make up that additional ten minutes delay in the air.

ACID	DLOBT	COBT	DLTOT	CTOT	DLLDT	CLDT
THA641	0100	0110	0110	0120	0600	0600

Table 3: the updated DL-times

5.8 Aircraft Operators also have the ability to substitute flight slots in order to meet their business objectives. For example, CPA713 is a high-priority flight, so the Cathay Pacific FOC substitutes it with CPA739. The CLDTs of the two flights are swapped and the CTOTs are recalculated based on the new slot times. The result of the substitution is shown in **Figure 11**.

Pre-Substitution

ACID	ADEP	CTOT	ATOT	SLDT	CLDT	TMI Delay
CPA739	VHHH	0345	----	0705	0710	5
CPA713	VTBS	0455	----	0710	0720	10

Post-Substitution

ACID	ADEP	CTOT	ATOT	SLDT	CLDT	TMI Delay
CPA739	VHHH	0355	----	0705	0720	15 (+10)
CPA713	VTBS	0445	----	0710	0710	0 (-10)

Figure 11: Pre- and Post- Flight Substitution

5.9 Pilots request pushback clearance at the departure airport at the Delayed Off-Block Time (DLOBT). Following the departure airport's procedures, flights receive clearance for pushback. At certain departure airports, procedures may be altered such that flights can only receive pushback approval if the request is within a compliance window.

5.10 Approach and en-route controllers will operate as they do in current operations and may have a basic understanding of the Regional ATFM concept. Flights that intend to absorb some delay in the air may request speed and or altitude changes en-route in order to meet the intent. The en-route controller may accept or reject the speed or altitude request based on ATC operational requirements.

5.11 Arriving flights will be measured for compliance at an AFIX prior to landing. If a flight's actual time over (ATO) the fix is within the compliance window of the flight's CTO for the fix, the flight will be considered compliant. In addition, flights that are late to the fix due to an ATC constraint will not be considered non-compliant.

6- Expected Benefits of the Concept

6.1 There are many expected benefits with the implementation of the Regional ATFM concept. The major areas of improvements upon the current procedures include:

- A smoother transition of demand and capacity balancing from strategic to pre-tactical and tactical phases of ATFM.
- Reduced fuel burn and emissions.
- Accurate and common view of demand and capacity predictions.
- A means of modeling and evaluating proposed ATFM measures in collaboration with the stakeholders prior to implementation.
- Flexibility for Aircraft Operators to optimize their schedules through a web-based CDM platform.
- Flexibility for flights to absorb inevitable delay on the ground or efficiently through the en-route portion of the flight rather than by holding in the terminal area.
- A more reliable data source of stakeholder intent—this applies to Aircraft Operators sharing how they intend to operate the flights, as well as ANSPs and airports sharing any resource constraints.
- Enhanced safety by ensuring safe traffic densities.
- 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 trend analysis.

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Attachment A - ATFM Background

ATFM Measures

A.1. There are a wide variety of ATFM measures that resolve demand-capacity imbalances by shifting demand either spatially or temporally. These measures can be classified into the following three groups

- Spacing Restrictions—Require consecutive flights in a common flow to be separated by a specified time or distance.
  - Miles-in-Trail (MIT)
  - Minutes-in-Trail (MINIT)
  - Minimum Departure Intervals
- Rerouting: Shifts demand around a weather constraint to create a spatially balanced flow of traffic.
  - Fix balancing
  - Collaborative Trajectory Options Diversion of flows
  - Level capping (i.e. restricting the altitude of certain flight plans)
  - Re-route
- Ground Holding: Shifts predicted airborne holding delays to ground holding at the departure airport by controlling flights' departure times.
  - Ground Delay Program (GDP)
  - Ground Stop (GS)

Some actions that would be used to mitigate the impact of ATFM Measures:

A.2. Some measures can be taken by the Airspace User to mitigate the impact of a proposed ATFM measure based on their business model: slot swapping is the most commonly used method. Re-routings, even though they are ATFM measures, may also be used by Airspace User(s) to that end, when, for example, an Airspace User opts for a longer route or a speed reduction in order to avoid a congested area at a specific time. In all cases, such mitigations can only be chosen following an established CDM process.

A.3. Slot swapping can be applied either manually or via automated means. The ability to swap ATFM departure slots gives Airspace Users the possibility to change the order of departure of the flights that should fly in a constrained area. This action provides Airspace Users with the ability to manage and adapt their business model to a constrained environment.

A.4. Airborne holding may be complementary to ground delay programs and ground stops. Airspace Users may, in collaboration with the ANSP, choose to use this program to keep a small inventory of holding aircraft during periods of congestion, to maintain demand pressure on the approach. The supply of available aircraft can prevent losing opportunities when departure demand is not constant or when meteorological conditions vary. Airborne Holding, in general, is costlier than other methods, but Air Traffic Managers may plan for airborne holding when required delays are predicted to be low.

A.5. It is recognized that airborne holding is a last-resort measure, as in-flight holding places a hefty burden on both Airspace Users and ANSPs. In the event that the arrival of a given flow of traffic needs to be delayed, measures such as slowing aircraft well before the planned top of descent, and making use of the required time of arrival (RTA) have proven to be effective. Most of these techniques make good use of aircraft capabilities and usually reduce operating costs and environmental impacts without increasing the workload of the ATC.

ICAO Guidance on ATFM

A.6. The ICAO Doc 9971- *Manual on Collaborative Air Traffic Flow Management (ATFM)* provides recommendations for ATFM implementation. ATFM should be implemented in phases in order to build stakeholder knowledge as operations become more complex. It is also important for procedures to be developed in a harmonious manner among states in the region to reduce operational differences. ICAO also recommends three communication methods for information sharing: scheduled telephone or web conferences, tactical telephone conferences, and an automated web page or ATFM operational information system.

A.7. The list below is a summary of the ICAO document's suggested initial steps to implement ATFM:

- Establish objectives, project management plan, and oversight of ATFM
- Identify personnel who will lead the development of ATFM
- Brief stakeholder groups on ATFM principles
- Define the ATFM structure that will be established
- Consider the facilities and equipment that will need to be procured
- Develop a model for establishing AAR
- Identify points of contact for dealing with ATFM issues
- Define the elements of common situational awareness including: Meteorological information
- Traffic display tools
- Identify the appropriate means of ATFM communication
- Develop Letters of Agreement between adjacent FIRs
- Develop user manuals and training materials

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Attachment B - Participation Analysis – Changi Case Study

B.1. This following is a summary of an analysis conducted to determine a required participation level for effective implementation of ATFM measures.

B.2. A fast-time simulation was created to simulate the impact of various participation levels on ATFM measure effectiveness, using scheduled takeoff times were from Changi arrival data. The flight progress was simulated with GDPs implemented with various reduced capacities at two participation levels. 1400 NM and 2400 NM radii around Changi provide approximately 50% and 75% participation levels, respectively. The map in **Figure B1** shows the airports that are included in the two radii explored.

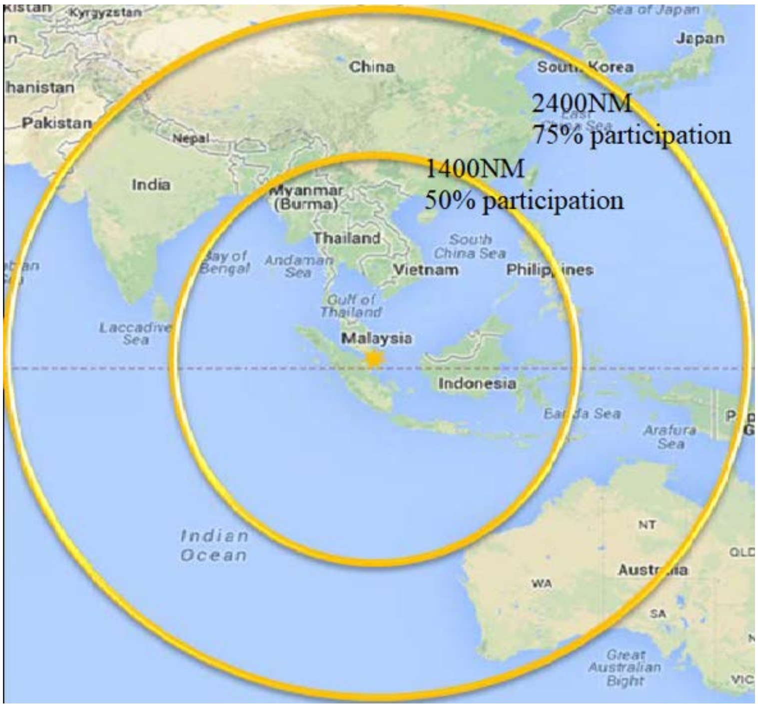

Figure B1: Airports within Participation Radius

B.3. The results for the two participation levels are compared in **Figure B2**. As indicated by the plots, the total delay increases exponentially as the capacity is reduced. In the severe case of a 16 flights/hour airport capacity (about half of the nominal arrival capacity), participating flights receive an average of 2.3 hours of delay when participation is 50% and about 1.6 hours of delay when participation is 75%. Therefore, increasing the participating flights reduces the delay per participating flight by 0.7 hours. The reason for this reduction is that there are fewer exempt flights that get priority in the slot assignment.

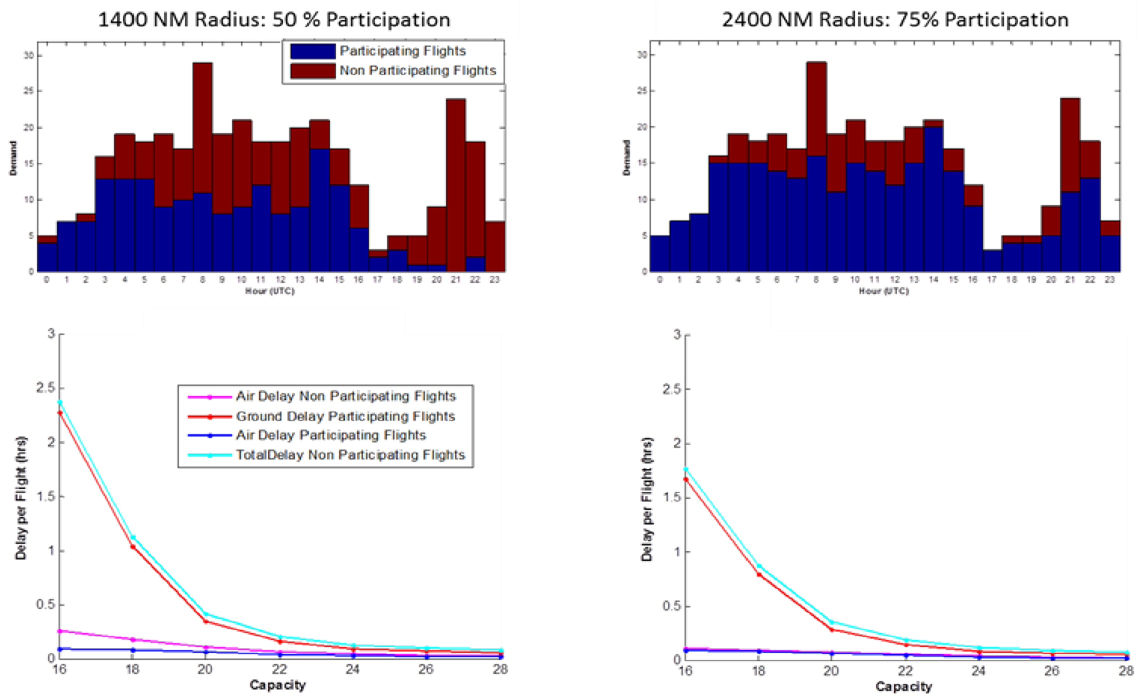

Figure B2: Participation Analysis

B.4. The delays for the non-participating flights are also reduced when the participation level is increased. In the example below, the airborne delay for non-participating flights is reduced from 0.3 hours to about 0 hours when increasing participation from 50% to 75%. This is because the demand of participating flights is generally lower than the capacity of 16 when the participation is 75%, whereas when the participation level is 50% there are a significant number of non-participating flights that need to be delayed in order to bring the total demand below capacity.

B.5. When the capacity reduction is less significant, the difference between the two participation levels is less pronounced. For example, when capacity is reduced to 20, the average delay for participating flights is reduced from 0.4 hours to 0.3 hours for 50% and 75% participation, respectively. The reason for this reduction in the difference between the two participation levels is due to the fewer flights that receive delay. As shown in **Figure B2**, the demand is below 20 for most of the day, meaning an ATFM measure is not needed for most of the day.

B.6. Based on these results and knowledge from currently implemented ATFM systems, high participation (>75%) is necessary to manage the flow of traffic during events with a relatively high reduction in capacity. If the capacity reducing event induces minor delays, the flow may be managed with less than 75% participation.

Table of Contents

PART III – MID ATFM Common Operating Procedure and Implementation Guidance

PART III

MID ATFM Common Operating Procedures and Implementation Guidance

1- Introduction

Executive Summary

1.1 The large growth of air traffic movements in the MID 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 cockpit - ATC workload and 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 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 common operating procedure and Implementation Guidance

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

1.4 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 MID region, Regional ATFM procedures and Cross-Border operations will be required due to the unique operational requirements of the region.

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

1.6 The ICAO Doc. 9971 – Manual on Collaborative ATFM, together with the Regional ATFM ConOps (Part II) and the Regional ATFM Framework (Part I) 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 part, provides additional guidance (the “how”) for states in the MID 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 part will evolve as the Cross-Border Multi-Nodal ATFM concept further develops.

2- Understanding the impact of ATFM/CDM Implementation

2.1 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 ICAO MID Strategy Plan. Some ANSPs in the region have implemented ATFM/CDM these implementations have had significant positive impact on operations resulting in both qualitative and quantitative benefits.

2.2 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.

2.3 When increased ATFM measures are introduced in the MID 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.

2.4 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

2.5 ATFM/CDM implementation requires a significant culture change in all stakeholder organizations. This culture change is required at all levels within organizations. 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.

3- Setting up an ATFM/CDM Project

Requirement assessment and gap analysis assessment

3.1 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

3.2 A general process for ATFM/CDM implementation is presented in Figure 1. 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.

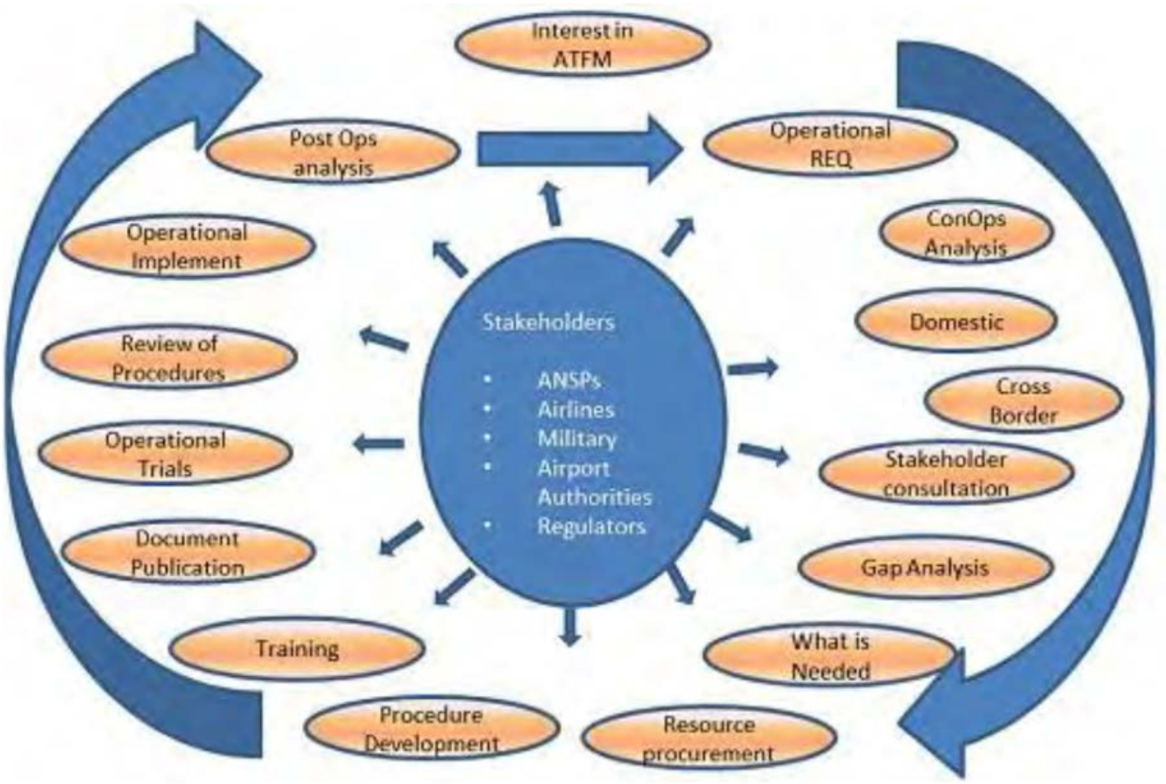

Figure 1: Typical ATFM/CDM process Educating and convincing all stakeholders

Educating and convincing all stakeholders

3.3 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.

3.4 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

3.5 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)
- 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 – (ATFM LOA Templates is in Part I, Appendix H)

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

3.6 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:

– Enhance Safety

– Reduce fuel burn

– Reduce carbon emissions

– Reduce ATC – Pilot workloads

– Increase situational awareness

– Improve predictability

- Optimise airspace and airport operations

3.7 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

4- Implementation

Introduction

4.1 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

4.2 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.

4.3 During the requirements analysis, 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.

4.4 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

4.5 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.

– Whether there are significant increases in seasonal demand (Haj/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, labor 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 [ACDM]).

- 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.

<u>ATFM/CDM CONOPS</u>

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

<u>Domestic ATFM</u>

4.7 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.

4.8 Examples of Domestic ATFM/CDM implementations (South Africa, Australia, and Japan); have all recognized 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 Harmonization Group (NARAHG) regional group which is considering how to develop Cross Border ATFM/CDM in this sub region.

4.9 In MID, States/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/Telecom 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

4.10 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.

4.11 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 MID Regional ATFM CONOPS
  - Stakeholders agree to the adoption of the MID 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 MID 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 practice 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 practice 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.

4.12 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

4.13 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 2).

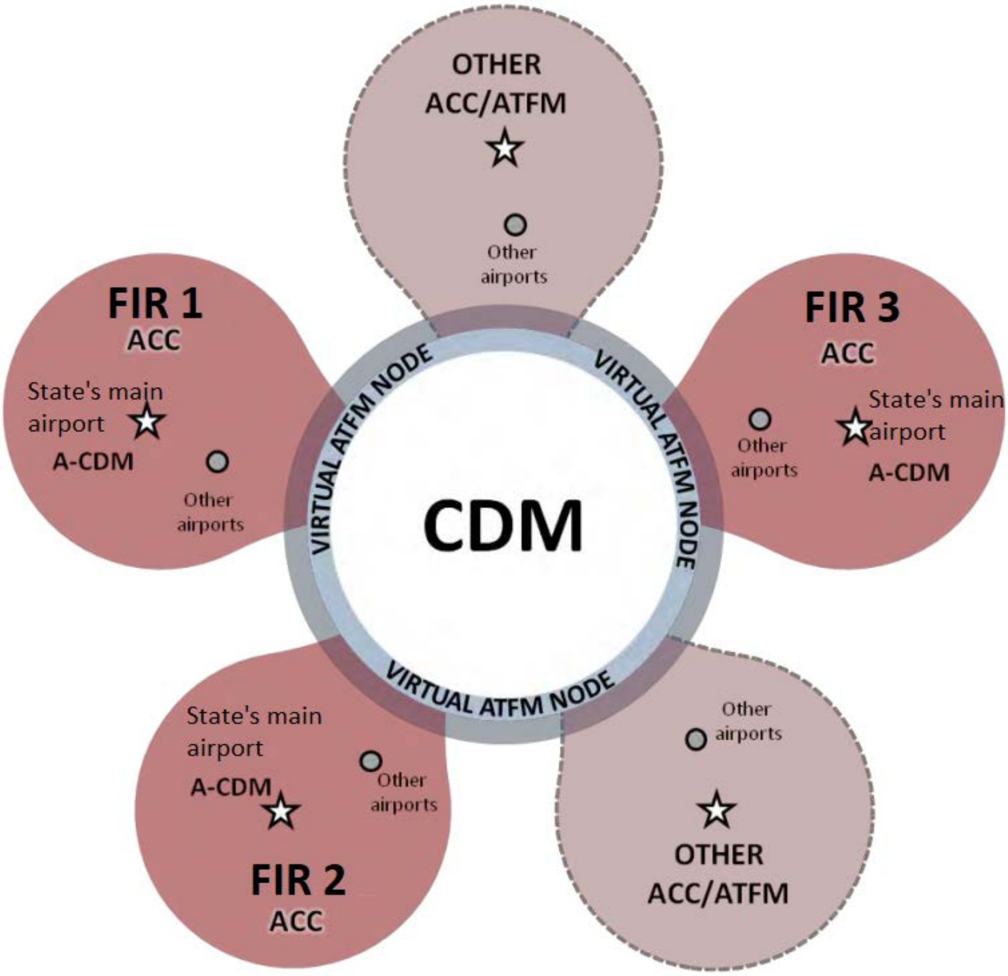

Figure 2: A Distributed Multi-Nodal ATFM Network

4.14 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.

4.15 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

4.16 Key components of the cross-border ATFM/CDM concept, to be considered in conjunction with the Regional ATFM CONOPS (Part II) and Regional ATFM Framework (Part I), are:

– Multi-Nodal Stakeholders interconnected via virtual communication framework

Note: The group was established in the ICAO MID Secure Portal and Group name was renamed to be OPSDataEX for that purpose.

- 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 as well as *OPSDataEX* group which was established in the ICAO MID Secure Portal.
- 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

4.17 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.

4.18 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

4.19 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.

4.20 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.

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

5- Implementation Risks and Mitigation

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

5.1 Tables 2 - 14 summarises the general risks and mitigation for Cross-Border ATFM/CDM implementation.

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

Table 1: 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 airline
Probability/Impact	Medium

Table 2: 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 3: 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 (CO2) emissions.
Mitigation	Popularize ATFM/CDM via all available means and to all possible stakeholders explaining benefits is very significant.
Probability/Impact	High

Table 4: 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 5: 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 6: 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. The Regional ATFM Framework document must be respected and maintained but can be enhanced in line with implementation maturity.
Probability/Impact	Medium

Table 7: 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

Table 8: 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 9 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 10: 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 11: 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 12: Risk 12 – No go decision

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

Table 13: Risk 13 – Insufficient system integration

6- Post-Implementation Activities

ATFM/CDM becomes a daily operation

6.1 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

6.2 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

6.3 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.

7- Timeline

7.1 The ICAO MID Air Navigation Strategy (MID Doc 002) provides a blueprint for coordinated Regional development, including capability improvements described in the ICAO Doc 9750 (Global Air Navigation Plan (GANP) - Sixth Edition) regarding ICAO Aviation System Block Upgrades (ASBU) roadmap. Air Traffic Flow Management (ATFM) taking a network view, is a key module in ASBU Blocks zero, one, two and three. B0/1-NOPS element – Initial integration of collaborative airspace management with air traffic flow management - has been identified by MIDANPIRG/18 as one of thirty-five priorities for the MID Region.

Phase IA – expected implementation duration: 1 Year;

- 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 duration 1 Year;

- Analyze 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/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 duration: 1 year.

- Distributed Multi-Nodal ATFM information distribution capability utilizing 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, utilizing 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.

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

ATTACHMENT A - ATFM Implementation Guidance - Assessment of Benefits

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. As the MID region, it becomes essential to optimize the use of available capacity through ATFM.

Throughout the MID 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.

<u>Qualitative Benefits</u>

Regional Wide Benefits

Implementation of Regional ATFM will derive the following benefits:

- 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 optimized 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 incentivized 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, 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

nonparticipating 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/contingency events such as 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 optimization 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.

– Improved special event and flexible usage of airspace planning.

– More efficient DCB at airports and in airspace.

– Optimization 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.

– Optimization 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 optimize 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.
- Maximized benefits for aircraft with advanced avionics (PBN routings).
- Significant fuel savings.
- Significant reduction in CO2 emissions.
- Better aircraft utilization.
- Better passenger experience.
- Optimization 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 utilization of ground resources (ground handling, catering, refueling, etc.).
- Enhanced situational awareness assists the entire community in the airport precinct (passengers, immigration, customs, security, baggage handling, etc.).
- Optimization 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 recognized 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 in reduced unstable approaches events.

- 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.

- END -