

AFRICA ATFM IMPLEMENTATION PLAN

CANSO MOMBASA ATFM ROADMAP

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Executive summary

Safe and seamless air travel is achieved through high functionality and performance, and a strong air traffic management (ATM) network.

In Africa, fluctuating demand, exponential growth in drone operations and the requirement for rapid development of unmanned aerial systems (UAS) traffic management (UTM) highlight the need to develop ATM.

Conclusion 21/08 of the Twenty-First Meeting of the Africa-Indian Ocean Planning and Implementation Regional Group (APIRG) stated that Africa needs to ensure the seamless operation of ATM to ensure the synergetic implementation of the AFI Seamless Sky. Implementation of the AFI Seamless Sky will require the introduction of air traffic flow management (ATFM) processes, an integral part of the ICAO Global Air Navigation Plan, and the ICAO Aviation System Block Upgrade modules. Focusing on collaborative ATFM as a solution will ensure efficient traffic flows and address system disruptions including crises caused by human or natural phenomena.

CANSO actively supports the implementation of ATFM/collaborative decision making (CDM)/ practices in all regions of the world. CANSO is committed to improving the safety and efficiency of air transport and has published *Implementing [Air Traffic Flow Management and Collaborative Decision Making](#)*, a guide to assist ANSPs in implementing ATFM/ CDM in their environments, in accordance with ICAO Doc 9971: Manual on Collaborative Air Traffic Flow Management (ATFM). The guide supports ANSPs with the implementation of ATFM/CDM by outlining topics for consideration; i.e. concept of operations development, potential ATFM measures and how their use can optimise capacity, post-operations analysis, etc. Additional CANSO guidance documents include *[Guidelines on Airport-Collaborative Decision Making \(A-CDM\) Key Performance Measures](#)* and *[Airport Collaborative Decision-Making: Optimisation through Collaboration](#)*.

In 2016 and 2018 CANSO organised a CDM conference in Uganda and a CDM/A-CDM symposium in Durban South Africa respectively. The symposium concluded that the Africa region lags in the implementation of CDM processes; therefore, a need exists for involvement of all industry stakeholders in decision making processes during all phases of a flight. Transparency and the free exchange of information between all interested stakeholders are essential elements to efficiently coordinate and manage operations.

At the CANSO Africa Conference 2018, 'Improving Efficiency through Collaborative Decision Making and Air Traffic Management' in Mombasa, Kenya, key ATM stakeholders (including Africa ANSPs, CAA, IATA, and ICAO) agreed and resolved to develop a strategy to implement ATFM in the Africa region. This plan is known as the CANSO Mombasa ATFM Roadmap.

From a technical viewpoint, depending on the operational choices and extensiveness of ATFM service provision, the range of supporting systems and processes can be very wide. This document limits the scope to the tools required to support the establishment of ATFM in Africa.

Introduction

1.1 Background

In Africa, ANSP's face many challenges including: fluctuating traffic demand; implementation of modern technology; new entrants to airspace such as unmanned aircraft; and increasing automation. The ATM industry must address these while maintaining and improving safety.

The CANSO Africa Conference 2018 concluded with seven emerging issues that must be addressed to ensure regional seamless operations, invisible borders and to better prepare the Africa region to cope with the anticipated traffic growth.

1. Collaboration
2. Technology and innovation
3. Policies and regulations
4. Data and information sharing
5. Member commitment
6. Implementation plan of CDM, A-CDM and ATFM
7. Compliance with ICAO requirements

An effective and efficient CANSO Mombasa ATFM Roadmap requires strong partnership, collaboration, a platform for data and information sharing, and most importantly – stakeholder commitment to achieve seamless operations in Africa.

The CANSO Mombasa ATFM Roadmap is an important mechanism for managing air traffic growth efficiently and effectively. It is based on the basic principle of the proactive engagement of industry partners and maintenance of shared processes and procedures.

Overview of ATFM

Air Traffic Flow Management (ATFM) is the process that enables smooth and efficient flow of air traffic in relation to capacity and demand, in accordance with [ICAO Doc 9971: Manual on Collaborative ATFM](#).

2.1 Concept, current situation and best practices

The fundamental concept of ATFM is the balancing of air traffic demand and capacity. ICAO Annex 11 states that 'air traffic flow management (ATFM) shall be implemented for airspace where air traffic demand at times exceeds, or is expected to exceed, the declared capacity of the air traffic control services concerned'.

ATFM measures are not currently utilised in most of Africa's regional airspace. However, the forecasted growth in traffic within the African continent in the coming decades will necessitate the use of ATFM measures to ensure that capacity is able to meet the demand of airspace users.

While ANSPs and airport operators should strive to increase and optimise airspace and airport capacity to meet demand and traffic growth, surges in traffic and capacity constraining events cause imbalances in air traffic management and thus the need for ATFM implementation.

Whereas the need for ATFM is obvious for some countries where the traffic demand is constantly exceeding the declared traffic capacity, it is necessary to implement ATFM to prepare for unusual circumstances like diversions that may result in traffic levels exceeding declared capacity. ATFM facilitates efficient operation between countries that have implemented ATFM and those that have not yet implemented. The introduction of ATFM will facilitate proactive planning for the projected future traffic growth in the Africa region

ATFM is a key enabler for safety, efficiency, cost-effectiveness, and reduction of environmental impact of ATM. Its objective is to balance the demands of all airspace users against airspace and airport capacity.

ATFM provides a timely, accurate depiction of predicted flight activity for all flights utilising an ATM resource (e.g., airport, en-route sector, etc.). Aggregated data from all operational data sources, including airline schedules, flight plan data, airport slot

management systems, ATM operational systems, and airspace user (AU) intentions should be utilised.

An ATFM service relies on several supporting systems, processes and operational data to function effectively. The maturity level of these systems and processes will determine the level of established ATFM service.

2.2 The ATFM process

The ATFM process consists of five phases – planning, strategic, pre-tactical, tactical, and post-operations analysis. These phases should be thought of as a continuous planning, action and review cycle that is fully integrated with the ATM planning and post-operations processes. The individual phases can be found in [ICAO Doc 9971: Manual on Collaborative ATFM](#).

2.3 Enablers of ATFM

ATFM performance is dependent upon changes in a number of organisational and technical areas:

2.3.1 Human enablers

An ATFM service should be staffed by personnel with sufficient knowledge and understanding of the ATM system they are supporting and the potential effects that their work may have on the safety and efficiency of air navigation. It is fundamentally important that all ATFM stakeholders receive the necessary training.

2.3.2 Technical enablers

2.3.2.1 Communication, navigation, surveillance (CNS) systems and information management (aeronautical information management and ground systems)

2.3.2.2 Information sharing platforms and interfaces

2.3.2.3 System interoperability (SWIM)

2.3.2.4 AIDC implementation across the region

2.3.2.5 Calculated Time of Take-off (CTOT) compliance by airspace users

2.3.3 Institutional enablers

These relate to standards and regulations.

2.3.4 Procedural enablers

ATM procedures implemented by stakeholders (ANSPs, airports, airlines and military). Predefined and agreed upon procedures and rules to ensure that collaborative decisions are expeditious and equitable.

2.3.5 Participation of ATM community

A successful ATFM system requires stakeholder participation and should be continuous in planning, implementation and operation to ensure that the global ATM system meets the expectation of the ATM community.

2.3.6 Collaborative decision making (CDM)

The CDM process is a key enabler in any ATFM strategy, allowing for the sharing of all relevant information among decision makers and supporting an ongoing dialogue between the various stakeholders throughout all phases of flight.

2.3.6.1 Concept, current situation and best practices

Collaborative decision making (CDM) in ATM represents the means for collaboration and cooperation between several stakeholders, such as ANSPs and airports, to improve the provision of ATS, often between several connected FIRs. CDM involves not only the sharing of critical information but also sharing of subsequent analyses and the relevant operational measures. CDM 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.

The overall objective of the process is for the ATM system to improve its performance while balancing against the individual performance needs of individual ATM community members.

Within Africa, CDM is currently in use but no specific CDM procedures have been developed. If correctly implemented, CDM would improve the overall performance of the ATC system by facilitating collaboration among all stakeholders, focusing on the management of constraints, inefficiencies, and unforeseen events that affect system capacity in order to minimise negative impacts of disruptions and changing conditions.

[*ICAO Doc 9971: Manual on Collaborative Air Traffic Flow Management \(ATFM\)*](#) is a valuable reference for defining best practices for CDM. The manual defines a methodology for the successful implementation of CDM in ATM, including the following steps:

1. Identification for the need for CDM
2. CDM analysis
3. CDM specification and solution
4. CDM performance case
5. CDM validation and implementation
6. Continuous CDM operation, maintenance and improvement

Finally, a common view of the airspace situation, including all aeronautical data, is also critical to the ATFM process.

2.4 Advantages of ATFM

1. Reduction of ground and en-route delays
2. Maximisation of capacity and optimisation of the flow of air traffic
3. Enhancement of operational safety
4. Improvement in operational efficiency
5. Provide an informed choice between departure delay, re-routing and/or flight level selection
6. Alleviate unplanned in-flight re-routing; and assist ATS Units in planning for and managing future workload in the light of forecast increased traffic flows within the region.
7. Assessing the impact of FUAs, UAVs and RPAS operations on the air traffic control systems
8. Provide improved solutions around predicted severe weather
9. Balance the demand and capacity of ATC sectors
10. Determine the necessity for an airspace/ground delay program and other traffic management initiatives (TMIs) and enact them
11. Enabling aircraft operators to operate as close to their preferred trajectories
12. Balance airspace capacity impact through collaboration with UTM (unmanned aircraft systems management) initiatives and seamless integration including the UAV surveillance to ATM
13. A functional ATFM system enhances situational awareness

CANSO Mombasa ATFM Roadmap

The proposed CANSO Mombasa ATFM Roadmap is planned to establish an integrated regional ATFM system as per the resolution of the CANSO Africa Conference 2018. It is envisaged that regional stakeholders will collaborate through CDM and A-CDM to optimise traffic flow and ensure participation of all African stakeholders.

Stakeholders must coordinate and collaborate on issues of training, operations organisation, sharing information, and ensuring agreements are in place to support successful ATFM implementation.

3.1 CANSO Mombasa ATFM Roadmap implementation

For successful implementation of the CANSO Mombasa ATFM Roadmap, sequential steps should be taken to establish an AFTM structure from initiation to post implementation review analysis including all stakeholders.

[*ICAO ATFM Manual Doc 9971*](#) describes the following steps for consideration when implementing an ATFM system:

- a. A project management approach should clearly define the tasks for each stakeholder and contain milestones
- b. ANSP should oversee the implementation process in collaboration with the relevant oversight authorities, involving, when relevant, affected stakeholders
- c. The personnel who will lead the development of ATFM should be identified. Best practices indicate that the ANSP usually takes the lead and key stakeholders from AUs airport operators, and military authorities should be involved in the planning, development and implementation of ATFM.

3.2 CANSO Mombasa ATFM Roadmap stakeholders

ATFM is a collaborative approach involving all stakeholders which include but not limited to the following:

1. ANSPs
2. CAA
3. Airport-ground handling (GH), catering, cargo, security
4. Airlines/air operators
5. Meteorology (MET)
6. Military
7. Police/law enforcement
8. Maritime authorities
9. Environmental community
10. Government departments-protocol
11. Airport operators
12. Airlines/general aviation
13. Ground handlers
14. Immigration
15. Customs

3.3 Proposed actions to achieve the roadmap

A project management approach is recommended for the implementation of the CANSO Mombasa ATFM Roadmap, broken down into the following actions with tasks as listed below:

3.3.1 Demand and capacity determination

- The capacity of the FIR should be calculated as an entry count (based on the maximum number of aircraft able to enter an ATC sector in a given period).
- The exact method for calculating the capacity of the regional FIRs should be defined based on guidance contained in ICAO Doc 9971, but should consider, inter alia:
 - traffic density and complexity
 - ATS route structure
 - aircraft equipage
 - CNS/ATM capabilities
 - ATCO workload
- Demand should be calculated using received flight plans in addition to supplementary information, i.e. Official Airline Guide (OAG), airline operational schedule data, airport arrival/departure data, surveillance position data, etc.
- Determination of appropriate ATFM automation tools; i.e., communication, data fusion capability, database, application software, etc.

3.3.2 Regional ATFM preparations

- Cooperate with neighbouring countries through the regional framework of CANSO to plan ATFM measures
- An initial design for the ATFM service should be created in agreement with neighbouring States through a regional framework
- Based on the initial design, an ATFM gap analysis should be performed, reviewing existing arrangements and processes against the agreed requirements for the ATFM service

3.3.3 Initial regional ATFM system

- Align and follow ICAO Plans and initiatives and regional bodies (EAC, COMESA, SADC, ECOWAS)
- Develop and finalise Letters of Agreement (LoAs)/LOPs and/or MoUs with regional ATFM stakeholders
- A CDM process to support decisions on ATFM measures
- Technical mechanisms allowing for common information sharing between stakeholders
- Monitoring mechanisms to enable the evaluation of improvements
- A flow management position (FMP) should be implemented
- The FMP should utilise the declared ATC Sector capacities
- Appropriate arrangements should be made with adjacent ATFM units, including the coordination of flow principles and measures between FMPs
- The training requirements for the initial ATFM service should be defined

The implementation and timelines are as shown in Annex 1 attached to this document.

3.4 Establishment of regional sectors

This aims to establish five blocks of airspace defined according to countries geographical proximity and on Africa traffic flows, existing CNS-ATM infrastructure and areas of routing in consultations with the ICAO AFI region.

As such, it is proposed that, to effectively implement the CANSO Mombasa ATFM Roadmap, the states will be organised into the following five sectors:

1. Eastern Africa
2. Southern Africa (SADC Region)
3. Central Africa
4. Central/West Africa Region
5. Western Africa Region (as illustrated in the map below)

3.4.1 Sector composition

AREA 1	AREA 2	AREA 3	AREA 4	AREA 5
Eritrea	Botswana	Angola	Cameroon	Benin
Ethiopia	Comoros Islands	Angola	Central Africa Republic	Burkina Faso
Kenya	eSwatini (Swaziland)	Democratic Republic of the Congo	Chad	Cape Verde
Madagascar	Lesotho	Malawi	Equatorial Guinea	Gambia
Rwanda	Mauritius	Zambia	Gabon	Ghana
Seychelles	Mozambique		Niger	Guinea
Somalia	Namibia		Nigeria	Guinea Bissau
Tanzania	South Africa		Rep. of the Congo	Ivory Coast
Uganda	Zimbabwe			Liberia
				Mali
				Mauritania
				Senegal
				Sierra Leone
				Togo



The definition of the current FIRs will be preserved, and air navigation services will continue to be provided through the same units as they are today. However, harmonisation will be increased within each sector according to regional needs but consistently with other sectors under the guidance and support of CANSO.

Acronyms

ACC	Area control centre or area control	FIR	Flight information region
A-CDM	Airport-collaborative decision making	FIS	Flight information service
AFI	Africa and Indian Ocean Region	FMP	Flow management position
AIDC	ATS inter-facility data communication	FUA	Flexible use of airspace
ANS	Air navigation services	GANP	Global Air Navigation Plan
ANSP	Air navigation service provider	GATMOC	Global Air Traffic Management Operational Concept
APP	Approach control office / approach control service	GH	Ground handling
ASBU	Aviation System Block Upgrade	ICAO	International Civil Aviation Organisation
ATC	Air traffic control	IATA	International Air Transport Association
ATCU	Air traffic control unit	LOAs	Letters of agreement
ATFM	Air traffic flow management	LOPs	Letters of procedures
ATM	Air traffic management	MOUs	Memorandum of understanding
ATMOC	Air traffic management operational concept	NAMP	National Airspace Master Plan
ATNS	Air Traffic and Navigation Services	NCLB	No Country Left Behind
ATS	Air traffic services	NextGen	Next Generation Air Transportation System
ATSU	Air traffic services unit	RATS	Remote air traffic service
AU	Airspace users	RPAS	Remotely piloted aircraft system
CAA	Civil aviation authority	SESAR	Single European Sky ATM Research
CANSO	Civil Air Navigation Services Organisation	SWIM	System wide information management
CDM	Collaborative decision making	TMI	Traffic management initiative
CNS	Communication navigation surveillance	TRACON	Terminal radar approach control
CTOT	Calculated Time of Take-off	TSAs	Temporary segregated areas
EAC	East African Community	TWR	Aerodrome Control Tower or Aerodrome Control
FAA	Federal Aviation Administration	UAV	Unmanned aerial vehicle
FAJA	Johannesburg Flight Information Region	UTM	Unmanned aircraft system traffic management
FAJO	Johannesburg Oceanic Flight Information Region		

Glossary

Area control centre (ACC)

A unit established to provide air traffic control service to controlled flights in control areas under its jurisdiction.

Aerodrome

A defined area on land or water (including any buildings, installations and equipment) intended for use either wholly or in part for the arrival, departure and surface movement of aircraft.

Aerodrome control service

Air traffic control service for aerodrome traffic.

Aerodrome control tower

A unit established to provide air traffic control service to aerodrome traffic.

Air traffic management (ATM)

The dynamic, integrated management of air traffic and airspace – safely, economically and efficiently – through the provision of facilities and seamless services in collaboration with all parties and involving airborne and ground-based functions.

Air traffic flow management (ATFM)

A service established with the objective of contributing to a safe, orderly and expeditious flow of air traffic by ensuring that ATC capacity is utilised to the maximum extent possible, and that the traffic volume is compatible with the capacities declared by the appropriate ATS authority.

Approach control service

Air traffic control service for arriving or departing controlled flights.

Air traffic control unit

A generic term meaning variously, area control centre, approach control unit or aerodrome control tower.

Air traffic services unit

A generic term meaning variously, air traffic control unit, flight information centre or air traffic services reporting office.

ATM community

The aggregate of organisations, agencies or entities that may participate, collaborate and cooperate in the planning, development, use, regulation, operation and maintenance of the ATM system.

ATM operational concept (ATMOC)

The ATMOC is a high-level description of the ATM services necessary to accommodate traffic at a given time horizon; a description of the anticipated level of performance required from, and the interaction between, the ATM services, as well as the objects they affect; and a description of the information to be provided to agents in the ATM system and how that information is to be used for operational purposes. The operational concept is neither a description of the air navigation infrastructure nor a technical system description nor a detailed description of how a functionality or technology could be used.

ATM system

A system that provides ATM through the collaborative integration of humans, information, technology, facilities and services, supported by air and ground – and/or space-based communications, navigation and surveillance.

Air traffic service (ATS)

A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service (area control service, approach control service or aerodrome control service).

Seamless airspace

Airspace without any visible boundaries or restraints to the operator TMs.

Traffic management initiative (TMI)

Traffic Management Initiatives (TMIs) are programs and tools that ATC may use to manage air traffic.



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