



## ORGANIZACIÓN DE AVIACIÓN CIVIL INTERNACIONAL

*Oficina Regional Sudamericana - Proyecto Regional RLA/06/901*

*Asistencia para la Implantación de un Sistema Regional de ATM considerando el concepto operacional de ATM y el soporte de tecnología en CNS correspondiente*

**Noveno Taller/Reunión del Grupo de Implantación SAM (SAM/IG/9)**

(Lima, Perú, 14 al 18 de mayo de 2012)

SAM/IG/9-NE/12

03/04/12

### Cuestión 5 del

**Orden del Día: Implantación de la gestión de afluencia del tránsito aéreo (ATFM) en la Región SAM.**

## PRESENTACIÓN DEL BORRADOR DEL MATERIAL GUÍA ATFM DE LA OACI

(Presentada por la Secretaría)

Resumen	
<p>En esta Nota de Estudio se propone a la reunión la revisión del primer borrador del Material Guía ATFM de la OACI, a fin de fomentar la participación de los Estados en el desarrollo del documento, que tiene como objetivo la implementación global y armonizada de los conceptos ATFM.</p>	
<b>Referencias:</b> <ul style="list-style-type: none"><li>• Manual ATFM para las Regiones CAR/SAM;</li><li>• Borrador del Manual Global ATFM de la OACI;</li><li>• Anexo 11 de la OACI – Servicios de Tránsito Aéreo, Sección 3.7.5;</li><li>• Doc 4444 de la OACI – PANS ATM, Sección 3.2;</li><li>• Doc 9854 de la OACI – Concepto Operacional Global ATM; y</li><li>• Doc 9426 de la OACI – Manual de Planificación de Servicios de Tránsito Aéreo.</li></ul>	
<b>Objetivos estratégicos de la OACI:</b>	<i>A – Seguridad operacional</i> <i>C. Protección del medio ambiente y desarrollo sostenible del transporte aéreo</i>

### 1

#### Antecedentes

1.1 En muchas zonas del mundo, el reto principal es la capacidad de pistas, sectores ATC y el ATFM es una de las soluciones. Como la naturaleza de la ATFM requiere soluciones locales para adaptarse a cada entorno operativo, un material de orientación mundial deberá ser escrito de una manera que proporcione una gama de herramientas, procedimientos y prácticas recomendadas que deberán ser aplicadas de forma global y teniendo en cuenta las diferencias entre los Estados y Regiones.

1.2 Tomando en cuenta lo anterior, la sede de la OACI, en Montreal, por orientación del D/ANB, constituyó un equipo, a fin de coordinar el desarrollo de este material, intitulado **Material Guía ATFM de la OACI, Apéndice A**. Además, uno de los resultados de la primera reunión del grupo (*kick-off meeting*), que se llevó a cabo en Ámsterdam de 5 a 8 de marzo de 2012, fue la propuesta para la utilización del “Manual ATFM para las Regiones CAR/SAM”, aprobado por el GREPECAS/16, como referencia en los trabajos del grupo. Como reconocimiento de la calidad del dicho Manual, el grupo aprobó el uso del Manual como base para el desarrollo del futuro **Material Guía ATFM de la OACI**.

## 2 **Discusión**

2.1 El propósito de este Material Guía es proporcionar orientación y armonizar el desarrollo y la implementación global de la Gestión de la Afluencia del Tránsito Aéreo (ATFM). La orientación para la implementación de este documento está destinada a apoyar la colaboración a nivel mundial entre los diferentes actores involucrados en la ATFM.

2.2 La estructura del documento es formada de textos de orientación sobre cómo se aplica el concepto ATFM mediante el uso de la toma de decisiones en colaboración (CDM), la definición de los procesos con la finalidad de lograr un equilibrio entre la demanda y la capacidad, dentro del contexto del Control de Tránsito Aéreo (ATC), los entornos de los aeródromos, en estrecha colaboración con la Coordinación Civil / Militar y Comité de Cooperación proporcionando la utilización flexible del espacio aéreo (FUA).

2.3 El *Material Guía de la OACI* será la Parte 2 de un documento global de la OACI, todavía sin título definido, que ya tiene la Parte 1 aprobada e intitulada “*Toma de Decisiones en Colaboración (CDM)*”.

## 3 **Acción sugerida**

3.1 Se invita a la reunión a:

- a) Tomar nota de la información proporcionada; y
- b) Revisar el borrador del Material Guía ATFM de la OACI, disponible solamente en la versión en inglés, evaluar su contenido y emitir comentarios referentes a la estructura, objetivos y aplicabilidad del documento.

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**APPENDIX / APÉNDICE A**

**BORRADOR DEL MATERIAL GUÍA ATFM DE LA OACI  
DRAFT OF ICAO ATFM GUIDANCE MATERIAL**

**AVAILABLE ONLY IN ENGLISH LANGUAGE  
DISPONIBLE SOLAMENTE EN INGLÉS**

**D R A F T**

Part II

# **Air Traffic Flow Management**



**D R A F T**

Part II

# **Air Traffic Flow Management**

**First Edition  
October 2012**

## FOREWORD

Because of the continued growth in civil aviation, in many places, demand often exceeds the available capacity of the air navigation system to accommodate air traffic, resulting in significant negative consequences not only to the aviation industry, but also to general economic health. One of the keys to maintaining the vitality of civil aviation is to ensure that a safe, secure, efficient and environmentally sustainable air navigation system is available at the global, regional and national levels. This requires the implementation of an air traffic management system that allows maximum use to be made of enhanced capabilities provided by technical advances.

One of the elements of ATM that can be built to attend the expectations of the aviation community is air traffic flow management (ATFM) which is building momentum among Air Navigation Service Providers.

While ATFM is proven to enhance safety and provide measurable efficiency gains, it is also viewed as a transformational concept that introduces new levels of collaborative decision making and offers potential for harmonizing seamless airspace operations. It provides a range of benefits to all stakeholders in the aviation community by improving predictability in the operations from gate-to-gate, improving access and equity in the use of airspace, and enabling optimization of curb-to-curb operations.

The improvement in efficiency of operations provided by ATFM also contributes to reduce impact of aviation on the environment and supports sustainability goals.

This guidance material describes and builds on ATFM processes drawn from regional, international, and industry experiences. This guidance material will support national air traffic control (ATC) capacity planning for enroute, terminal airspace, and airports and provide guidance for air navigation services providers intending to start an ATFM function using globally recognized and validated procedures.

This manual is also intended to provide guidance to harmonize the development and global implementation of ATFM by supporting worldwide collaboration among the different partners involved in ATFM such as:

a) Air navigation service providers, including:

- 1) policy/decision makers
- 2) airspace designers, and
- 3) operational Air Traffic Management (ATM) staff

b) Aircraft operators, including:

- 1) policy/decision makers
- 2) pilots,
- 3) dispatchers, and
- 4) technical staff

c) Airport operators, including:

- 1) operations department
- 2) environment department, and
- 3) slot coordination offices

d) Regulatory authorities

e) Military authorities.

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## EXPLANATION OF TERMS

***Air traffic management (ATM).*** The dynamic, integrated management of air traffic and airspace including air traffic services, airspace management and air traffic flow management — 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, efficient and sustainable flow of air traffic by ensuring that ATM capacity is utilized to the maximum extent possible, that fully takes account of the economic and operational priorities of the airspace user, and that the traffic volume is compatible with the capacities declared by the appropriate air traffic service (ATS) authority.

***Capacity.*** The maximum number of aircraft that can be accommodated in a given time period by the system or one of its components (throughput).

***Demand.*** The number of aircraft requesting to use the ATM system in a given time period.

***Predictability.*** Predictability refers to the ability of airspace users and ATM service providers to provide consistent and dependable levels of performance. Predictability is essential to airspace users as they develop and operate their schedules.

***Traffic synchronization.*** Traffic synchronization concerns the management of the flow of traffic through merging and crossing points, such as traffic around major aerodromes or airway crossings. It currently includes the management and provision of queues both on the ground and in the air. Traffic synchronization, as a function, is closely related to both demand/capacity balancing and separation provision and may in the future be indistinguishable from them. Traffic synchronization also concerns the aerodrome “service” part of the concept.

To be inserted during the development.

## **ABREVIATION AND ACRONYMS**

ATC	Air Traffic Control
ATS	Air Traffic Services
ATM	Air Traffic Management
ATFM	Air Traffic Flow management
FUA	Flexible Use of the Airspace
CDM	Collaborative Decision-Making
SMART	Specific, measurable, accurate, reliable and timely

To be inserted during the development.

## EXECUTIVE SUMMARY

This guidance material contains information on how ATFM is applied by using Collaborative Decision-Making (CDM) processes in order to balance capacity and demand within and efficiently manage Air Traffic Control (ATC) enroute airspace, terminal airspace, and airport environments. It highlights the need of close cooperation among different partners by providing flexibility in the use of the airspace and airport resources. It provides guidance for:

- a) Air navigation service providers;
- b) Aircraft operators;
- c) Airport operators, including airport slot coordinators as appropriate;
- d) Aviation regulators;
- e) Military agencies; and
- f) Industry related to ATFM.

Key objectives of this guidance material are to:

- Establish globally consistent ATFM planning and operating practices;
- Encourage a collaborative and harmonized approach to ATFM between States and regions; and
- Encourage a systemic approach to ATFM, including all ATM community members.

## CHAPTER 1

### 1.1 INTRODUCTION

#### 1.1.1 Air Traffic Flow Management Philosophy

1.1.1.1 The objectives of ATFM are as follows:

- a) to optimise the utilisation of airspace capability, and balancing the legitimate requirements of all users;
- b) to ensure an optimum flow of air traffic during times when demand exceeds, or is expected to exceed, available capacity of the air traffic control (ATC) system;
- c) to provide optimum operational choice to the airspace users considering economic and environmental priorities; considering ATM resource constraints;
- d) to help to achieve a seamless and harmonised ATM system and ensure compatibility with international developments;
- e) to ensure that optimum capacity is provided in a flexible and timely manner; and
- f) to minimise inefficiencies that affect ATM capacity.

1.1.1.2 ATFM is a positive enabler of ATM efficiency and effectiveness. It should be viewed as a process that contributes to safety, efficiency and cost effectiveness of an ATM system.

1.1.1.3 The level of ATFM system required will depend on the balance between capacity and demand. Nonetheless the planning, reporting and performance measurement components of an ATFM system will add value even in advance of any requirement for ATFM measures.

1.1.1.4 ATFM is a major enabler of global interoperability of the air transport industry. There are two concepts:

- a) Implementation of some form of ATFM globally; and
- b) Implementation of some global ATFM processes.

1.1.1.5 A key to the implementation of effective ATFM is to achieve robust coordination between States and between regions. Air traffic flow management and some aspects of capacity management cannot be restricted to the area of one State because of their far-reaching effects on the flow of traffic elsewhere. PANS-ATM (Doc 4444) recognises this important fact, and the procedures states that ATFM should be implemented on the basis of a regional air navigation agreement or, when appropriate, as a multilateral agreement.

1.1.1.6 It is equally important to recognise that effective ATFM requires the active participation of all affected stakeholders. ATFM should be performed as a collaborative decision making process, where airports, ANSPs and airspace users work together to improve the performance of the network.

### **1.1.2 Air Traffic Flow Management Pre-requisites**

1.1.2.1 An ATFM system uses a number of supporting systems, processes and operational data in order to function effectively. The maturity level of these systems and processes will determine the level of ATFM that can be established. Some elements to be considered are:

- The ATM resource: Shared information on the airspace and airport infrastructure of the area concerned and the neighbouring area.
- The ATM demand: A timely, accurate description of the flight intentions of all flights intending to transit the relevant ATFM area of interest, e.g. an integration of operational flight plan, airport slot and scheduling data. Accurate aircraft performance data is also required.
- The dynamic traffic situation: Accurate ATM data derived from the correlated surveillance systems and flight plan data in order to increase the accuracy of short term prediction.
- Systems and Data Interoperability: Sharing of data and operational information exchanges between adjacent ATFM units.
- Institutional arrangements: Formalised agreements between all ATFM partners in the relevant area and appropriate arrangements with adjacent ATFM units.

1.1.2.2 Whereas ATFM systems can function with a basic level of the above, the range, accuracy and effectiveness of the ATFM system will be constrained by the comprehensiveness and accuracy of these elements.

### **1.1.3 Air Traffic Flow Management Benefits**

1.1.3.1 The benefits of ATFM lie in various domains of the ATM environment:

- ATFM can be used to oversee collaboration between all affected stakeholders, service providers and users, with an objective of operating the ATM as efficiently and effectively as possible. This has societal benefits in terms of avoided emissions and costs as well as safety benefits overall.
- Management of excess demand, either temporary or long term, introduces safety benefits by not overloading the ATM system and predictability to aircraft operators who need to manage their operations.
- ATFM is an effective tool for the minimisation of ATM system disruption and facilitates the rapid recovery from situations of reduced capability in the network. When capacity is unusually constrained a collaborative effort is required to ensure fair access without overloading the ATM system.

## **1.2 AIR TRAFFIC FLOW MANAGEMENT OVERVIEW**

### **1.2.1 Operations Performance Planning and Management**

1.2.1.1 In situations where demand in a certain airspace or airport exceed ATM capacity, ATFM measures need to be applied. This however, should always be considered as the last resort, and

ATFM partners should take all possible actions to avoid situations where demand exceeds capacity.

1.2.1.2 For this purpose, States should ensure the application of demand and capacity balancing, in order to minimise the effects of ATM system constraints. This could be done through the use of an “operations planning performance and management process” (see fig 1).

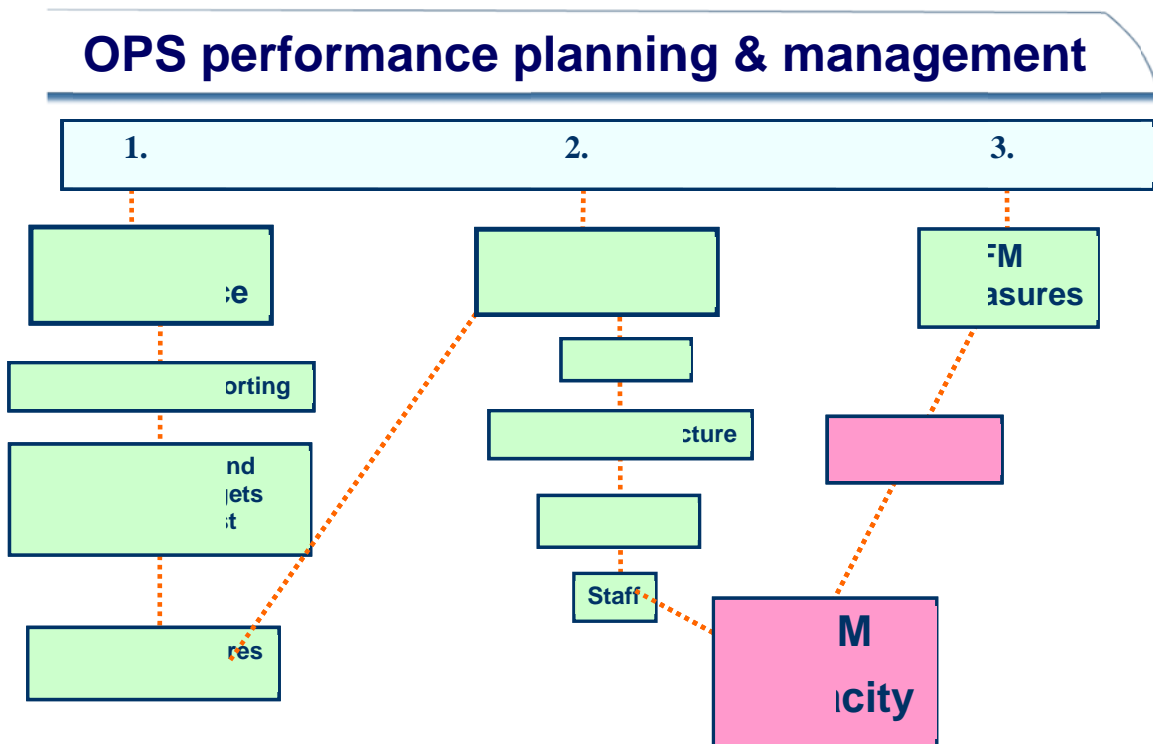


Figure 1.

1.2.1.3 This is a collaborative, interactive capacity and airspace planning process, where airports, ANSPs and airspace users work together to improve the performance of the network. Such CDM process will allow airspace users to optimize their participation in the ATM system while mitigating conflicting needs for airspace and aerodrome capacity. This also allows for a full realisation of the benefits of improved integration of airspace design, airspace management (ASM), and Air Traffic Flow Management (ATFM).

1.2.1.4 The process contains three equally important steps. In order to obtain the information necessary for the decisions to be made, the first step should be a post-ops performance activity, where available capacity is measured against anticipated demand and established performance targets. Such analysis will establish the magnitude of a possible imbalance between demand and capacity.

1.2.1.5 Based on the imbalance, mitigating measures needs to be developed. However, before this is done, it is very important to take into account the complexity and cost of these measures, in order to ensure optimum performance not only from a capacity point of view, but also from an economic perspective.

1.2.1.6 The next step is the Ops Planning Phase, where imbalances are addressed through mitigating measures being developed to support the demand-capacity balancing process. These measures include;

- Reviewing airspace design (route and ATC sectors) and airspace utilisation policies to look for improvements;

- Review of the technical infrastructure to assess the possibility of improving capacity through upgrading various ATM support tools;
- Review and update ATM procedures as required by changes to airspace design and technical infrastructure;
- Capacity analysis studies including controller task and complexity assessments to determine realistic capacity values; and
- Review staffing practices to evaluate potential for matching staffing resources with workload and the eventual need for an increase in staffing levels.

1.2.1.7 The analysis made and the measures taken will result in a declared ATM capacity, and only in those cases where demand supersedes the declared capacity will there be a requirement to consider entering into the third step, the utilisation of ATFM measures.

1.2.1.8 This third step of the process can in turn be divided into four different phases:

- Strategic Flow Management;
  - takes place seven days or more prior to the day of operation and includes simulation, planning and coordination activities.
- Pre-Tactical Flow Management;
  - is applied during the six days prior to the day of operation and consists of planning and coordination activities. This phase analyses and decides on the best way to manage the available capacity resources and on the need for the possible implementation of a wide range of appropriate ATFM measures in the pre-tactical or tactical phases.
- Tactical Flow Management;
  - is applied on the day of the operation. This phase updates the daily plan according to the actual traffic, capacity and monitoring values; and
- Post Operational Analysis;
  - is applied following the day of operation. This phase analyses the day of operation, and feeds back into the 3 previous phases.

1.2.1.9 ATFM considers continuously and pro-actively all possible ATFM and capacity management solutions through an iterative process, from the strategic planning through to the execution of operations. The anticipation of any events according to new information allows to minimise their impact on the network or to take benefit of any opportunity and fine tune the plan accordingly.

1.2.1.10 To resolve capacity shortfalls and improve the management of the network capacity whilst minimizing constraints, a variety of ATFM and capacity management solutions have to be considered, as shown in figure 2 below.



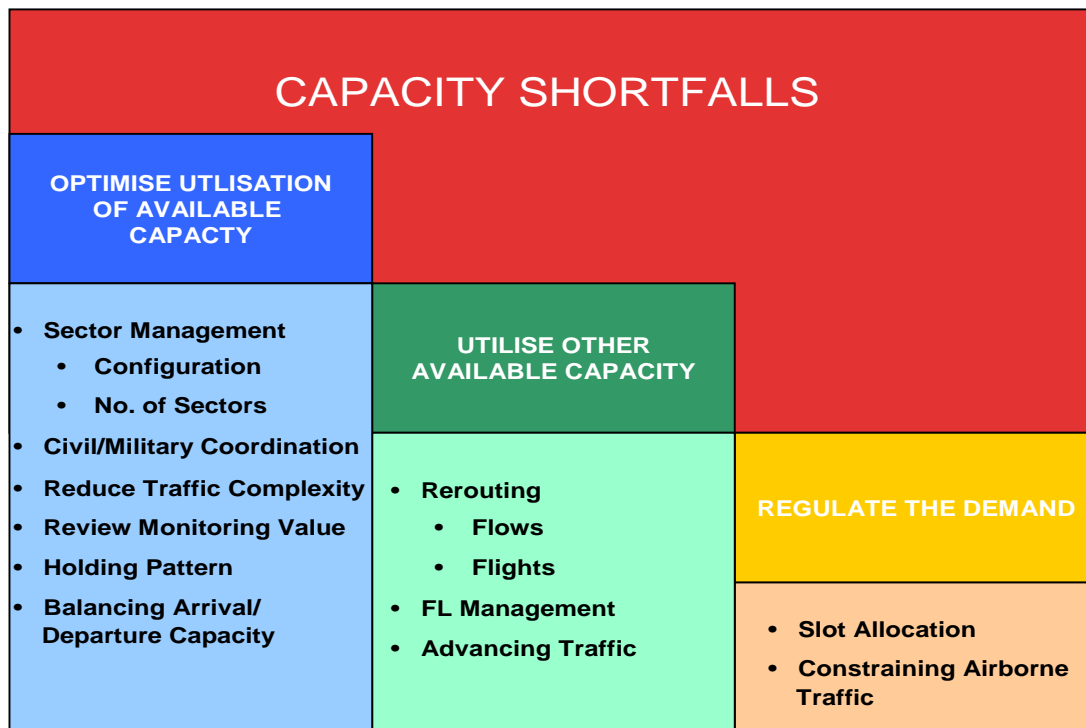


Figure 2.

### 1.2.2 ATFM Characteristics

1.2.2.1 ATFM is intended as an enabling process with systemic benefits, to ensure the ATM system is compatible, balances capacity, and is responsive to user needs. ATFM supports the introduction of new technologies and procedures that enhance airspace capacity and efficiency.

1.2.2.2 ATFM is evolutionary in nature, in order to manage a changing aeronautical environment. Thus the nature of ATFM is one of a system that is constantly reviewed in terms of the airspace, ATS routes and aerodromes, and the ATFM system effectiveness itself.

1.2.2.3 ATFM is integral to world economies, as it maximises aviation economic efficiencies and returns, in turn supporting many other economic sectors such as tourism and freight carriage. ATFM supports system predictability, and the efficient carriage of passengers and freight.

1.2.2.4 ATFM assists international cooperation, leading to an optimal seamless ATM environment. Even relatively simple ATFM systems such as slot management can be as effective as complex systems, to enable systems to cope with unexpected capacity deficiencies.

1.2.2.5 ATFM traffic data analysis can yield significant strategic benefits, especially when used in conjunction with airspace and ATS route planning, in terms of future ATM systems and procedure improvements. This is part of a continuous safety and service improvement loop (Figure 3).

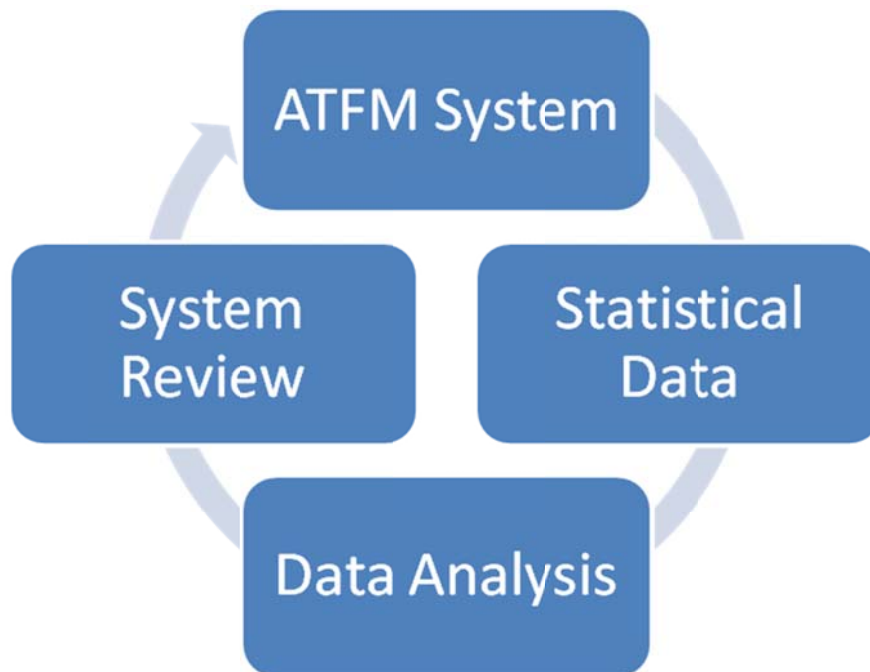


Figure 3: ATFM Cycle of Review and Improvement

### 1.2.3 Air Traffic Flow Management Principles

1.2.3.1 ATFM can be relevant to any ATC unit when that unit's effect on aviation is considered from a systemic (network) perspective.

1.2.3.2 Although initially directive in nature, ATFM is now collaborative in various, if not all, phases of the process. By ensuring that all stakeholders are aware of the objectives, they can all see and understand their part in the operations network.

1.2.3.3 Although the principle of 'first come, first served' and 'equitable access to airspace' are laudable concepts, it is evident that from an ATFM perspective there is also a need to consider the net result in terms of overall system efficiency and operating cost. When there are capacity issues to consider, the ATFM system may focus on other priorities than 'first come – first served', such as 'appropriately equipped aircraft' or type of traffic, in order to achieve optimal airspace capacity and best network performance. The equitable access to airspace should be viewed on a longer time horizon than envisaged in the first come – first served model.

1.2.3.4 General principles of ATFM are as follows:

- ATFM must seek to optimise available aerodrome and airspace capacity without compromising safety;
- ATFM must seek to balance the financial impact on stakeholders with safety, and operational and technical benefits, taking into account global interoperability;
- ATFM must entail timely and effective co-ordination with affected parties, including ATC units,

aircraft operators, military authorities and aerodrome operators as appropriate. Civil/military co-ordination ideally results in airspace being shared, either simultaneously or on a time-share basis. ATFM must take into consideration the requirements of the military, law enforcement, and search and rescue.

- Military aircraft operating as general air traffic should be subject to ATFM.
- ATFM recognises that airspace is a common resource for all users, ensuring fairness and transparency, while taking into account security and defence needs.

#### 1.2.3.5 Recommended ATFM practices:

ATFM planning should focus on regional ATFM and be prioritised for appropriate major traffic flows:

- Recognising that the most efficient utilization of available airspace and airport capacity can be achieved only if all relevant elements of the air traffic system has been considered during the planning stage. An Operations Planning and Management process as described above should be applied;
- When flow management measures are necessary for certain areas, they should be applied in a timely manner only for the period when expected air traffic demand will exceed the capacity in those areas. ATFM measures should be kept to the minimum and, whenever possible, be applied selectively and only to that part of the system that is constrained;
- Information on anticipated overload situations should be provided as soon as possible to all the stakeholders affected.

Relevant air traffic statistics should be generated in order to promptly identify bottlenecks in the system. Accurate and timely data should be continuously available to support implementation and ongoing ATFM operations in the form of:

- Static data identifying historical traffic loadings, for use as strategic planning and trend analysis, and
- Dynamic real-time data used for the tactical management of traffic in terms of commencement of ATFM measures;

Consideration should be given to granting exemption from flow control measures to certain type of flights:

- emergency flights, including aircraft subjected to unlawful interference;
- flights operating for humanitarian reasons;
- medical flights specifically declared by medical authorities;
- flights on search and rescue missions;
- flights with 'Head of State' status; and
- other flights as specifically required by State authorities.

However it is essential that clear processes are developed for the granting of such exemptions and that the rate of exemptions is monitored and potential abuses are prevented.

The use of appropriate automated tools should allow effective application of ATFM;

Formalised CDM should be utilised to promote increased information sharing, awareness and acceptance;

- States should ensure the use of the English language in a concise, non-verbose manner in ATFM operations;
- Whenever application of ATFM in the form of delays to airborne aircraft becomes unavoidable,

the flights concerned should be informed as soon as possible.

The ATFM service should have the following basic strategic and tactical functions:

- collection, collation and analysis of data on air traffic, the air navigation infrastructure and on the capacities of the ATS system and selected aerodromes;
- determination of available airspace, ATS and aerodrome capacity;
- determination of a coherent picture of expected traffic demand;
- identification of areas and time periods of expected critical traffic loadings; and
- in order to accommodate the growth of air traffic, an appropriate ATFM plan should be established, aimed at optimising the airspace utilisation.

#### **1.2.4 Collaborative Decision-Making (CDM) Objectives and Principles**

1.2.4.1 CDM is a supporting process always applied to other activities such as demand/capacity balancing and can be applied across the timeline of activities from strategic planning to real-time operations. CDM is not an objective but a way to reach the performance objectives of the processes it supports. These performance objectives are expected to be agreed upon collaboratively.

1.2.4.2 CDM, as part of ATFM, ideally involves people skilled in facilitation and It is about sharing information, which allows an understanding of user and ATM requirements, in order to achieve commitment, cooperation, and predictability. In effect, CDM allows the system to work smarter, not harder.

1.2.4.3 Although information sharing is an important enabler for CDM, the sharing of information is not sufficient to realize CDM and the objectives of CDM. It also requires there to be pre-defined and agreed procedures and rules to ensure that collaborative decisions will be made expeditiously and equitably.

1.2.4.4 CDM ensures decisions are taken transparently based on the best information available as provided by the participants in a timely and accurate manner.

#### **1.2.5 CDM Requirements and Benefits**

To be developed

#### **1.2.6 CDM Organization and Structure**

To be developed

#### **1.2.7 Global CDM Resources**

To be developed