AIR TRAFFIC FLOW
MANAGEMENT SYSTEM
(ATFMS)
1. INTRODUCTION

Optimization of network operations is essentially about the increasingly fine balancing of variable capacity and variable demand to ensure that each available capacity opportunity (airspace or runway slot) in the system is consistently presented for use, and that the users are given an opportunity to consistently access that presented capacity – not just at a single node or location, but across their integrated operations.

In circumstances where capacity consistently exceeds demand, there is generally no significant need to introduce flow or capacity management initiatives – slots are always available, and are used as required. Where there is competition for a particular slot, basic ATC interventions (vectoring, speed control, etc) manage the conflict.

In the past, where flow management initiatives were introduced, their primary application was either in the protection of the ATC system against overload, or to manage environmental or other expectations at a particular node. Rarely were such initiatives implemented for the benefit of the broader stakeholder community. Now, where demand does start to regularly exceed capacity, whilst some focus is placed on developing new capacity, given the long lead times for major infrastructure improvements (new runways, taxiway upgrades, new parking gates etc.) most emphasis is on better utilization of currently available capacity – or in many cases, simply transferring the capacity shortfall to the user through ground delay programs, demand limiting, and so on.

This is exacerbated by the traditionally tactical and reactive nature of the system – from an ANSP perspective aircraft are managed as they present on a ‘first come first served’ basis, and from a user perspective aircraft are presented to the system when they are ready, generally regardless of scheduled times. It is further exacerbated by the open nature of the system – that is, the inability to consistently control significant variables such as weather, system outages, landside disruptions, etc- and the relative lack of fidelity in strategic forecasting and tactical interpretation of available capacity. To a large extent, given the relative situational awareness monopoly, network management is currently a unilateral decision making process, managed by the ANSP.

Effectively managing the expected increase in traffic demand within a limited capacity environment, whilst promoting an environment within which airspace users can continue to grow their businesses, requires a change in network management paradigm that integrates a much larger volume of situational awareness information, and establishes an increasingly fine granularity of decision-making and business rules. This cannot be done unilaterally – it requires distribution of responsibilities, flexibility in system responsiveness, and integration of management.

The key to further improving demand/capacity management is in utilizing all available information from affected stakeholders to support a collaborative environment where all stakeholders participate in determining the best actions to balance demand against available capacity. This is best achieved through the implementation and use of collaborative decision-making capabilities.

Such a system termed as Air Traffic Flow Management (ATFM) is strongly advocated by ICAO in it’s the Global Air Navigation Plan developed by ICAO (Doc 9750) which is a strategic document to guide States for implementation of the global plan with horizon up to and beyond 2025. The document lists out several “Global Plan Initiatives” (GPIs) to be taken by the States to ensure that a safe, secure, efficient and environmentally sustainable air navigation system is available at global, regional and national levels.

The ICAO Global ATM Operational Concept (GATMOC) provides following vision for future demand and capacity balancing, which envisages: “…Demand and Capacity Balancing will strategically evaluate system-
wide traffic flows and aerodrome capacities to allow airspace users to determine when, where and how they operate, while mitigating conflicting needs for airspace and aerodrome capacity. This collaborative process will allow for the efficient management of the air traffic flow through the use of information on system-wide air traffic flows, weather and assets. Key conceptual changes include:

a. through collaborative decision making at the strategic stage, assets will be optimized in order to maximize throughput, thus providing a basis for predictable allocation and scheduling;
b. through collaborative decision making at the pre-tactical stage, when possible, adjustments will be made to assets, resource allocations, projected trajectories, airspace organization, and allocation of entry/exit times for aerodromes and airspace volumes to mitigate any imbalance; and
c. at the tactical stage, actions will include dynamic adjustments to the organization of airspace to balance capacity, dynamic changes to the entry/exit times for aerodromes and airspace volumes, and adjustments to the schedule by the users."

Further to the 48th recommendation ACAC CNS/ATM study, it is recommended the establishment of Air Traffic Flow Management (ATFM) system as a core function with dedicated operational personnel within ACAC Middle East States FIRs.

Whilst ANS and airport infrastructure initiatives will continue to be undertaken to increase capacity, it will become increasingly necessary to develop capabilities to both balance available capacity against demand, ensuring that the user community has equitable and consistent access to all potentially available capacity in the system - and to fully utilize new capacity as and when created.

All the aspects of Air Traffic Management service optimization and for meeting and exceeding the user and community expectations for flight efficiency, predictability, flexibility and environmental effectiveness, be achieved through the implementation of Air Traffic Flow Management (ATFM) system as an integrated network management of ATM resources in a collaborative manner.

This operational concept of ATFM outlines a range of changes in network management that will evolve through the next few years. Key to the concept is the principle of resource utilization with a network optimization view, management and interchange of relevant information, thus enabling a significant change in the roles of all participants and stakeholders’ within the ATM system. This philosophy is based on evolution of a holistic Collaborative Decision Making environment, where the diverging expectations and interests of all members of the ATM community are balanced cooperatively to achieve an optimum network outcome for all stakeholders.

The concept of operation discussed in this document lays a broad outlay of procedures, roles and responsibilities for the various components of the ATFM system.

The hardware configuration of ATFM system will be defined later.
2. REFERENCE DOCUMENTS

1. ICAO Annex 10
2. ICAO Annex 19
3. The ICAO Global ATM Operational Concept (GATMOC)
5. ICAO Doc 4444 de l’OACI : Air Traffic Management
6. ICAO Doc 7030 de l’OACI : Regional Supplementary Procedures
7. ICAO Doc 8168 de l’OACI : Aircraft Operations
8. ICAO Doc 8400 de l’OACI : ICAO Abbreviations and Codes
11. ICAO Doc 9854 : Global Air Traffic Management Operational Concept
12. ICAO Doc 9882: Manual on Air Traffic Management System Requirements
15. ICAO Doc. 9965: Manual on Flight and Flow — Information for a Collaborative Environment (FF-ICE)
17. AFTM_MAN: ATFM Users Manual

3. OVERVIEW OF ATFM SYSTEM

3.1. Need for ATFM system in ACAC Middle East Region

3.1.1. The Middle East saw the most growth over 2015 with a 12.1% increase. The region currently carries 14% of the world’s revenue passenger kilometers (RPKs), and this number is anticipated to grow at the percentages depicted in the Figure below:

![Figure 1: Middle East 2015 Traffic Increases](image)

3.1.2. Airlines in the Middle East are forecasted to require 3,180 new airplanes over the next 20 years, with rapid fleet expansion in the region driving an estimated 70% of that demand. Air traffic in the Middle
East is expected to grow 5.9% annually during the next 20 years. Approximately 80% of the world's population lives within an eight-hour flight of the Arabian Gulf. This geographic position, coupled with diverse business strategies and investment in infrastructure is allowing carriers in the Middle East to aggregate traffic at their hubs and offer one-stop service between many city pairs that would not otherwise enjoy such direct itineraries. The Middle East growth can be partly attributed to the continued development of airport hub operations as focal points between the East and West and supplemented by the rise of trade links between Africa, the Middle East, and Asia. [Ref ACAC CNS/ATM Study-2016]

3.1.3. ACAC Middle East region must satisfy this increased demand. Today, the primary method for long-term balancing demand with system capacity is to restrict demand by allocating a fixed number of arrival/departure slots to scheduled aircraft operating into and out of ACAC Middle East States’s, congested airports. Slot allocations are made on a bi-annual basis, with the numbers adjusted for seasonal weather and traffic conditions. The slots equitably distribute the restricted airport and airspace capacity to aircraft operators. Short-term (e.g., during a flight day) balancing is accomplished by air traffic control (ATC) imposing delays on aircraft and airlines’ decisions to divert to alternate airports during periods of weather-restricted capacity.

3.1.4. Airport capacity information is made available to ATC and flights via ACAC Middle East States’s Aeronautical Information System (AIS). Each party makes independent decisions about how to restrict and manage flights during problem periods. This often results in less than optimal utilization of available airspace, airports, and aircraft resources.

3.2. Overview of ATFM System

3.2.1. Keeping in view the current and future growth of traffic and to ensure safe and efficient flow of traffic through various airports and airspace, the Air Traffic Flow Management system (ATFM) shall integrate various stakeholders as part of the system to program various operational constraints strategically and tactically in such a way that the demand and capacity are optimally balanced through Collaborative Decision making process.

3.2.2. The solutions must dynamically balance capacity and demand, while providing a CDM capability to allow airlines to most effectively utilize available capacity for the maximum benefit of their business, operations and passengers.

3.2.3. The proposed ATFM System will balance demand and capacity in ACAC Middle East States region airspace and airports for most efficient operations that will include both international and domestic traffic.

3.2.4. A key part of the future ATFM concept shall be Collaborative Decision Making (CDM) which helps ATC achieve its goal of managing the ATC system and the operators achieve their goal of managing their schedules. The result of CDM is a shared situational awareness and collaborative resolutions for “win-win” solutions for both ATC and stakeholders. Collaboration leads to enhanced options, resulting in improved decision making, stakeholder acceptance and support, and increase service performance.

3.2.5. The ATFM system shall consist of a Central Command and Control Unit (CCC) which will be provided with strategic and tactical ATM information from across the region. The CCC will be aided by Traffic Management Units (TMU) located at all the major ACC and APP units which will function as local ATFM units coordinating with CCC for effective ATFM implementation and will be provided with strategic and pre-tactical demand predictions to determine periods of excess demand compared to the available capacity.

3.2.6. The ATFM system shall provide, notably:

- ACAC Middle East States and Aircraft Operator users with significant capabilities to perform strategic, pre-tactical, and tactical ATFM and CDM associated with sectors demand of ACAC airspace and arrivals into major airports of ACAC Middle East States.
ACAC Middle East States and Aircraft Operator users with access to aircraft operator schedule data and operational flight data from ACAC’s ATC automation system, strategic and pre-tactical demand predictions to determine periods of excess demand compared to the available capacity.

- capabilities to model and implement Traffic Management Initiatives (TMIs) to smooth the demand to the available capacity via Ground Delay Programs. TMIs are shared with aircraft operators as an integral part of the CDM process. For periods of significant, unexpected capacity reductions, Ground Stop TMIs will also be modelled and implemented.

- updated demand predictions to monitor TMI performance. Updated predictions are driven by tactical flight data updates from the automation systems as well as flight specific updates provided by aircraft operators (Once a TMI is implemented).

- a web portal access to all stakeholders to have an increased situational awareness of the current ATFM status. Web is an important part of the enhanced ATFM system, as it allows Airline/aerodrome operators and ATS Units, access to information about TMIs. AOs will be able to view flight details and manage their own ATC slots during a TMI. ATS Units, Airline and aerodrome operators will be able to view all flights arriving and departing from their aerodrome

- real-time and post operational reports to help stakeholders evaluate system performance and lessons learned.

3.2.7. In addition to the operational capabilities, ATFM system shall provide System Administration and Adaptation Management functions to monitor and control the operational system and support the preparation and validation of system reference data.

3.2.8. The ATFM will cover all airports to support ATFM and CDM for airspace programs and arrivals into airports throughout ACAC Middle East States and ACAC region airspace.

3.2.9. The ATFM System shall have initially the capability to support:

- A total of (……) TMU (both APP and TWR) will be functional.
- The TMUs will be networked with ACC TMU and CCC.
- In addition other TWR TMUs will be able to interact with CCC through secured WEB Access.
- The CDM partners will access CCC through secured CDM portal with different levels of privilege.
- The general public will be able to access ATFM information on the CCC web portal.
- The WEB portal will display actual traffic situation in ACAC Middle East States skies.

3.2.10. The ATFM system shall need to be a part of sub-regional and regional ATFM system for optimum and seamless ATM across ACAC region. The ATFM system shall have capabilities to expand as a sub-regional/regional ATFM system.

3.2.11. The ATFM system shall enhance Airport ATFM capabilities and shall introduce Airspace ATFM measures, thus, playing a major role in reducing the demand and capacity gaps.

3.2.12. The ATFM development shall involve developing functionalities, which will enable ATFM system for exchanging ATFM information with adjacent ATFM systems and participate in a regional ATFM process.

3.2.13. The system shall interface for seamless data exchange with other ATFM systems in the sub-region and region, thus supporting evolution of an international ATFM system.

The technology used should be the most recent and should give to the ATFM System the best performances with a minimum cost of maintenance. On-site installation, testing of all equipment and applications and the supply and installation of necessary cables and accessories shall be borne by the supplier.
4. **ATFM SYSTEM ORGANIZATIONAL STRUCTURE**

4.1. **Organizational Structure of ATFM**

4.1.1. The ATFM structure shall consist of a Central Command and Control Unit (CCC) networked with Traffic Management Units (TMU) at major ACCs, APP units, Aerodrome Towers (TWR). The CCC should be accessible via WEB through secured access from selected Towers not directly connected to ATFM network.

4.1.2. The ATFM shall be envisaged to function in a collaborative manner. Access to the ATFM system for selected CDM Partners shall be granted through secured CDM portal.

4.1.3. The CCC will be located at [State/alternate] along with a backup and training facility.

4.2. **Organizational Structure**

4.2.1. ATFM shall be managed through the use of flow management units at each of the different ACAC Middle East States operational levels.

4.2.2. The ATFM organizational structure shall be broken into three layers. The first layer is the Central Command and Control Unit (CCC). The second layer includes all the Area Control Center (ACC) Traffic Management Units (TMUs). The third layer includes selected Approach Control facilities with Approach Traffic Management Units (APP TMUs) and selected Airport Traffic Control Tower (TWR) facilities with Airport ATC Tower Traffic Flow Management Units (TWR TMUs).

4.3. **Roles and Responsibilities**

4.3.1. The different ATFM units will be responsible for collectively identifying and resolving demand/capacity imbalances for airports and all airspace under Central Command and Control Control. However, in carrying out this shared responsibility, traffic management units at the individual facilities will have operational responsibilities consistent with their associated geographic areas. Overall responsibility for the coordination and execution of Traffic Management Initiatives (TMIs) will reside with the CCC’s traffic flow management positions.

4.3.2. The decisions made at local levels impact flows across the network and therefore they must be taken in collaboration with stakeholders.
4.4. **Central Command and Control Unit**

4.4.1. **General Responsibilities**

4.4.1. The CCC shall have the primary ATFM responsibility for ACAC Middle East States. The CCC shall establish and adjust to meet the demand of ATFM of ACAC Middle East States in both current operation, mid-term (3 to 5 years out) and future (5 to 20 years out) development.

4.4.2. Specifically, the CCC is:

- Responsible for balancing capacity/demand at all airports within airspace for which ACAC Middle East States has control authority. This is achieved by analyzing capacity/demand imbalances using available manual and automation tools and defined processes and procedures.
- The final authority in resolving any conflicts concerning civil airspace capacity/demand.
- Responsible to ensure that a “system approach” to ATFM is utilized when consideration is being given to the implementation of Traffic Management Initiatives (TMIs). TMIs that cross ACC boundaries are the responsibility of the CCC. Authority for TMIs and operations that do not cross ACC boundaries may be delegated, through policy or procedures, to the appropriate ACC.

4.4.2. **The ATFM Functions of CCC**

The ATFM Functions of CCC are:

4.4.2.1. **Flight Data Management:** Manage flows in strategic and pre-tactical phases

The CCC includes a Flight Data Management Unit responsible for planning, co-ordination and implementation of ATFM measures ATFM area. The Flight Data Management Unit (FDMU) of the CCC is responsible for collecting, maintaining and providing data on all flight operations and the air navigation infrastructure. FDMU includes the Integrated Flight Planning System (IFPS). The CCC shall have the following features:

- arrange and maintain scheduled flight table,
- handle international and inter-regional initial flight plan applications,
- manage various flight plans and their alterations,
- develop TMIs during large (special) events,
- organize ATFM fixed schemes,
- assess static sector capacity and static airport arrival rates/airport departure rates (AAR/ADR),
- participate in the allocation and adjustment of airspace structures.

4.4.2.2. **Tactical ATFM:**

- Manage flow in tactical phase,
- Organize ACAC Middle East States ATFM facilities, units and positions to identify air traffic flow problems in tactical phase,
- Organize and collaborate with relevant ATFM facilities and personnel to develop and revise ATFM initiatives,
- Organize to initiate and terminate the nationwide implementation of tactical ATFM measure,
- Supervise ACAC Middle East States ATC facilities during their implementation of ATFM initiatives and collect feedback,
- Collect operational logs and analyze post information,
- Participate in developing large (special) event TMIs, and
- Participate in the management of ATFM fixed scheme.
4.4.2.3. **Operation Evaluation:**
- Take charge of statistics,
- Post analysis and summarization of ATFM logs and operational data,
- Inspect and evaluate the operational safety and efficiency of air traffic operation facilities, and
- Solve problems on site.

4.4.2.4. **Equipment Operations Monitoring:**
- Collect basic and operational information of ACAC Middle East States communication, navigation and surveillance, and ATC automation system, and
- Participate in the evaluation of the operational capacity of airspace and airport.

4.4.2.4 **Operation Floor:**

The positions on the operation floor are mainly kept watch by the managers from the tactical ATFM office. Representatives from Flight Data Management, operation evaluation, and equipment operation monitoring will join to keep watch in certain positions in the operation floor and fulfill due responsibilities.

4.5. **Area Control Center Traffic Management Unit (ACC TMU)**

4.5.1. **General Responsibilities:**
4.5.1.1. ACC TMU, as a second level of the ATFM organization, is responsible for helping the CCC to organize relevant ACC, terminal, airport ATC towers, and other stakeholders within its geographical area to conduct ATFM.
4.5.1.2. The ACC TMU duties include communication, collaboration, and coordination of ATFM issues with surrounding and internal stakeholders.

4.5.2. **Main Responsibilities:**

4.5.2.1. Identify and assess sector capacity decline due to weather, military activity, aircraft operations, ATC facilities operations, ATC equipment status, airport capacity, etc.;
4.5.2.2. Study capacity changes of relevant sectors and airports within area of responsibility and convey the same to CCC.
4.5.2.3. Collaborate with CCC to adjust the threshold of arrival/departure rates of sectors and airports;
4.5.2.4. Participate in CCC organized planning conference calls for nationwide ATFM;
4.5.2.5. Make executive plans of ATFM initiatives in its area and inform relevant ATC positions;
4.5.2.6. Feedback implementation status of ATFM initiatives and operation plans to CCC;
4.5.2.7. Suggest adjustment or termination of implementation;
4.5.2.8. Log local operations, and help CCCs complete post analysis tasks, such as collecting air traffic operational data.

4.6. **Terminal (Approach) Traffic Management Unit (APP TMU)**

4.6.1. **General Responsibility:**

4.6.1.1. APP TMUs will be established in high density Terminal (Approach) areas where ongoing capacity and demand issues require regular ATFM initiatives and ATFM terminal will be set up in other approach control units, as needed. The Traffic Flow Manager of the ACC TMU facility will take charge of ATFM in Terminal (Approach) control facilities without APP TMUs. The Tower TFM or local controller in airport ATC tower will fulfill the relevant responsibilities in airports without APP TMU facilities.
4.6.2. Main Responsibilities:
4.6.2.1. Manage air traffic demand and constraint within their area of responsibility;
4.6.2.2. Find out AAR/ADR and monitor changes due to weather, military information, aircraft operation, ATC operation, ATC equipment, airport operation and other reasons;
4.6.2.3. Coordinate with airport tower and ACC TMU to properly adjust capacity threshold;
4.6.2.4. Participate in nationwide ATFM decision making organized by the CCC on its own initiative or invited by ATMU;
4.6.2.5. Participate in decision making organized by ACC TMU for ACC ATFM initiatives complying with flight plan and airport operation;
4.6.2.6. Inform the relevant ATC position of ATFM initiatives;
4.6.2.7. Feedback implementation status of the facility and suggestions to ACC TMU;
4.6.2.8. Log local operations, and collect and report air traffic operational data and other statistical data to ACC TMU.

4.7. Airport ATC Tower Traffic Flow Management Unit (TWR TMU)

4.7.1. General Responsibility:

4.7.2. TWR TMU will be set up in some large airport ATC towers according to traffic amount and operation environment of the airport. At middle size towers, a traffic management position may be established and supported with an ATFM automation system terminal. There are full-time TFM in these towers during busy time periods. The TFM or local controller will take ATFM charge during non-busy time periods. The controllers on duty take charge of ATFM in small airport towers. Towers without APP TMU facilities take the ATFM charge of ATFM in that terminal area.

4.7.2.1. Assist in the management of air traffic demand and constraint issues at the tower;
4.7.2.2. Identify and assess AAR/ADR changes due to weather, military information, aircraft operation, ATC operation, ATC equipment, airport operation or other reasons;
4.7.2.3. Coordinate with APP TMU and/or ACC TMU to properly adjust threshold of AAR/ADR, participate in nationwide ATFM decision making organized by ACC on its own initiative or invited by ACC TMU;
4.7.2.4. Participate in decision making organized by ACC TMU for ACC ATFM initiatives complying with flight plan and airport operation;
4.7.2.5. Inform the relevant ATC position of ATFM initiatives; feedback implementation status of the facility and suggestions to ACC TMU;
4.7.2.5. Log local operations, carry out post evaluation of daily ATFM, and report statistical data to ACC TMU.

4.8. Other Units Related to ATFM

In addition, there are some units that directly affect the efficiency of civil aviation ATFM. The ATFM facilities/units/positions of civil aviation should effectively collaborate with these units to achieve orderly ATFM and optimize resource allocation. This section discusses the roles of the units in civil aviation ATFM.

4.8.1. Regulator (DGCA)

4.8.1.1. Draft or develop national laws, regulations, rules, and standards of air traffic flow management;
4.8.1.2. Help develop the standards of air traffic operation management;
4.8.1.3. Help develop performance metrics for the ATFM network system;
4.8.1.4. Supervise the implementation and compliance of relevant laws, regulations, rules, and standards by all ATFM Stakeholders and
4.8.1.5. Further develop legislative requirements based on analysis of air traffic operations.
4.8.2. Airlines and Other Aviation Service Providers

4.8.2.1 Many airlines have Air Traffic Operations Coordination Positions inside their AOCs, to collaboratively coordinate air traffic issues with the ATS provider. As a contact point, these air traffic coordination positions should directly contact ATFM facilities as follows:
- Participate actively in the ATFM process as CDM Partners;
- They should master and respond to the ATFM information related to the company;
- They could file flight plans, provide latest updates on the active and planned flight plans; and
- Participate and comply with the ATFM tactical operation plan according to the advisory from air traffic flow management initiatives.

4.8.3. Airports

4.8.3.1 The Air Traffic Operations Coordination Position, or a similar function, of an airport is located inside the airport operations control center (AOCC). This position, or other positions designated by the airport operator, is a contact point for airport operation control units directly contacting ATM facilities.
4.8.3.2 They should master and respond to the ATFM information related to the airport and participate in decision making for air traffic operation related to the airport, according to the airport’s resource allocation.

4.8.4. Military

4.8.4.1 The ATFM concept envisages active Civil-Military coordination and cooperation in sharing of data, resources thus enabling an optimal use of national airspace system.
4.8.4.2 The Military representative is an active participant in the CDM process of ATFM.
4.8.4.3 They communicate with civil aviation and provide feedback on information required by civil aviation and advise civil aviation of relevant flights of military aviation, and their airspace use.

4.8.5. Neighboring Countries and Countries Having Close Aviation Contact with ACAC Middle East States

4.8.5.1 The ATFM system will be designed to be interoperable with ATFM systems of neighboring countries, regional or sub regional systems.
4.8.5.2 The ATFM system will be flexible to have interactions with other ATFM system at different levels, like from exchanging ATFM tactical information to actively participating in the regional ATFM process.
4.8.5.3 The CCC will be the focal point of contact between ACAC Middle East States and its neighboring countries, as well as countries and regions having close aviation contact with ACAC Middle East States.
4.8.5.4 This ATFM system will develop procedures for communication and coordination on international flow problems and ATFM methods.
4.8.5.5 In future, it can achieve international CDM and solve cross-border ATFM problems effectively.
5. ATFM SYSTEM PERSONNEL - RESPONSIBILITIES AND TRAINING

5.1. Roles and Responsibilities

The ATFMS shall allow the following operational roles at the CCC and TMUs.

- **CCC (and TMU) ATFM Operations Supervisor:** The CCC (and TMU) ATFM Operational Supervisor acts as the top principal of ATFM operation management system to fully master and manage regional/nationwide daily ATFM operations, direct daily operations of regional/nationwide ATC facilities, coordinate air traffic operation problems, make final decisions on air traffic flow management initiative (ATFM initiatives), and have liability for the operability, effectiveness, and safety of decision making. The Flow Manager is responsible for planning the use of airspace and the execution of tasks related to flow management, such as slot allocation and re-routing. The presentation of current and future air situation in the console display, as well as view filters, are at the Flow Manager’s disposal to assist in analysis and decision-making on specific issues.

- The CCC ATFM Operational Supervisor is assisted in ATFM operations by appropriately trained ATFM personnel in the following areas of specialization.

  o **Operations Planning:** Conduct complex analysis of system capacity and airspace users demand, full master status and movements of regional/nationwide air traffic, focus on key problems in regional/nationwide air traffic operations, periodically or timely have CDM in regional/nationwide operations, study and develop regional/national air traffic operation management plans and TMIs, and direct operations of all positions on the operation floor.

  o **Airspace User Coordination:** Handle flight plans occasionally added and adjusted within the operation day, communicate with airspace users on operation plan, receive their comments, and resolve air traffic problems of airspace users in their operations. The Airspace Operator is responsible for editing airspace data in the database—points of notification, aids, airways, SIDs, STARS, corridors, airports – defining airport capacity, defining notification points and sectors, and setting FIRs boundaries and respective sectors. Besides editing features, Airspace Operator has at its disposal an environment for simulation and visualization of the Air Situation to assist in the optimization of aeronautical infrastructure.

  o **Capacity Analysis:** Organize or participate in capacity analysis of nationwide air traffic operation management system, keep contact with relevant facilities and units, and analyze system capacity decline due to weather, military activities, airport operation, communication/navigation/surveillance equipment and other reasons.

  o **ACC Monitoring:** Monitor air traffic operations within its responsible ACC, keep contact with local ATC facilities, supervise the execution of relevant ATFM initiatives and plans, receive feedback, and coordinate with relevant positions to study the solutions of conflicts in air traffic operations.

  o **CDM Coordinator:** At the heart of ATFM concept is CDM with CDM partners. The CDM Coordination ensures effective and timely coordination mechanism with all CDM Partners (Airports, Airlines, and Military etc.) to arrive at most efficient decision to meet the DCB challenges. The CDM process also involves airspace coordination when necessary, under the FUA concept with Military.

  o **Special Flight handling:** For handling VVIP flight plans and flight plans with other special requirements, advise relevant facilities and publish the information on schedule, monitor special flight operations, contact aircrew of these flights as necessary, and coordinate to resolve problems occurred in operations.
o **International Coordination:** Communicate with relevant domestic ATC facilities and foreign airspace users, coordinate international ATFM affairs, and collaborate to make decisions and focus on implementation of relevant domestic air traffic operation facilities when it is necessary to extend the management measure and operation plan abroad.

o **Weather Impact Analysis:** Analyze and master the trends of relevant weather systems, track, collect, organize, and evaluate nationwide weather conditions and forecasts, and inform relevant positions on the operation floor of this information; offer directive suggestions to weather analyzers in ATC facilities, airspace users operation units, and airport operation units; participate in operation CDM meetings (planning conference calls) or CDM when necessary.

o **Large (Special) Event Coordinator:** Supervise joint initiative implementations of air traffic operation facilities coming across large (special) events, communicate with and provide feedback to organizers, and coordinate solutions to various problems in civil aviation.

- The CCC shall have the following specific positions for providing appropriate and relevant information about demand and capacity.

  o **Flight Plan Information Management:** Collect and handle all flight plan information from Fax, AFTN/AMHS (e.g., from Societe Internationale de Telecommunication Aeronautiques (SITA)), Aeronautical Telecommunication Network (ATN)), e-mail, etc., to build the flight plan database for strategic, pre-tactical and tactical demand analysis. The Flight Plan Operator is responsible for maintaining the integrity of the flight plan workflow.

  o **Aeronautical Information:** Collect, organize, and provide, in a timely fashion and to relevant positions, aeronautical information such as Notice to Airmen (NOTAM), manage and update all paper and electronic aeronautical information in the operation floor, collaboratively draft and publish the information of operation decision-making in form of NOTAM when necessary. The Aeronautical Information Operator is ultimately responsible for the operational function of capacity management, assuming the following responsibilities:

    - Reception and processing of conventional aeronautical messages in text format-NOTAM, making this information available to other operators in the center. With the aid of decision support tools, the operator interprets the NOTAM texts capturing the corresponding effects on the capacities of the regulated elements;
    - Reception and processing of meteorological messages, such as, METAR, SPECI, TAF, GAMET, SIGMET, AIRMET and wind forecast (GRIIB), the latter used in the route extraction process of a flight plan and the correction of estimates;
    - Acquisition and interpretation of meteorological images. With these data and with the aid of decision support tools, the Aeronautical Information Operator interprets the information received capturing the corresponding effects on the capacities of the regulated elements;
    - Monitoring and maintenance of operational status of the aeronautical and airport infrastructure, capturing the corresponding effects on the capacities of the regulated elements;
    - Establish operational priorities for maintenance and restoration of the technical equipment, following up the corrective actions.

  o **Communication, Navigation, and Surveillance (CNS)/ATM Equipment Monitoring:** Communicate with equipment monitoring systems on equipment operations, master equipment status such as periodic shutdown and repair, help the Capacity Position (CP) analyze the influence on system capacity due to abnormal equipment operation, etc

- The CCC is also equipped for conducting post operations analysis and data mining. The functions of the unit are: Collect and analyze various operational data, gather
regional/nationwide system operation logs, evaluate the safety, effectiveness, and operability of ATFM initiatives and plans already in the execution state or finishing execution, edit and release various statistical report forms and operation information.

- **System Maintenance:** Maintain various equipment on the operation floor, ensure operation of equipment, and offer consultation services to operation and maintenance personnel in other units.
  
  - **System Software Maintenance:** Monitor software operations of air traffic operation management systems, ensure safety and orderliness of various networks and databases, and offer consultation services to operation and maintenance staff in other units.
  
  - **The System Administrator** is responsible for:
    - Supervision of technical equipment, communication links and working positions;
    - Maintenance of operational configuration data (VSPs);
    - Update system date and time;
    - Management of flight plan storage;
    - Implementation of routine data backup;
    - Registration of subscribers/users of ATFM system with their privileges and restrictions

The CCC also makes provisions for having CDM partners and Stakeholders at the CCC.

Some of the Positions are:

- **Airlines Observer:** Act as representative of air transport enterprises to supervise the publicity, fairness and justness of air traffic operation management, communicate with airlines to reflect the various demands, coordinate operation conflicts, and participate in emergent handling and decision making for significant air traffic operation problems when invited.

- **General Aviation Observer:** Act as representative of general aviation enterprises to supervise the publicity, fairness and justness of air traffic operation management, communicate with airlines to reflect the various demands, coordinate operation conflicts, and participate in emergency handling and decision making for significant air traffic operation problems when invited.

- **Airport Observer:** Act as representative of airport enterprises to supervise the publicity, fairness and justness of air traffic operation management, communicate with airports to reflect the various demands, coordinate operation conflicts, and participate in emergency handling and decision making for significant air traffic operation problems when invited.

- **Military Coordinator:** Act as representative of the ACAC Middle East States military to monitor civil air traffic operations for the military, advise civil aviation of military activity plans and actual activities that affects civil air traffic operations; help relevant civil ATC facilities continuously evaluate the scope and duration of military activity influence on civil use of airspace capacity; try to reduce undesirable influence of military activities on safety and efficiency of civil air traffic operation; and exchange information with a Special Flight Position (SFP) on special flight plan and movements

### 5.2. Training Requirements

[TBD]
6. ATFM SYSTEM – OPERATION- GENERAL GUIDELINES

6.1. **OVERVIEW**

6.1.1. The ATFM System shall provide ANSPs and Aircraft Operators with a decision support capability to safely, efficiently, and predictably manage demand when it exceeds capacity at constrained resources (e.g., airports) within the ANSP area of responsibility.

6.1.2. The ATFM System shall provide the functions necessary for integrated strategic, pre-tactical and tactical flow management for balancing aggregate capacity with predicted air traffic demand. In addition, the ATFM System shall enable CDM so that all system stakeholders have a role in optimizing system efficiency and safety.

6.1.3. The ATFM System shall provide ANSP users the ability to proactively manage capacity reducing events through the ability to create and modify Traffic Management Initiatives (TMIs). The ATFM System shall provide a framework for exchanging data among users who share the need for a common view of air traffic flow operations. When conditions such as weather, controller staffing, equipment outage or spikes in air traffic demand affect a resource’s capacity, easy-to-understand visuals enable users to monitor the impact of those conditions.

6.1.4. The ATFM System shall permit users to identify a capacity/demand imbalance, model the impact of candidate TMIs, coordinate TMIs with CDM participants, and determine which candidates yield optimal solutions to address the capacity/demand imbalance. The ATFM System shall continually update the known and predicted demand so that ANSP users can monitor the operational conditions and modify the TMI to adapt to the changing environment.

6.1.5. The ATFM System shall fully embrace and supports the goals and processes of CDM. The ATFM System shall enable an Aircraft Operator to exchange slots between their flights in real time, thus optimizing their use of the overall capacity created by the ANSP to achieve the Aircraft Operator’s business goals. CDM slot substitutions and Aircraft Operator flight data changes are realized through a Web-based interface, a more advanced component, and via a direct system-to-system interface between the Aircraft Operator and the ATFM System.

6.1.6. The ATFM System shall provide the following principal functions:

- 6.1.6.1. Predict demand of ANSP-specified resources
- 6.1.6.2. Monitor demand and capacity of ANSP-specified resources
- 6.1.6.3. Evaluate alternatives to address capacity/demand imbalances
- 6.1.6.4. Perform CDM with stakeholders
- 6.1.6.5. Initiate, monitor, and modify TMIs (ATFM Measures) for constrained resources
- 6.1.6.6. Report metrics and analyze performance

6.2. **SYSTEM ARCHITECTURE**

The high level architecture of ATFM system shall have the following supporting infrastructure which is critical to the success of ATFM system:

- Seamless aircraft surveillance through all phases of flight that can provide a digitized national aircraft position;
- Voice and data communication between all participants in the ATFM system;
- A national weather picture that includes integrated weather sensor data and accurate forecasts; and,
- Automated decision support and display tools to aid all ATFM and collaborative decision making (CDM) participants to maintain situational awareness and assess potential impacts of Traffic Management Initiatives (TMIs) under consideration at any time.
6.2.1. Architecture Type

ATFMS shall be designed as an open architecture system. The intent is to provide a system as flexible as possible to allow the system to grow and evolve as the operations, technology, and environment evolves in ACAC Middle East States. Therefore, the open architecture will allow the integration of future ATFM capabilities into this system’s architecture.

6.2.2. Components of the ATFM Concept of Operation

There are three primary components to the ATFM Concept of Operation that will increase its effectiveness and acceptance by the user community.

- Developing effective CDM mechanisms;
- Establishment of ATFM function for balancing demand and capacity;
- An efficient ATM System for providing capacity at airports and in airspace.

6.2.2.1. Effective Use of Collaborative Decision Making (CDM)

The effectiveness of CDM is greatly improved by all units and stakeholders sharing the same situational awareness and using common flow planning tools to arrive at optimal Traffic Management Initiatives (TMIs). TMIs are actions taken to balance current or anticipated demand with available capacity. Examples include imposing a minimum Miles-in-Trail (MIT) between aircraft in an en route flow or stopping departures of all aircraft destined for a particular city (a Ground Stop, or GS). TMIs work best when all participants work together to create technological and procedural solutions to traffic flow problems, and respond collaboratively to real-time operational constraints.

CDM provides a unified approach to improve the ATM system and services through increased information exchange and a common situational awareness among stakeholders resulting in enhanced options, improved decision-making, and stakeholder acceptance and support.
6.2.2.2. Establishment of an Air Traffic Flow Management Function

The ATFM function includes staff at every appropriate level of the ATC system: Airport, Approach, Area Control, and ATFM Central Command Center. These staff plus representatives from military organizations, Airline Operations Centers (AOCs), and airports are responsible for facilitating and implementing TMIs.

The ATFM function shall utilize advanced tools for strategic planning, as well as pre-tactical and tactical management of traffic flows within the available capacity of the ATM system. The system shall provide with comprehensive ATFM capabilities to model, implement, and analyze all traffic management initiatives for both airport and airspace volumes in ACAC Middle East States. TMIs are used to dynamically balance air traffic demand with capacity to keep traffic flowing as smoothly and efficiently as possible.

As a minimum, implementing ATFM will require seamless voice and data communications between all participants in the system:

- Ground to ground voice and data communications between Units and the numerous stakeholders (e.g., AOCs, military, airports) in order to implement ATFM CDM;
- Seamless surveillance that provides a digitized regional/national aircraft position for use by all participants in the ATFM process; and
- Automation and display tools to aid all ATFM and CDM participants to maintain situational awareness and assess potential impacts of TMIs under consideration at any time.
- A national weather picture that includes integrated weather sensor data and FORECASTS.

The proposed ATFM system shall describe in detail the implementation of the three mainly components mentioned above.

6.3. PHASES OF OPERATION

At the top level, ATFM is an iterative process that can be divided into four phases to gain a better focus on its particular tools. This iterative process will increase the effectiveness and efficiency of air traffic operations. Each phase is differentiated by factors including time, scale, focus, and goals. Regardless of the phase, it is important to note that adjustments in one phase or area may potentially impact other phases in the ATFM system.

6.3.1. Strategic Phase

The strategic management phase occurs prior to events up to one week before the execution date. Its management focus is mainly on scheduled flight plans. The goals are to pre-arrange scheduled flight plans, based on the system’s general capacity, to avoid planned flow demands exceeding capacity, develop ATFM schemes for large airspace use events, and offer suggestions on improving long-term development of ATC methods and airspace design.

The ATFM strategic phase seeks a greater dialog between ATFM partners and capacity “providers” in order to analyze airspace, airport and ATC restrictions, seasonal weather changes and significant meteorological phenomena. It also seeks to identify, as soon as possible, any possible discrepancies between demand and capacity in order to jointly define possible solutions with the least impact on traffic flows. These solutions would not be frozen in time, but would be applicable according to the demand foreseen in this phase.

The main output of this phase is the creation of a list of hypotheses, some of which are disseminated in aeronautical information publications that, through capacity forecasts, allow planners to find solutions for
problem areas while improving support to ATFM by anticipating the solution to possible traffic configurations.

The strategic phase may be divided into two parts:

- A continuous data collection and interpretation process, with a systematic (information quality control) and regular review of procedures and measures.
- A process of coordination with the units or positions (TMUs) with a view to ensuring the compatibility and efficiency of national requirements.

The ATFM strategic phase has the following objectives:

- Identify demand/capacity imbalances in ATC systems, whether in underutilized or saturated areas.
- Use that information to recommend measures leading to the achievement of additional capacity or to an effective use of the existing one.

Regarding the above, a comparison between available traffic forecasts and known capacity data is a method that could be used to detect demand/capacity imbalances.

Gathering of demand and capacity data DEMAND data may be obtained from different sources, such as:

- Demand-adjusted databases.
- Recent traffic history, comparable to the one to be analyzed (the same day of the previous week or of some high-demand period).
- Traffic trends provided by national authorities, user organizations (e.g., IATA), etc.
- Repetitive flight plans (RPL) filed by the AOs.
- Other related information (air shows, major sports events, military maneuvers) and, in general, events or situations that might entail an additional or extraordinary demand that affects available ATC capacity.

CAPACITY data is provided by the different ATCs. Despite that, it is important to have close coordination among ATFM components to make sure that available capacity is distributed in such a way that it meets the existing demand. The ATFM specialists should also consider factors such as personnel availability forecasts, possible medium-term changes in ATC procedures; installation of new equipment, airport infrastructure works that affect runways or parking positions, etc.

### 6.3.2. Pre-tactical Phase

The pre-tactical management phase occurs about seven days to one day before the execution date. Its management focus is mainly on non-scheduled flight plans, planned large (special) events, and applying forecast airspace constraints to the ATFM models. The goals are to avoid flow demands exceeding capacity given the forecast conditions of the existing flight plan and predicted system capacity, and to adjust the schemes of large (special) events.

Measures to be taken from one day to six hours prior to the operation, a definition which differs from the one described in the Procedures for Air Navigation Services - Air Traffic Management document (PANS-ATM), which specifies that the measure has to be taken more than one day prior to the date in which it will become effective. The pre-tactical phase involves the study of the demand for the day of the operation (since 48 hours before), comparing it with the capacity available on that day, adjusting the plan developed in the ATFM strategic phase, or determining different measures as necessary.

The main objective of the pre-tactical activity is to optimize capacity through a more effective organization of resources, based on the foreseen traffic demand (for example, sector configuration management, use of alternate flight procedures, etc.).

The work methodology consists in maintaining an optimum collaborative capacity (CDM) and is based on a close relationship between the ATFM unit, the air traffic management positions (TMUs) at the air traffic control centers or ATC units and the other corresponding partners (airspace managers, airlines).
The final result is a plan that describes the necessary capacity resources and the measures still pending for regulating traffic. This activity uses hypotheses developed in the strategic phase and adjusts them to the expected situation. The time limits of the activity are related to the precision of the forecasts (one week at the most) and to the capacity of the different partners.

The flight intention of air operators should be consistent with the plan developed during the strategic phase and with the adjustments made during the pre-tactical phase. The success of the activity depends to a large extent on the quality of human relations and mutual trust, as well as on the precision, reliability and timeliness of the information exchanged. All this requires an effective combination of technical and diplomatic abilities to attain optimum results.

Once the process has been completed, the agreed measures, including restrictions, should be disseminated through an ATFM or ANM message, which may be distributed through the AFTN or the various aeronautical communication networks.

The tasks to be performed during this phase may include the following:

- Determine the capacity available in the various areas, based on the particular situation that day.
- Estimate the existing demand.
- Conduct a comparative demand/capacity study.
- Study the sectors that are expected to have saturation, flows affected, calculating the acceptance rates to be applied according to system capacity.
- Prepare a summary of ATFM measures to be proposed and submit them to the ATFM community for CDM.

Twenty four hours before the operation, a last review should be carried out in consultation with the affected ATC units, in order to determine the definitive ATFM measures, which shall be published through the corresponding ATFM messaging before the operations are affected.

Acceptance rates may be established taking into consideration the following:

- They should be expressed as the number of flights in a period of time over a given point.
- Acceptance rates that are applied for extended periods of time must be periodically calculated.
- It is advisable to conduct a subsequent study to assess the impact of the measures and to adjust them, inasmuch as possible, based on the information received from the various units that make up the system, and to be able to make the necessary tactical adjustments.

### 6.3.3. Tactical Phase

Tactical management generally starts on the day of execution and lasts to the completion of the day’s ATFM initiatives. Since traffic flow projections increase in accuracy as they approach the real time event, often the tactical phase has a rolling boundary between it and the pre-tactical or strategic phase of only hours. Its management focus is on executing flight plans, monitoring air traffic, evaluating capacity and demand issues/constraints, and implementing TMs. The goal is to avoid flow demands exceeding capacity by recognizing and managing the differences that occur between the proposed flight plans, the Filed Flight Plans (FPL), and the active, in-the-air flight paths.

During this phase, measures are adopted six hours in advance of the operation. Tactical management of traffic flows and capacity involves considering, in real time, those events that affect the plan, and making the necessary modifications.

The main objective is to minimize disturbances and take advantage of any opportunities that may arise. The need to adjust the original plan may result from staffing problems, significant meteorological phenomena, crises and special events, unexpected opportunities or limitations related to ground or space infrastructure, more precise flight plan data (FPL), the revision of sector capacity values, etc.
The provision of real information is of vital importance in this phase, since it permits short-term forecasts, including the impact of any event. There are different types of solutions that may be applied, depending on whether the aircraft are already airborne or about to take off. Interaction with traffic synchronization is essential to reach the best compromise.

Proactive planning and management phases use all the information available on forecasts. It is also of vital importance to make improvements to the aforementioned phases based on relevant information.

The tactical activity is aimed at ensuring that the measures taken during the strategic and pre-tactical phases solve the demand/capacity problems in the flows or areas of application, and that the measures taken are the minimum required and unnecessary measures are avoided. It also seeks to ensure that ATC resources are properly used and that the existing capacity is maximized without jeopardizing safety.

It should also be borne in mind that existing delays are equitably distributed among operators. To this end, real-time monitoring of the ATFM Plan is required in close contact with the ATC.

In this tactical phase, the main ATFM measure is the application of ATFM slots, trying to avoid major penalties for the operators.

**6.3.4. Post Analysis Phase**

Post analysis begins after the completion of the day’s ATFM process. Its analysis object is executed flights. The goal is to record, collect, and analyze the air traffic operations and ATFM process. Analysis of ATFM allows for ongoing review of ATFM initiatives and results. This phase feeds relevant information regarding airspace management, ATC, and ATFM back to all levels of the ATFM team and system stakeholders. Post-analysis is also a static process since it aims at statistics and analysis of existing facts.

However, from the perspective of the airspace users, the requirement to file accurate flight plans early in order to solve flow problems during the strategic and pre-tactical phases conflicts with the requirement of using airspace flexibly. Therefore, while developing the ATFM system, emphasize ATFM in the strategic and pre-tactical phases, but keep in mind that the tactical phase is the most important phase. In fact, the tactical ATFM process is by far the most diversified and complicated and will be the focus of this Concept of Operations. This operational concept will explore the tactical ATFM in detail and briefly describe the process of strategic management, pre-tactical management, and post analysis.

Because the time boundaries between most phases are difficult to distinguish in actual operations, detailed attention should be given to the management processes and methods rather than trying to identify a particular management phase. In fact, as automation technology allows greater collaboration between different ATFM elements, pre-tactical and even tactical decisions can be made with a greater awareness of the strategic plan for an overall system approach to solutions.

Regardless of the phase, the important concept is that Traffic Management Specialists (TMSs) may take various ATFM initiatives, based on their awareness, at different times to adjust the balance of system capacity and traffic demand. Some initiatives are best suited for the earlier phases, and many are only suited for the tactical phase. For example, an airspace user requests to add a scheduled flight from this week and continue it till the end of the flight season. On such a request, TMSs should arrange the corresponding scheduled time of takeoff and landing as well as routes, in accordance with existing ATFM principles and procedures at the strategic level, but also in coordination with all impacted areas of flight—from the airport to terminal to en route—at the pre-tactical level of forecasting capacity and demand. Another example, flight plan adjustments are normally initiated in the tactical phase (i.e., on the day of execution, during severe weather, etc.). However, in special weather conditions, like a typhoon that moves slower and affects a larger scale area, airspace users will usually file adjusted flight plans to combine flights or revise flight routes one or two days before the execution date. As a result, some ATFM initiatives will be continued from the pre-tactical phase through the tactical phase since integrated management should be performed on
these kinds of large-scale route changes. The above-mentioned phases constitute an integrated ATFM process across time. While TMSs should take ATFM initiatives as soon as possible to achieve orderly.

The proposed ATFM system shall describe in detail the implementation of the four operation’s phases mentioned above.

6.4. ATM PLANNING

In order to optimize ATM system performance in the ATM Planning phase, the ATFM system shall establish available capacity and then compare it to the forecasted demand and to the established performance targets. Measures taken by the system in this step shall include:

- reviewing airspace design (route structure and ATS sectors) and airspace utilization policies to look for improvements;
- reviewing the technical infrastructure to assess the possibility of improving capacity through upgrading various ATM support tools;
- reviewing and updating ATM procedures as required by changes to airspace design and technical infrastructure;
- reviewing staffing practices to evaluate potential for matching staffing resources with workload and the eventual need for an increase in staffing levels; and
- Reviewing the training that has been developed and delivered to ATFM stakeholders.

Such analysis will provide an idea of the magnitude of a possible imbalance between demand and capacity and based on the imbalance, mitigating measures may need to be developed. However, before this is done, it is very important to:

- Establish an accurate picture of the expected traffic demand through the collection, collation, and analysis of air traffic data.
  - In order to identify a demand excess, airports and airspaces should be monitored in order to identify significant changes in:
    - forecast demand;
    - ATM system performance targets;
  - Demand data can be obtained from different sources, such as:
    - Comparison of recent traffic history (e.g., comparing the same day of the previous week or comparing seasonal high-demand periods);
    - Traffic trends provided by national authorities, user organizations (e.g., IATA), etc.; and
    - Other related information (e.g., air shows, major sports events, large-scale military manoeuvres).
- 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.

The analysis made and the measures taken will result in a declared ATC capacity and only in those cases where demand exceeds the declared capacity should there be a requirement to consider the utilization of ATFM measures in the next phase, ATFM execution.
6.5. Types and Identification of Flow Management Problems

There are generally three types of flow management problems:

- Airport capacity/demand imbalance;
- Airspace capacity/demand imbalance; and
- Avoidance of unusable and undesirable airspace.

These three problems, at both the terminal and en route levels, exist throughout the ATFM process and are often interrelated. TMSs need to spend most of their time identifying and solving these problems as a whole—a problem in one may generate a problem in another. Identifying the problem and seeking solutions are the main responsibilities of all ATFM specialists at different levels.

During daily operations, flow managers monitor system capacity and demand and are regularly alerted to potential airport capacity/demand imbalances and their severity from automation systems or other channels. When TMSs find this kind of imbalance, they should figure out the cause and impact of the imbalance through analysis and collaboration with other levels of flow control, and then work out preliminary solutions and collaboratively develop successive ATFM initiatives. In order to clearly identify the cause of potential flow problems, flow managers should have continual situational awareness of air traffic flow, which requires that TMSs be provided with accurate and timely knowledge of flight movements and system operation conditions pertaining to their areas of responsibility. This allows TMSs to estimate the scope, duration, and features of ATFM problems as soon as possible, and identify the range of flights that might be affected when they solve these problems. While individual situational awareness is an important precondition to identify all air traffic flow problems and can help solve minor, local issues, collaboration of ATFM specialists from multiple Traffic Management Units (TMUs), and other system stakeholders, is required to solve complicated flow problems. These specialists should have common situational awareness, (i.e., the same timely and accurate knowledge of air traffic flow situation and operation conditions) in order to effectively solve large scale flow problems through collaborative analysis, decision-making and action.

6.5.1. Airport Demand-Capacity Balancing

Airport capacity/demand imbalance or terminal area imbalance can be predictors or symptoms of arrival or departure delays. Automation system predictions, mental calculations of experienced TMSs, stakeholder collaboration, clear and timely communication, and ongoing coordination between the different levels of ATFM are all indispensable factors to estimate whether the current airport capacity will affect airport arrival and/or departure flows. These processes are critical in determining if airport constraints will result in delays at some point in the future.

The allocation of runways between arrival and departure flows is a major factor in determining whether arrival and departure flows will result in delays. Overall airport arrival and departure capacity is determined by the airport configuration (i.e., utilization of runway(s) and arrival/departure procedures, navigational aids, runway/taxiway availability) and is adjusted as conditions change. Since a runway may be shared by arrival and departure flows, the two kinds of flows are related. Excessive demand of one flow may cause the restriction on using or taxing across a busy runway and result in the delay of another flow. Therefore, traffic flow managers should weigh the two flows separately, but consider them together, when evaluating the traffic capacity or demand of an airport.

During non-constrained operations, an important principle in the airport ATFM process for safety, fuel saving, and environmental protection purposes is that arrival flow typically has priority. In fact, an optimum arrival flow would occur when ATC spaces aircraft, so that just as a preceding aircraft vacates the runway,
the trailing aircraft crosses the runway threshold. However, over time, this can lead to serious ground delays, as no room exists for departures. The results are excessive wait times, long lines of aircraft awaiting departure, passenger crowding as they wait for delayed aircraft, and in the worst case, an airport gridlock where no room exists to taxi or get into or out of a gate.

This is in fact what often occurs, as airport TMSs usually minimize arrival delays at the cost of increasing departure delays, with the departures being released when adequate space between arrivals can be provided. In addition, long departure delays can also occur if the overhead stream of en route traffic is too congested to allow departures to fit into the stream. Without adequate en route slots, departure aircraft remain on the ground, leading to the same type of ground delays as with too many arrivals.

Both of these problems have the same symptoms, i.e., departure delays, but are solved in different manners. Thus, traffic managers must coordinate among levels of control to determine the cause before taking action. To reduce arrival rates, lower average arrival rates or increased arrival spacing can be adopted to reduce arrival demand and increase the departure rate. To increase departures into a congested overhead stream, coordination between terminal and en route TMSs can lead to the en route structure building slots, either manually or via time-based metering. Departure traffic can be accommodated by TMSs applying TMI en route or from feeder airports.

6.5.2. Airspace Demand-Capacity Balancing

The route capacity is usually weighed from the capacity of its minimal operation unit, namely the control sector. The sector capacity threshold is a maximum capacity value obtained from capacity evaluation calculation, known constraints, and personnel experience. It represents the level of system capacity when no tactical flow problem occurs and is related to factors such as airspace structure, communication, navigation and surveillance/ATC automation system, ATC methods, controllers’ human factors, and so on. Its capacity is ultimately determined by evaluating the ability of controllers to handle aircraft in this sector within a certain period of time (Ref 3).

The ATFM automation system uses the pre-estimated static threshold values of various sectors. It will give an alarm when it predicts the future sector flow exceeds the threshold. Since the threshold has been evaluated in advance under some ideal condition, while the internal features of the traffic flow are relatively simple (e.g., flow direction is consistent or no climbing and descending), the controller might still be able to deal with the existing or predicted flows when the system alarms. However, when receiving a sector capacity alarm, the TMS should coordinate with the sector supervisor to confirm whether ATFM initiatives should be taken.

When the TMS determines ATFM initiatives are required, they should coordinate with other sector/en route center specialists as well as with terminal specialists to decide on the best measures for implementation. A system approach should be part of this process. Executing the wrong measure may solve the specific sector issue, but cause greater delays in adjacent centers or terminal areas. Collaboration, coordination, communication, and automated modeling can help TMSs determine the best course of action. Once measures are instituted, the TMS should monitor and periodically coordinate with the sector supervisor to adjust those measures, as needed. All significant activities and actions should be documented to assist in post event analysis.
6.5.3. Problems Due to Avoidance of Unusable or Undesirable Airspace (Constrained Airspace)

A route or airspace may sometimes be unusable due to severe weather (e.g., thunderstorm or air turbulence), a dangerous situation (e.g., volcanic ash) or Special Use Airspace (SUA) activities (e.g., military activities). The pilots sometimes are also unwilling to use airspace with air turbulence or strong headwind.

Most cases of unusable or undesirable airspace are quite difficult to forecast in the strategic and pre-tactical phase, becoming key issues to be resolved in the tactical phase. Pilots, controllers, and TMSs may obtain information on unusable or undesirable airspace by monitoring weather conditions, contacting the military, and so on. The CCC should be aware of and monitor these selective constrained areas as well.

Regardless of who obtains the information and from which source, the important element in effective handling of these problems is dissemination of information. As a result, all levels of ATFM, ATC, the military, and the users (pilots, airlines, etc.) have the same situational awareness of changes in the airspace system due to unusable or undesirable (constrained) airspace. With this information, a coordinated approach to route aircraft around unusable or undesirable airspace can be taken. Changing flight levels (FLs) and radar vectoring are the most commonly used control measures when unusable or undesirable airspace appears in an area. Since these measures will increase the workload of the controller, lower the capacity of the sector, and eventually cause flow restrictions, the TMS should use a “traffic preview tool” to assess and determine the result of ATFM initiatives to confirm and model the outcome of different TMIs allowing selection of the least restrictive initiative to accomplish the impact mitigation.

The proposed ATFM system shall describe in detail the implementation of the three flow management problems mentioned above.
7. ATFM SYSTEM COMPONENTS- ROLES AND RESPONSIBILITIES

7.1. CCC – OPERATIONS

The ATFM System shall allow the establishment of an ATFM facility (the Central Command and Control Unit, or CCC) at [State] where all capacity and demand data and information can be acquired, merged, displayed, and distributed to participating CDM partners and ATFM units.

The ATFM System shall allow the ATFM CCC continually make decisions to hold or cancel flights at airports because of delays, traffic congestion, weather problems, emergencies, and other conditions. This will require an ability to communicate with any impacted air traffic control facility and all affected AOCs, allowing the [ATFM Authority] to collaborate on optimizing mitigating responses before a final decision. The airports/AOCs need to efficiently coordinate all airport operational activities and ensure security of the airport infrastructure at all times. Up-to-date information needs to be shared between various shareholders (airlines, airports, military, etc.) in order to maximize throughput capacity, maintain safety and minimize delays and impact on the environment.

The ATFM System shall provide CCC with a decision support tools that can propose optimized arrival and departure sequences for maximum inbound and outbound punctuality, while reducing runway queues. By considering separation requirements for the successive arrivals and takeoffs at all planning stages, these decision support tools ensure maximum safety.

A typical coordination hierarchy could consist of the following:

- Control towers (TWR) coordinate with Approach Control Facilities (APP).
- Approach Control Facilities (APP) coordinate with an Area Control Center (ACC).
- Area Control Centers coordinate with ATFM authority.
- ATFM authority would be responsible for dissemination within their respective region.

The ATFM System shall allow the CCC Supervisor to be responsible for the day to day monitoring, planning and co-ordination of all ATFM measures affecting traffic entering, leaving, overflying or remaining within the ACAC Middle East States Airspace.

7.2. TMU – OPERATIONS

The ATFM System shall allow the TMU to be responsible for all co-ordination between ATC and the CCC and for providing ATFM support to Aircraft Operators.

TMUs monitor and balance traffic flows within their areas of responsibility in accordance with air traffic flow management directives. They also direct traffic flows and implement approved traffic management measures. TMU duties may include:

- collecting all relevant information, such as meteorological conditions, capacity constraints, infrastructure outages, runway closures, automated system outages, and procedural changes that affect ATS units. This may be accomplished through various means available, such as teleconferences, e-mail, internet, automated data gathering, etc.;
- documenting a complete description of all ATFM measures (for example, ground delay programs, miles-in-trail) in a designated log. It should include, among other data, the times of start and end, the affected stakeholders and flights, and the justification;
- coordinating procedures with the affected stakeholders;
conducting daily telephone and/or web conferences, as required; and
continuously monitoring the ATM system, make service delivery adjustments where necessary, manage ATFM measures and cancel them when no longer required.

The local ATFM unit (TMU) manager shall be responsible for all ATFCM activities in the designated area and within its area of responsibility and shall act as the focal point for administrative and organizational matters in dealings with the central unit for ATFM.
The local ATFM unit (TMU) manager shall be required to meet the following criteria:

- have extensive knowledge of the overall ATC/ATFCM operation in the area of responsibility of the designated area;
- have an extensive understanding of the ATC/ATFCM operations in adjacent designated areas;
- have a comprehensive knowledge of the central unit for ATFM organization and its systems;
- have undergone appropriate ATFCM training
- have an extensive understanding of the factors influencing Aircraft Operations in so far as they may affect ATFCM.

Local ATFM (TMU) units shall:

- act as the interface between the central unit for flow management and;
- designated areas and their associated aerodromes and ATS units (military and civil) within their area of responsibility aircraft operators
- inform local AOs of their role in providing advice and information by arranging for the relevant TMU telephone numbers to be published in the National AIP with a short description of the service provided.
- establish local ATFM unit procedures and practices to ensure that local ATFM unit staff are fully conversant with the latest central unit for ATFM operational procedures and any ATFM local instructions or Temporary Instructions applicable to their local ATFM unit.
- monitor the effectiveness of such procedures and, where necessary, recommend changes.
- act as the point of contact within an designated area for coordination on ATFM matters
- ensure that the central unit for flow management has all the data and information required in each of the ATFM phases to make the most effective use of available capacity in order to implement the most effective ATFM plan and for checking the accuracy of that data
- ensure the local promulgation, by the appropriate means (national NOTAM, AIP, ATC operational instruction, etc.), of procedures which affect ATC Units or aircraft operators within the local ATFM unit’s area of responsibility.
- include the provision of all the relevant updated information and documentation so that information and advice passed to AOs by the local ATFM unit is relevant, up-to-date and fully conforms with current ATFCM manual operating procedures.
- act as the local ATFCM partner for the designated area, other ATS units (military and civil) within the local ATFCM area of responsibility and local AOs.

7.3. Responsibilities of the TMU

The name/Location/Area of Responsibilities of TMU will be defined in due course. TBD

7.4. Responsibilities of ACC TMU

ACC TMU, as a second level of the ATFM organization, is responsible for helping the CCC to organize relevant ACC, terminal, airport ATC towers, and other stakeholders within its geographical area to conduct ATFM. The ACC TMU duties include communication, collaboration, and coordination of ATFM issues with surrounding and stakeholders. All ACCs also have Initial Flight Plan Management Positions, Operation Coordination Positions, and Flight Plan Processing Positions to fulfill relevant ATFM responsibilities.
General responsibility of ACC TMU

- Create and distribute the action plan prior consultation with the designated facilities and customers
- Collect all relevant information, such as meteorological conditions, delays, interruption of navaids/radar, runway closures, telecommunication failures, deficient operation of computers, and procedural changes affecting air traffic facilities. This may be accomplished through various means available, such as teleconferences, e-mail, internet, etc.
- Analyze and distribute all data
- A complete description of all TMIs (for example, ground delay programs, miles in track - MIT) is recorded in a designated log, which must include, among other data, the time of start and end, the affected facilities/operations and the justification.
- Coordinate procedures with the parties involved.
- Create a structure for dissemination of information; for example, a website
- Conduct daily teleconferences, as required
- Monitor/review the flow management system, make adjustments where necessary, and cancel when no longer required.

In general, the ACC TMU is responsible to monitor air traffic operations within their area, participate in periodic nationwide planning conference calls for ATFM, help CCC develop and adjust TMIs, communicate with area airspace users and airports on flow problems. Specific responsibilities include:

- Identify and assess sector capacity decline due to weather, defense activity, aircraft operation, ATC facilities operation, ATC equipment outages, airport impacts, etc.
- Help APP TMUs in its area study capacity changes of relevant sectors, departure and arrival fixes, and airports.
- Collaborate with CCC to adjust the capacity threshold of sectors and arrival/departure rates at threshold airports.
- Analyze capacity/demand imbalance of area sectors based on flight plan and traffic in the air.
- Plan TMIs within its area of responsibility and inform relevant ATC positions.
- Feedback status of TMIs, planned and executed, to CCC. Suggest adjustment or termination of implementation.
- Carry out post evaluation of daily ATFM, and report evaluation results as required to the CCC.

7.5. Responsibilities of APP TMU

APP TMU: As appropriate, APP TMUs should be established in Terminal (Approach) where ongoing capacity and demand issues require regular ATFM initiatives. ATFM Authority should set up APP TMUs in main Terminal (Approach) control facilities according to flow and environment status and set up ATFM terminal in other approach control units, as needed. The MIC of the facility will take charge of ATFM in Terminal (Approach) control facilities without APP TMUs. The Tower MIC or local controller in airport ATC tower will fulfill the relevant responsibilities in airports without APP TMU facilities

General responsibility of APP TMU

- In general the APP TMU is responsible to manage air traffic demand and constraints within their area of responsibility. Specific responsibilities include:
- Identify and assess sector capacity decline due to weather, defense activity, aircraft operation, ATC operation, ATC equipment outages, airport impacts, etc.
- Collaborate with relevant ACC TMU and TWR TMU to adjust the capacity threshold of sectors and arrival/departure rates threshold of airports.
- Collaborate with TWR(s) and ACC TMU to identify Airport Arrival Rate/ Airport Departure Rate (AAR/ADR), arrival and departure fix demand/capacity, and monitor the changes due to weather, military information, aircraft operation, ATC operation, ATC equipment, airport operation or other reasons.
- When required participate in nationwide ATFM decision making organized by CCC on its own initiative, invited by ACC TMU or invited by the CCC.
• Participate in decision making organized by ACC TMU for regional TMI\s complying with flight plan and airport operation.
• Support relevant ACC TMUs in the development of regional TMI\s.
• Feedback implementation status of TMI\s and recommend operation plans to ACC TMU.
• Inform the relevant ATC position of ATFM initiatives.
• As required report statistical data to ACC TMU.

7.6. **Responsibilities of TWR TMU**

To set up TWR TMU in some large airport ATC towers according to traffic amount and operation environment of the airport. At middle size towers, a traffic management position may be established and supported with an ATFM automation system terminal. There are full-time TMS\s in these towers during busy time periods. The MIC or local controller will take ATFM charge during non-busy time periods. The controllers on duty take charge of ATFM in small airport towers. Towers without APP TMU facilities take the ATFM charge of ATFM in that terminal area.

**General responsibility of TWR TMU**

In general, the TWR TMU has the responsibility to assist in the management of air traffic demand and constraint issues at the tower. Specific TWR TMU responsibilities include:

• Collaborate with APP TMU to identify AAR/ADR changes due to weather, military information, aircraft operation, ATC operation, ATC equipment, airport operation or other reasons.
• Collaborate with APP TMU and/or ACC TMU to properly adjust threshold of AAR/ADR and departure fix demand issues.
• When required participate in nationwide ATFM decision making organized by CCC on its own initiative, invited by ACC TMU, or invited by the CCC.
• Participate in decision making organized by ACC TMU for regional TMI\s complying with flight plan and airport operation.
• Inform the relevant ATC position of ATFM initiatives
• Feedback implementation status to ACC TMU.
• Carry out post evaluation of daily ATFM, and report statistical data to ACC TMU.

7.7. **Responsibility of ATS Units**

ATS Units shall be responsible for ATFM slot compliance at departure aerodromes. Whereas the exact procedures to be followed will depend on the way ATS is organized at each aerodrome, the following requirements shall apply in all cases, unless otherwise coordinated:

a) a slot tolerance (-5' to +10') is available to ATS units to organize the departure sequence;

b) ATS units shall provide all possible assistance to operators to meet ATFM slots or to coordinate a revised ATFM slot.

c) The ATC unit at the departure airport, when in receipt of a notification of a rejected or suspended flight plan, shall not give take-off clearance to the affected flight. The ATC unit at the departure airport shall ensure that procedures are in place to enable it to be aware of current expected off blocks times for flights operating from that airport and does not give take-off clearance to those flights that have missed its estimated off blocks time, taking into account the established time tolerance.

d) ATC shall deprioritize the flights that are non-compliant behind flights that are compliant and the flights that are exempt from ATFM measures. This re-prioritization will be applied only once at departure airports (which are subject to ATFM regulations) or at arrival airports.
e) ATS units shall provide the central unit for ATFM with the necessary data concerning the progress of airborne flights including actual take-off time and significant deviations from the flight plan route.

f) ATS units shall provide the central unit for ATFM with the following data and subsequent updates, in a timely manner and ensuring its quality:
   - updated flight positions,
   - deviations from flight plans,
   - actual flight take-off times.

7.8. **Responsibility of Airspace Users**

   TBD

7.9. **Responsibility of Airport Operators**

   TBD
الخطة التنفيذية لفريق عمل إدارة تدفق الحركة الجوية
لسنتي 2017-2018

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