INTERNATIONAL CIVIL AVIATION ORGANIZATION

MIDDLE EAST OFFICE

FIFTH MEETING OF THE MIDANPIRG AIR TRAFFIC FLOW MANAGEMENT TASK FORCE

(ATFM TF/5)

(Virtual, 25 – 27 May 2021)

SUMMARY OF DISCUSSIONS

1. PLACE AND DURATION

1.1 The Fifth meeting of the Air Traffic Flow Management Task Force (ATFM TF/5) was held virtually, from 25 to 27 May 2021, using MS Teams.

2. OPENING

2.1 The meeting was opened by the Task Force Chairperson, Mr. Hamad Al Belushi, Senior Expert Air Traffic Management, General Civil Aviation Authority (GCAA), UAE. In his opening remarks, the Chairperson welcomed all participants and appreciated the different initiatives taken by MID States related to ATFM. Mr. Al Belushi recalled the main tasks assigned to the ATFM Task Force in its ToR and underlined the need to harmonize the ATFM implementation in the Region. He thanked all the participants for their attendance and wished the meeting every success in its deliberations.

3. ATTENDANCE

3.1 The meeting was attended by seventy-three (73) participants from fifteen (15) States (Bahrain, Egypt, India, Iran, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Sudan, Syria, UAE, USA/FAA and Yemen) and seven (7) International Organizations (AACO, ACAO, AEROTHAI, CANSO, EUROCONTROL, IATA, IFATCA). The list of participants is at **Attachment A**.

4. OFFICERS AND SECRETARIAT

4.1 The ATFM TF/5 meeting was chaired by Mr. Hamad Al Belushi, Senior Expert Air Traffic Management, UAE General Civil Aviation Authority (GCAA) who extended his appreciation to the participants for being part of the ATFM Task Force and for accepting the invitation to actively participate in the meeting and share their experiences and views, which would support the ATFM Task Force in achieving its objectives.

4.2 Mr. Ahmad Amireh, Regional Officer, Air Traffic Management and Search and Rescue (RO/ATM/SAR) ICAO MID Office was the Secretary of the meeting, supported by Mr. Ahmad Kaveh, Regional Officer, Air Traffic Management (RO/ATM).

5. DISCUSSIONS

AGENDA ITEM 1: ADOPTION OF THE PROVISIONAL AGENDA

5.1 The meeting adopted the following Agenda:

Agenda Item 1: Adoption of the Provisional Agenda

Agenda Item 2: Regional framework:

- Follow-up on the MID ATFM CONOPS Version 1.0 (MID Doc 014)
- ATM Operational Data Exchange Model
- FIFA World Cup 2022 Framework:
  - RVSM Airspace assessment results
  - FWC 2022 ATFM CONOPS
- Follow-up on MIDANPIRG CART Implementations “Plan of Actions”

Agenda Item 3: Future Work Programme

Agenda Item 4: Any other Business

5.2 The documentation, working papers and presentations delivered during the meeting are available at the ICAO MID Office website: https://www.icao.int/MID/Pages/2021/ATFM%20TF5.aspx.

AGENDA ITEM 2: REGIONAL FRAMEWORK

Follow-up on the MID ATFM CONOPS version 1.0 (MID DOC 014)

5.3 The subject was addressed in WP/2, presented by the Secretariat.

5.4 The meeting recalled that MIDANPIRG/18 (virtual, 15 – 22 February 2021) through Conclusion 18/28 endorsed the MID Region ATFM CONOPS V1.0, as at **Appendix A**; and it is now published as ICAO Doc 014 and made available at ICAO MID Office website: https://www.icao.int/MID/MIDANPIRG/Pages/MID-Docs.aspx.

5.5 The meeting reviewed the proposed main skeleton of the MID ATFM Framework and agreed to task the Secretariat, with the support of the Task Force Chairperson, to develop the initial draft of the MID ATFM Framework and the common operating procedures. The scope of the documents is to support the implementation of the CONOPS in the MID States/ANSPs taking into account the current Regional capabilities, capacity building subjects and recommendations for harmonized implementations, to be shared with the ATFM TF members to be reviewed by the ATFM TF/6 meeting, so as to be presented to ATM SG/7 (scheduled in November 2021).

ATM Operational Data Exchange Model

5.6 The subject was addressed in WP/3, presented by the Secretariat.

5.7 The meeting reviewed the ATM Data Exchange Process, developed by ICAO HQ at the beginning of COVID-19 crisis, to support Regions or sub-Regions where no ATFM structure is implemented. The meeting recalled MIDANPIRG/18 Conclusion 18/29 related to the development of a customized version of the "MID Region ATM Data Exchange Process" in order to ensure better coordination between ANSPs and improve ATS planning, considering the current available tools and capabilities within the MID Region.

5.8 The meeting noted the development of "MID ATM Operational Data Exchange Process", as at **Appendix B**.

5.9 The meeting agreed to conduct a breakout session to brief and familiarize the nominated Focal Points (FPs) from the States with the details included in the process, as well as their responsibility to gather the data at National level, to be presented in the Coordination meetings, which will be periodically organized by the MID Office. The breakout session was conducted on **26 May 2021, 0800UTC,** before the second day of the ATFM TF/5 meeting, in participation of the Chairperson and nominated State FPs.

5.10 During the briefing in the breakout session, the "MID ATM Operational Data Exchange Process", **at Appendix B**, was presented in detail, including the responsibilities at National and Regional levels, and the data collection forms. The meeting agreed that at the current stage, the most essential data will be provided to be exchanged, in particular those with direct impact to the airspace capacity (i.e. NOTAMs, information related to route structure, closure of certain areas, Runways, flow restrictions, calibration flights, major training exercises…).

5.11 The meeting noted the establishment of the Group "OPSDataEX" under ICAO MID Secure Portal website, to include both Airspace users/air operators "Intention To Operate (ITO)" plans and the Airspaces data.

5.12 The States nominated focal points were invited to add the Group "OPSDataEX" to their profile in the ICAO secure portal website.

5.13 The meeting urged the Airspace users to continue providing the Airspace demand data/Intention To Operate (ITO) periodically to be posted on the ICAO MID Office Secure Portal, to enable the States/ANSPs to optimize the planning of the ATS units and manage the Airspace capacity, and to provide the MID States/ANSPs with a forward looking demand prediction.

5.14 The meeting emphasized that the ITO and ATM Operational Data are used solely for airspace management and ATC planning purposes, and should not be shared outside the ATM community as it contains operational and financial sensitive data. The access to the secure portal will be solely granted to State Focal Points by submitting the official Nomination Form.

CADENA Operational Information System (OIS)

5.15 The subject was addressed in WP/4 and PPT/4, presented by CANSO.

5.16 The meeting noted the capabilities of CANSO Operational Information System (OIS), namely the CANSO ATFM Data Exchange Network for Cooperative Excellence (CADENCE), and the successful implementation of CANSO ATFM Data Exchange Network for the Americas (CADENA).

5.17 The meeting noted the possible benefits of implementing the tool in the MID Region; as proposed by CANSO. Furthermore, the meeting noted with appreciation the offer received from CANSO, for the basic tool, and the possibility for upgrades/customization.

5.18 The meeting agreed to implement the "MID ATM Operational Data Exchange Process" (Para 5.6 above), with the available basic tools, as a start. The progress will be evaluated at a later stage, to ensure establishing capabilities and expertise within the MID Region, to assess the need for a more advanced tool, in order to be implemented and customized according to the National and Regional needs.

FIFA World Cup 2022 Framework: FWC 2022 RVSM Airspace Assessment

5.19 The subject was addressed in WP/5, presented by the Secretariat on behalf of the MIDRMA. The meeting recalled MIDANPIRG/18 Conclusion 18/30, related to the development of RVSM Airspace Assessment related to FWC 2022 forecasted air traffic based on the worst-case scenario.

5.20 The meeting noted the development of the "FWC 2022 RVSM Airspace Assessment" by MIDRMA, at **Appendix C**. The meeting appreciated the efforts made by the MIDRMA team and the Secretariat in the development of such an assessment, using the capabilities, tools and expertise available within the MIDRMA. Additionally, the criteria established in the development of forecasted traffic, which would be used as basis for any future similar RVSM route structure assessment.

5.21 MID States were invited to take note of the results in the FWC 2022 RVSM Airspace Assessment related to their FIRs/Airspaces, and to take actions accordingly.

5.22 The meeting noted the concern highlighted by the MIDRMA regarding the traffic movements in the lower Airspace, related to traffic climbing and descending bound from/to Doha TMA below the RVSM airspace and traffic exchange between the nearby destinations. The meeting invited Qatar to consider assessing the forecasted traffic movements below the RVSM airspace and the need to implement ATFM measures with the adjacent FIRs/Airspaces.

FIFA World Cup 2022 Framework: FWC 2022 ATFM CONOPS

5.23 The subject was addressed in WP/6 and PPT/6 presented by FWC 2022 TF Chairman/Qatar.

5.24 The meeting noted the progress made by Qatar in the development of "FWC 2022 Operational Plan and roadmap" along with FWC 2022 ATFM implementation in line with the MID Doc. 014: MID Region ATFM CONOPS V1.0, at **Appendix D**.

5.25 The meeting agreed that, in coordination with the FWC 2022 TF Chairman, ICAO MID to circulate the FWC 2022 Operational Plan to MID States, ATFM TF members and the FWC 2022 TF teams members, to provide feedback and comments; in order to present it to the ATM SG/7 (scheduled in November 2021) to start the implementation phase.

5.26 The meeting invited States to support the implementation of the FWC 2022 Operational plan and the tasks of the FWC 2022 Operational Committee established by Qatar.

Follow-up on MIDANPIRG CART Implementations "Plan of Actions"

5.27 The subject was addressed in WP/7, presented by the Secretariat.

5.28 The meeting recalled that MIDANPIRG/18 Conclusion 18/8 related to the endorsement of MID CART Implementation "Plan of Actions" and urged States, ANSPs, Airspace users, Airport Operators and all concerned stakeholders to support the implementation of the Plan of Actions and exchange relevant operational data.

5.29 The meeting noted with appreciation the alleviation of unrequired ATFM measures during the period of low traffic related to COVID-19 in the MID Region, in particular Oman, Saudi Arabia and UAE, and invited MID States to assess the implemented measures according the recent Air Traffic demand.

5.30 The meeting agreed that, ICAO MID Office, in coordination with Stakeholders/IATA, to organize workshop/webinar "Flight Planning System" capabilities.

5.31 The meeting agreed that the MID Office provide a Regional standardized ATFM related publication templates, to harmonize publications in the MID Region.

5.32 MID States/ANSPs were invited to actively participate in the ATFM webinars "Flight Planning System capabilities" and to use the MID Region harmonized/standardized ATFM related publications.

Update of the ATFM Action Plan

5.33 The subject was addressed in WP/8 presented by Secretariat. The meeting reviewed and updated the "Action Plan for the implementation of ATFM in the MID Region", as at **Appendix E**.

AGENDA ITEM 3: FUTURE WORK PROGRAMME

5.34 The subject was addressed in WP/9, presented by Secretariat.

5.35 The meeting reviewed and updated the ToR of the ATFM TF, as at **Appendix F**.

5.36 The meeting noted that the ATM SG/7 meeting is planned in November 2021, and the FWC 2022 TF/6 meeting is planned during Q4-2021 according to the progress of development of the FWC 2022 Operational plan and roadmap.

5.37 The meeting agreed that the ATFM TF/6 meeting will be held virtually during Q4-2021, after FWC 2022 TF/6 and before ATM SG/7 meeting, in order to capture the tasks emanating from the FWC 2022 TF/6 related to ATFM implementation. The exact dates will be determined by the ICAO MID Office in coordination with the concerned chairpersons.

AGENDA ITEM 4: ANY OTHER BUSINESS

5.38 India Airports Authority presented IP/3, related to the "Flight and Flow Information for a Collaborative Environment (FF-ICE) for ATFM" to indicate the benefits and role of FF-ICE in future Air Traffic Flow Management implementation.

5.39 GACA/SANS presented PPT/6, related to the “Flights resumption highlights by Saudi Arabia”, to share the experience of GACA/SANS activities and preparedness for the predicted air traffic related to the resumption of national carrier flights, amid COVID-19.

6. CLOSING

6.1 In closing, the Chairman thanked the participants for their attendance, excellent cooperation and contribution to the meeting.

6.2 The participants thanked ICAO for organizing such a fruitful meeting.

INTERNATIONAL CIVIL AVIATION ORGANIZATION

MID REGION

AIR TRAFFIC FLOW MANAGEMENT

CONCEPT OF OPERATIONS

Version 1.0 Feb 2021

This document was developed by the MIDANPIRG Air Traffic Flow Management Task Force (ATFM TF) and reviewed by the ATM SG.

Approved by MIDANPIRG/18 and published by the
ICAO MID Office, Cairo

Table of Contents

1. Overview

Concept Development and references

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

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

Fundamental Concept of ATFM

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

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

ATFM and Collaborative Decision-Making

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

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

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

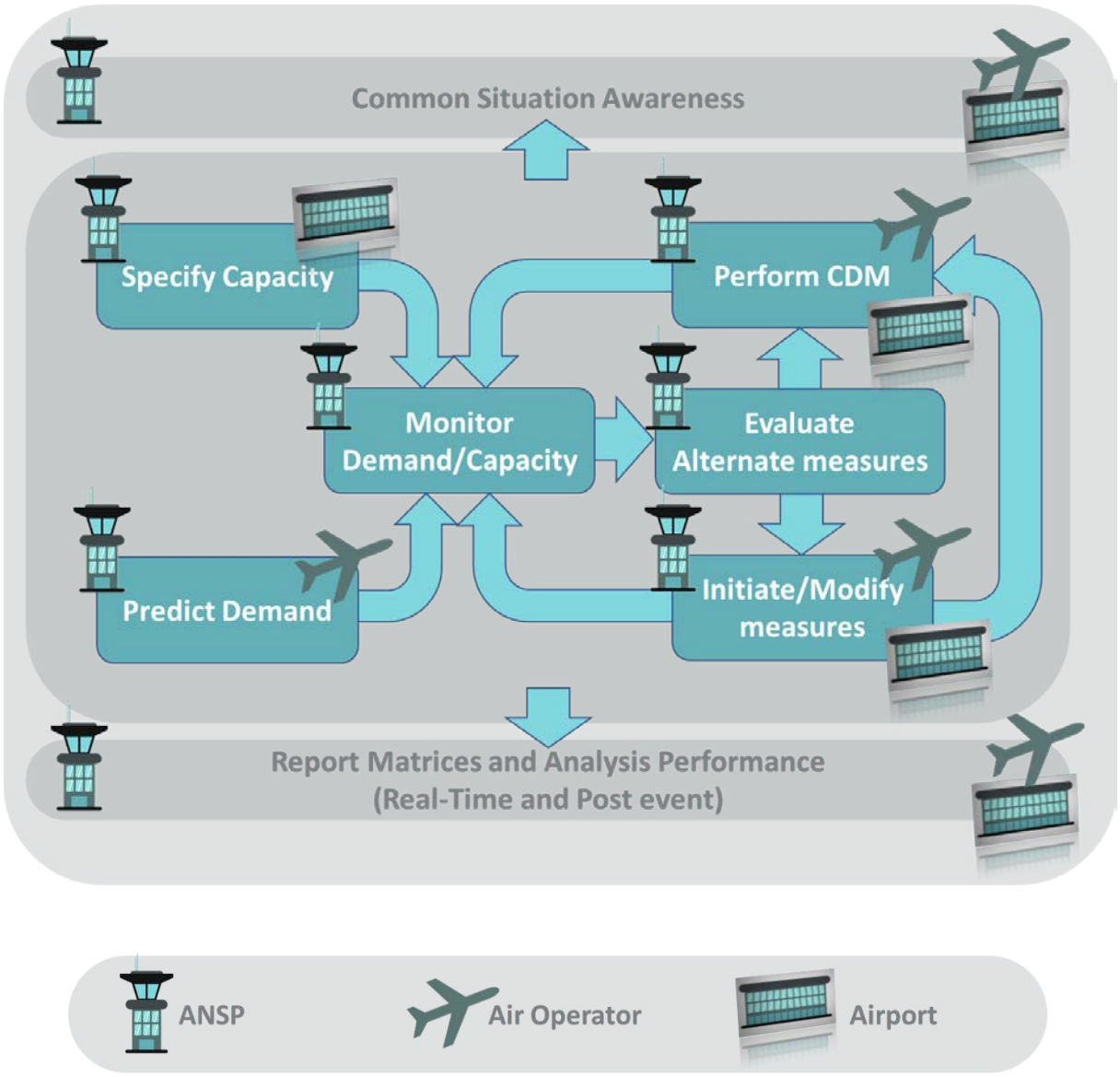

Figure 1: ATFM/CDM Functions

2. Scope

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

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

Document Overview

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

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

The document has the following Sections:

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

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

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

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

3. Current Operations in the MID Region

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

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

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

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

this challenge and effectively apply ATFM measures to flights operating into constrained airports and airspace, while operating from airports or in the airspace of a different control authority.

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

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

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

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

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

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

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

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

Successful Implementation Example 2: ATFM in Australia

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

(e.g., substitutions and cancellations).

Successful Implementation Example 3: ATFM in Japan

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

4. Concept – Regional ATFM

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

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

Concept Overview

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

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

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

distances. However, the Regional ATFM concept, which aims to address cross-border ATFM, includes short- and long-haul international flights to achieve optimized demand/capacity balancing at constrained resources.

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

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

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

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

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

Delay Absorption Intent

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

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

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

- **Airborne Delay Intent**: Delay intended to be taken efficiently during the cruise portion of the flight. For flights that are airborne or will soon be airborne when the ATFM measure is implemented, all of the program delay is assigned to the

Airborne Delay Intent. The ability to absorb program delay in the air is not part of any current operational ATFM system.

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

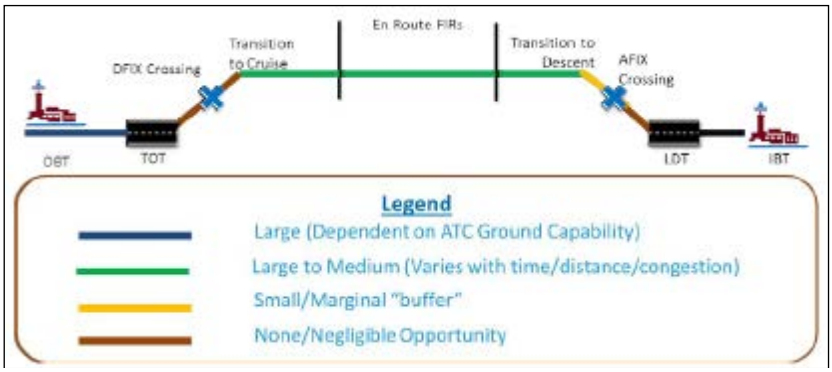

Figure 2: Opportunity for Absorption of Delay per Phase of Flight

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

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

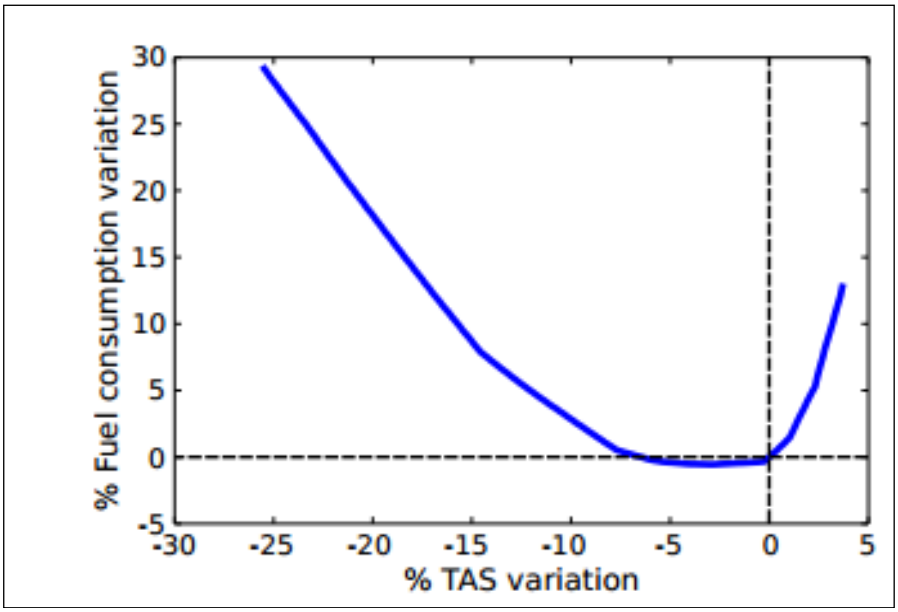

Figure 3: Fuel consumption variation for A320 Rome-Paris, F320, Mach 0.78, Cost Index 25 [Muñoz 2013]

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

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

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

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

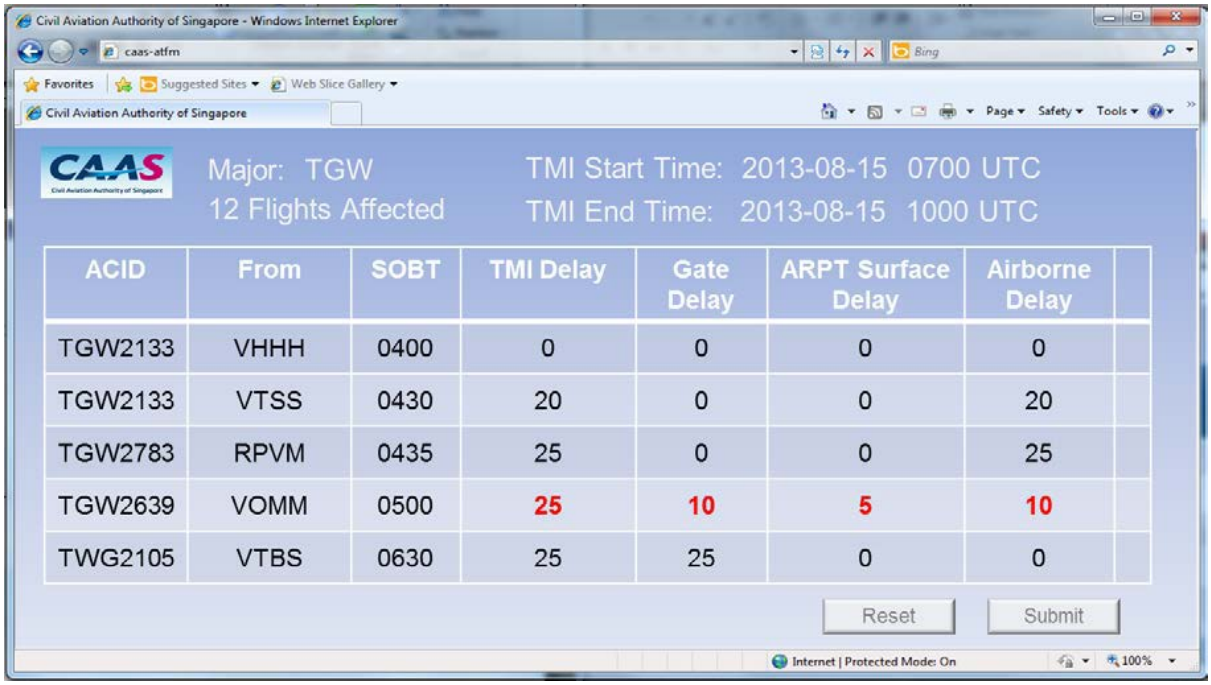

Figure 4: Example of web-based interface for delay absorption intent.

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

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

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

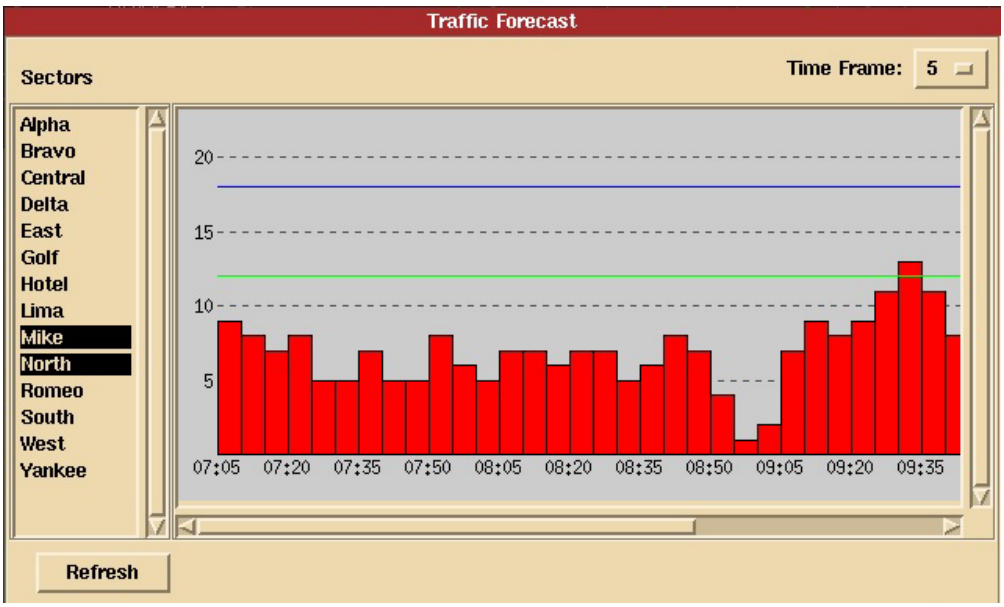

Figure 5: Example of capacity and demand

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

Initiating an ATFM measure

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

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

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

Maximum Delay concept

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

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

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

Collaborative Decision-Making

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

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

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

Compliance

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

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

4.32 Compliance is measured at a fix rather than at landing as flights have more control over

meeting a fix crossing time prior to initiated tactical ATC sequencing into the arrival airport. ANSPs specify the fixes that are to be used both for ATFM measures and measuring compliance. Flights will attempt to arrive at this fix within a compliance window.

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

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

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

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

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

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

Post-Operations Analysis

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

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

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

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

Table 1: General Scenario Metrics

Metric	Description
Number of Evaluations	Total number of CDM stakeholders participation organized before implementation an ATFM measure.
Number of Substitutions	Total number of flights that were substituted
Number of Inter-Operator Slot Exchanges (ISEs)	Total number of ISEs
Number of Bridged Flights	The number of flights that were bridged
Number of Cancellations	Total number of canceled flights for a given time period
Substitution Savings	The amount of the savings in minutes of flights that move forward as a result of a substitution
Bridging Savings	The amount of the savings in minutes of flights that move forward as a result of being bridged
Number of Delay Modifications	Number of modifications made by the Aircraft Operator to their flight event times to show flight would be delayed

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

Table 2: CDM Action Metrics

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

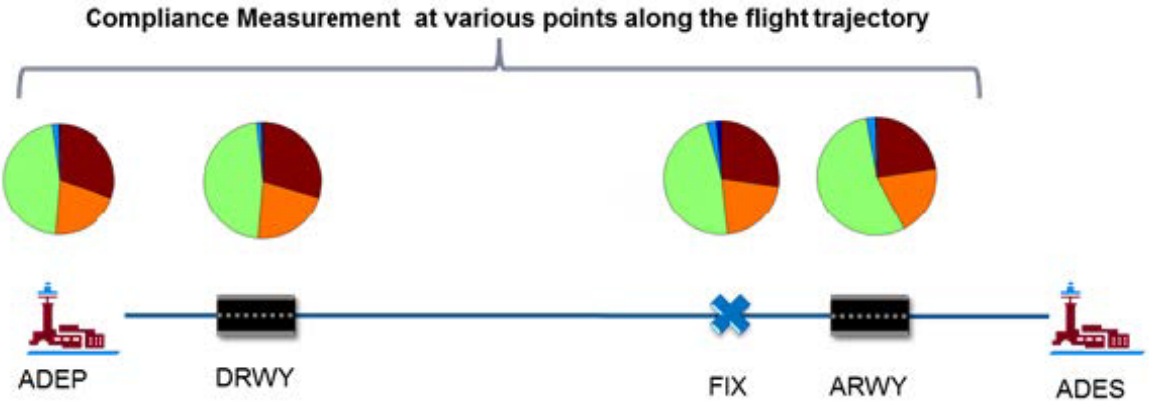

Figure 6: Compliance Metrics

Stakeholder Roles and Responsibilities

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

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

Flow Management Position

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

4.45 The main responsibility of the FMP is to monitor the demand by viewing flight data from the ATFM System and comparing that to the arrival capacity of the airport(s) in their jurisdiction. The FMP collaborates with relevant stakeholders to update the capacity (i.e. AAR) when there is a constraint such as predicted weather or resource maintenance/outage. Whenever the predicted demand exceeds the capacity, the FMP shall organize CDM stakeholder's virtual/teleconferences to determine the best solution for the problem, which will likely involve implementing an ATFM measure. The FMP will have the ability to model various initiatives to smooth the imbalance and, in coordination with local stakeholders, select the solution that suits the best to meet the operational objectives set by the CDM

stakeholders. Additionally, if multiple ANSPs in the region have an ATFM system, the FMP may coordinate with FMPs of other ANSPs to establish the best regional solution taking all the regional requirements into consideration. While ANSPs may have different ATFM systems, they will transmit and receive data in a common way, thereby enabling all regional FMPs to share the same operational information.

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

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

Aircraft Operators

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

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

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

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

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

Airport Operators – Departure Airports

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

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

for absorbing delay on the ground whenever necessary.

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

Airport Operators – Arrival Airports

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

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

Airport Collaborative Decision Making (A-CDM) Interface

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

ATC – Departure Tower

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

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

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

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

ATC – Arrival Tower

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

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

ATC – Approach Control Unit (APP)

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

4.65 Approach Control Unit (APP) will have no requirement to change their operational procedures to accommodate flights subject to an ATFM measure. Pilots may request an altitude or speed change in order to comply with their delay intent distribution. The ATC will follow normal ATC

operating procedures before approving these changes. Education on the fundamental principles of the Regional ATFM concept will serve to increase controllers' awareness.

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

ATC – Area Control Centre (ACC)

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

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

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

Proposed Changes Resulting from Implementation

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

Technology Changes

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

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

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

Policy Changes

4.74 Policy changes associated with Regional ATFM include involvement in teleconferences, which will increase information sharing compared with current-day operations. CDM stakeholders may participate in scheduled teleconferences to discuss the plan for the day as well as to

review operations on the previous day. The stakeholders calling into the scheduled teleconferences include the FMP, Aircraft Operators, neighboring ANSP facilities, the ATC tower(s), and the local Airport Operator. If necessary, the FMP will coordinate with the FMPs of other regional ANSPs in a separate teleconference. The FMP may also convene and chair ad-hoc teleconferences to handle unforeseen demand and capacity imbalances.

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

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

Justification for Changes

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

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

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

Table 3: Changes and their Justifications Arising from the Concept

Impacts During Deployment

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

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

Multi-Nodal Concept

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

can be adapted. **Figure 7** provides an example of the networked ATFM nodes under the MID Regional ATFM concept.

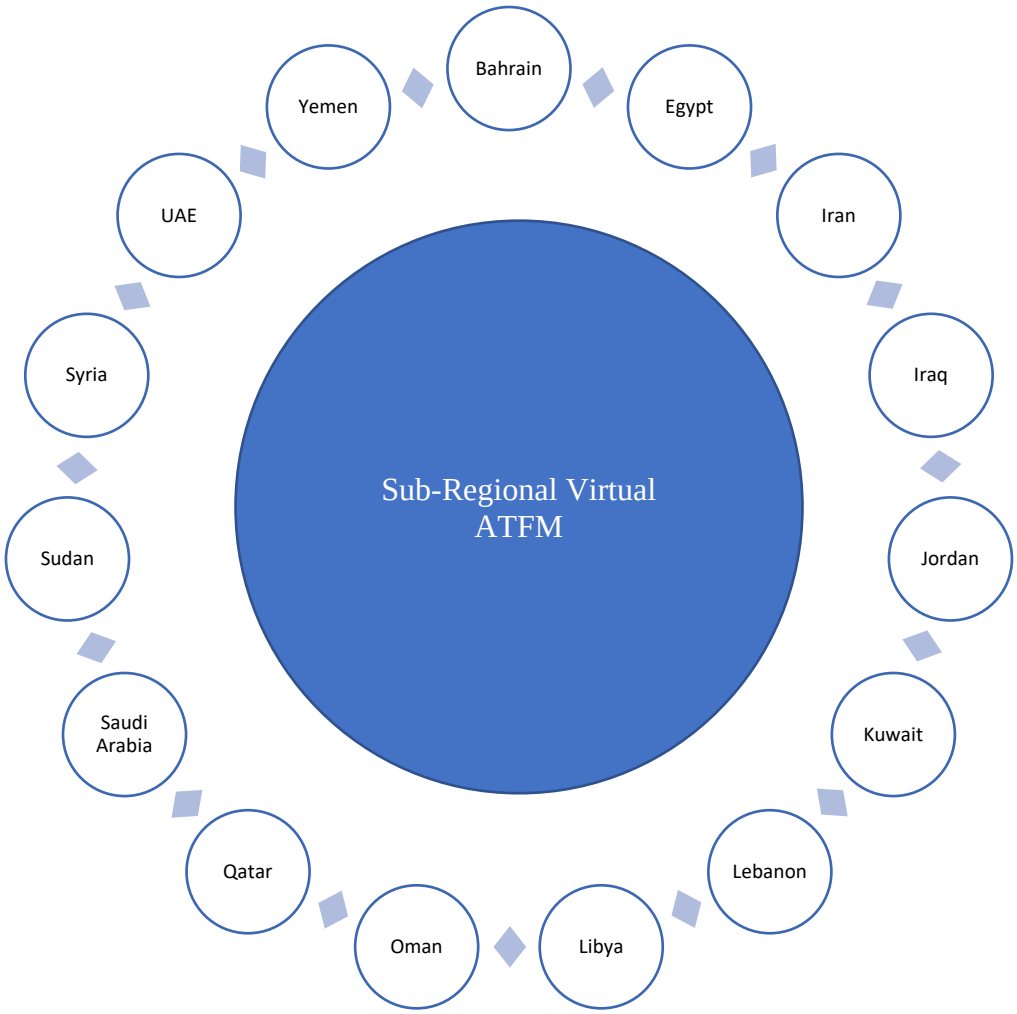

Figure 7: Distributed Multi-nodal ATFM Network

Implementation Considerations

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

Compliance Handling

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

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

- Sharing of compliance statistics with stakeholders

  - Advantages

- Promotes CDM principles through the transparency of data;
- Aircraft Operators will strive for high compliance to maintain/improve the airline's reputation;
- Flights that are unable to absorb delay (e.g. VVIP flights and emergencies) will not be penalized for non-compliance.

- Disadvantages
  - No direct consequences for non-compliance

- Departure ATC prevents pushbacks or departures if flights will be non-compliant with their assigned CTOTs
  - Advantages
    - Little if any non-compliance with CTOTs
  - Disadvantages
    - Increased workload for ground movement controllers
    - Operational challenges associated with pilots absorbing delay at a holding pad
    - No penalty for non-compliance with intended airborne delay

- Deprioritize non-compliant flights in the arrival airspace
  - Advantages
    - Equitable amounts of delay taken for compliant and non-compliant flights
    - Compliant flights are not penalized when other flights are non-compliant
  - Disadvantages
    - Technical and procedural challenges associated with integrating the ATFM system and AMAN
    - Increased workload for approach controllers

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

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

an ATC constraint. Pilots generally have enough control over the flight to prevent an early arrival.

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

Performance Metrics and Post-Operational Analysis

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

- Program Delivery – Shows how effective the ATFM measure was at balancing the capacity and demand. It compares the expected demand after the ATFM measure was implemented with the actual demand. This is useful in identifying periods of non-compliance.
- On-Time Performance Metrics – Typically ATFM only considers whether ATFM measures were successful in balancing demand with resource capacity. On-Time performance represents another aspect of national airspace operations that is a good indicator of efficiency and is directly tied with impacts to the passengers. It is important to track the impact on passengers because it gives an insight on whether ATFM measures were able to provide benefits to more passengers rather than more aircraft.
- Environmental Metrics – Shifting air delay to ground delay has a positive impact on the environment through emissions reduction. Fuel burn metrics could be developed to study and track positive impacts of implementing an ATFM measure. The metrics could also support achieving the environmental goals any government may have.

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

Maximum Delay

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

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

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

Future Considerations – Role of En-route ATC

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

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

5. Operational Scenario

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

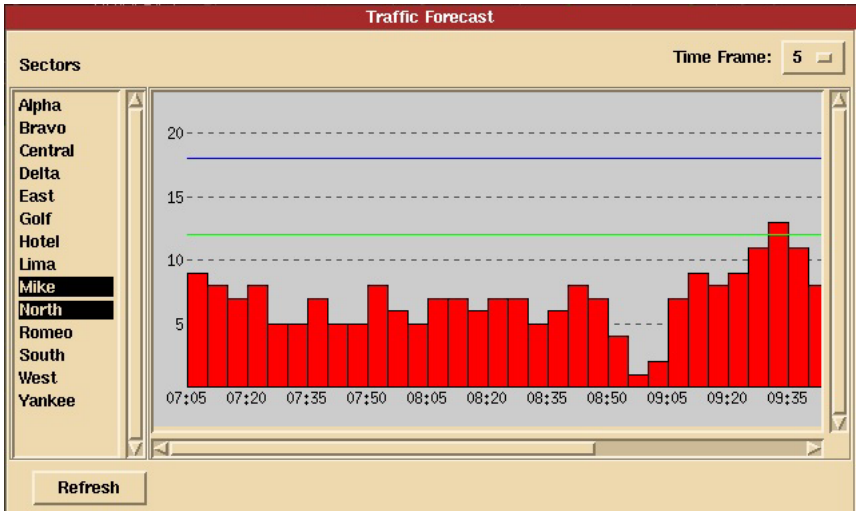

Figure 8: Demand and Capacity Prediction

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

- AAR based on the capacity reducing event: 25 between 0500 and 1100 UTC
- ATFM measure start time: 0500
- ATFM measure end time: 1100
  - Flights with estimated landing times between the start and time of the program will receive a slot, or Calculated Landing Time (CLDT), at the arrival airport.

- Non-exempt flights: 15 major airlines from the region
  - The major airlines will attempt to comply with their assigned slot times, regardless of their departure airport.
  - The few remaining flights from other airlines are exempt and will receive priority in slot assignments.
  - Exempt/Non-exempt status can also be set for specific airports and flights and based on distance.
- Active Flight Exemption Horizon: 1 hour
  - Airborne flights estimated to land within the next hour will be exempt from the program and receive priority in slot assignments because they will not be able to efficiently absorb any delay.
- Required Notification Time: 1 hour
  - The default intent for pre-departures that are estimated to depart within the next hour is to absorb all of their delay in the air because the FOCs require approximately one hour to notify pilots of the ATFM measure.

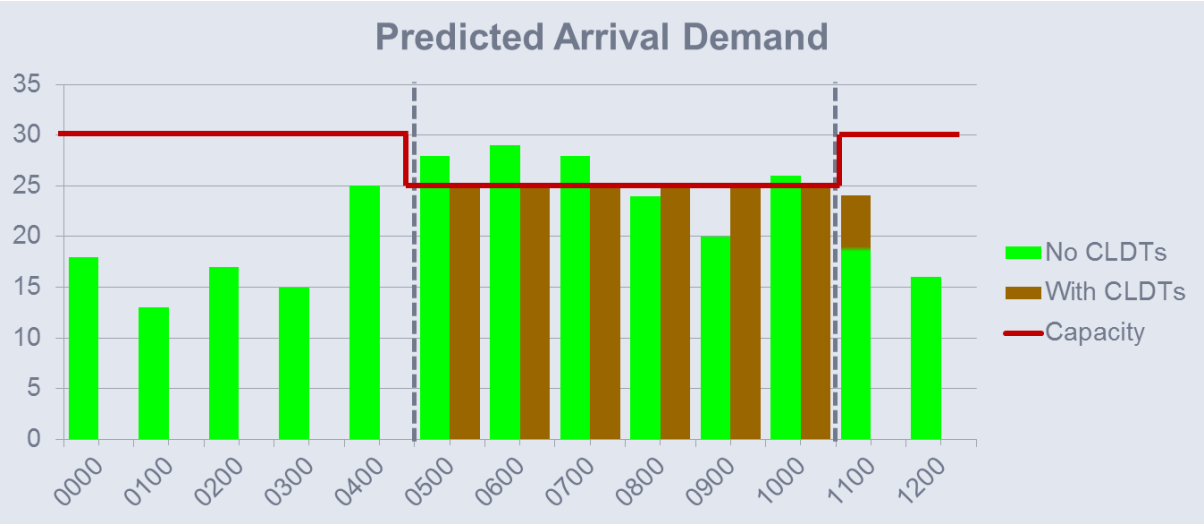

Figure 9: Modelled ATFM program

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

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

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

5.5 Aircraft Operators have the flexibility to distribute the delay intent of pre-departure

flights into three attributes: Intended Gate Delay, Intended Surface Delay and Intended Airborne Delay. In certain cases, Aircraft Operators will coordinate gate and surface delay intents with the Airport Operator to manage gate turnaround times and gate conflicts.

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

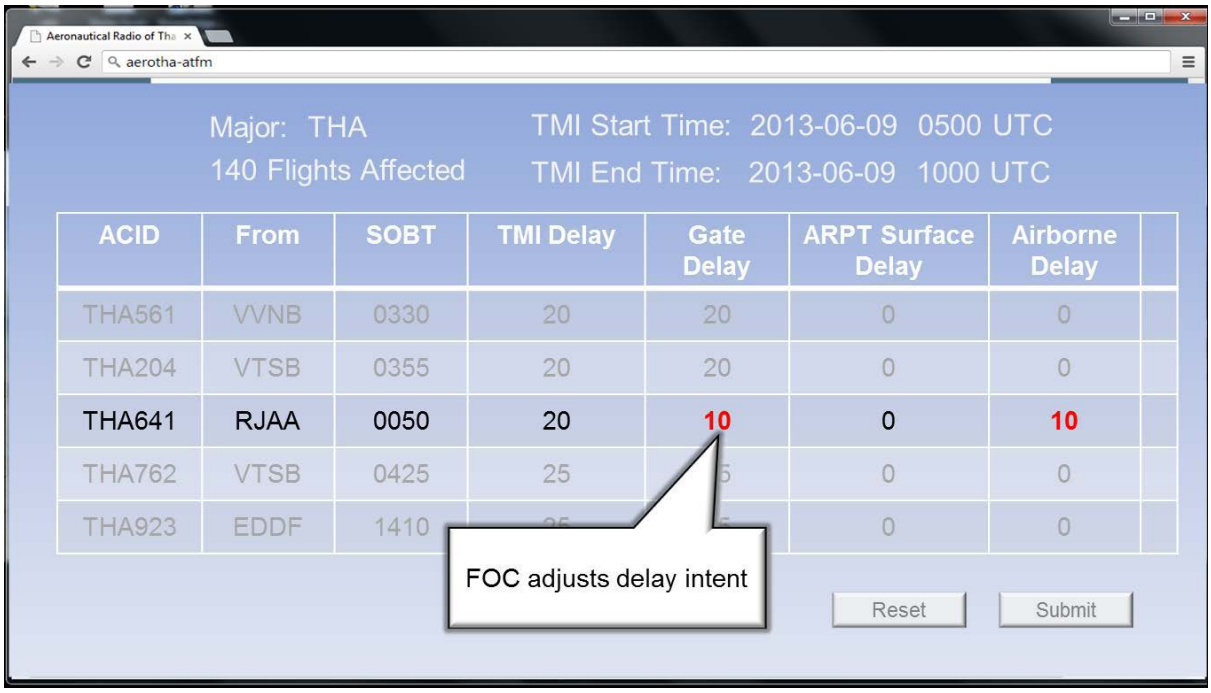

Figure 10: Delay Absorption Intent

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

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

Table 3: the updated DL-times

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

Pre-Substitution

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

Post-Substitution

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

Figure 11: Pre- and Post- Flight Substitution

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

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

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

6. Expected Benefits of the Concept

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

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

- A data platform that integrates various flight data sources and provides common situational awareness to the stakeholders.
- An environment in which ATFM measures and other operational procedures can be improved through post-operational trend analysis.

-END-

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Attachment A: ATFM Background

ATFM Measures

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

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

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

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

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

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

A.5. It is recognized that airborne holding is a last-resort measure, as in-flight holding places a hefty burden on both Airspace Users and ANSPs. In the event that the arrival of a given flow of traffic needs to be delayed, measures such as slowing aircraft well before the planned top of descent, and making use of the required time of arrival (RTA) have proven to be effective. Most of these techniques make good

use of aircraft capabilities and usually reduce operating costs and environmental impacts without increasing the workload of the ATC.

ICAO Guidance on ATFM

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

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

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

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Attachment B: Participation Analysis – Changi Case Study

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

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

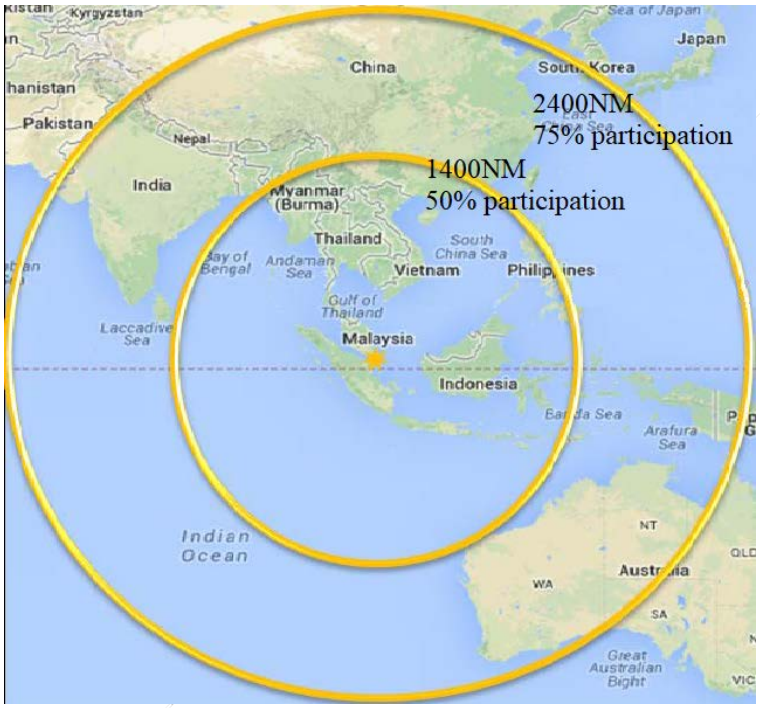


Figure B1: Airports within Participation Radius

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

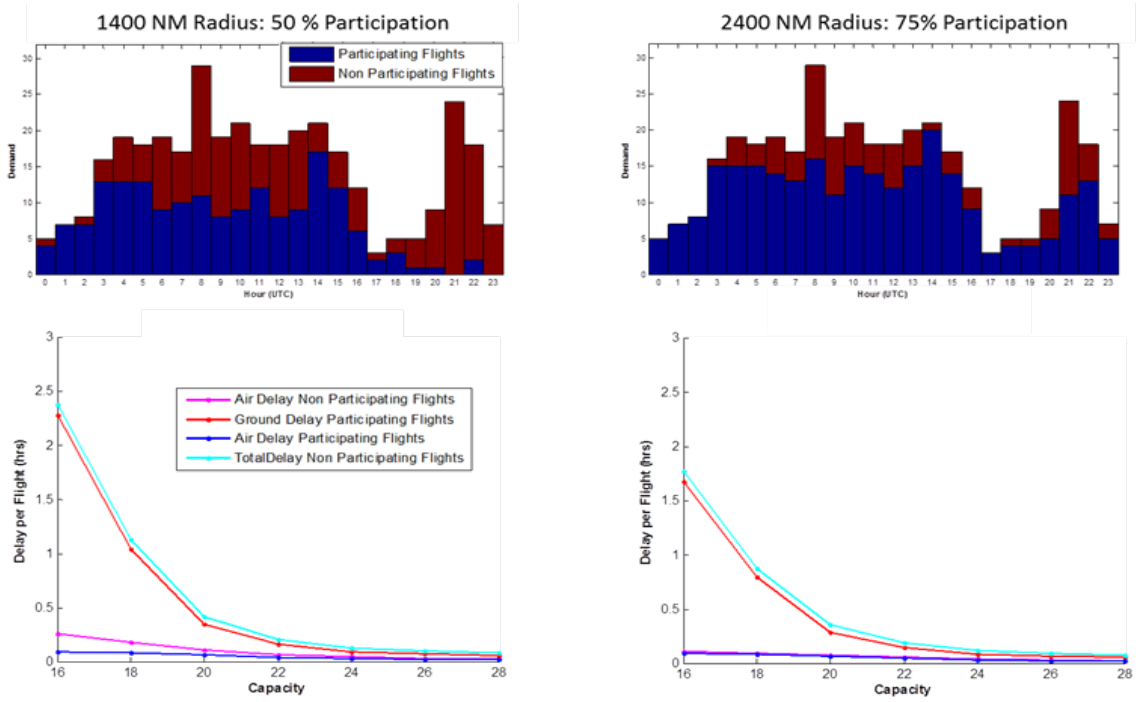


Figure B2: Participation Analysis

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

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

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

INTERNATIONAL CIVIL AVIATION ORGANIZATION

ICAO MID

MID REGION ATM Operational Data Exchange Process

Edition 1.0, Feb 2021

INTRODUCTION

1. The intention of this simplified CDM procedure is to provide effective process for air navigation service providers (ANSPs) in order to carry out cross-border coordination with their adjacent ANSPs taking into consideration the circumstances that would have impact on traffic flows. This includes going into a contingency situation or returning to normal operations.

2. The main objective of the procedures, however, is to provide a better collaborative platform for the coordination and management of traffic during the disruption caused by the COVID-19 Pandemic. These procedures would also support a smooth and less challenging return to normal operations. In this regard, the templates at Appendices A and B were developed to support coordination between adjacent area control centers (ACCs).

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

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

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

a) National Level.

b) Cross border between adjacent States.

c) Multi-States Collaboration (Optional).

d) Regional. Which could be part of the contingency coordination teams (CCTs) framework or similar mechanism.

Note 2: Contingency Coordination Teams (CCTs) terminology utilized on these pages represent: contingency coordination teams, regional contingency groups, contingency and emergency response groups or any similar framework.

National Level

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

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

7. The CDM Committee should hold frequent (preferable daily) coordination meetings/telecoms to

address the operational status and agree on the measures that should be implemented to mitigate the associated challenges.

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

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

Cross-border Coordination

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

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

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

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

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

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

- optimized implementation of ATFM measures due to improved view of demand and capacity predictions.

15. The Table at **Appendix A** presents a simplified ATM/CDM Telecom Template to facilitate the daily discussions between adjacent ACCs or ATFM units during the COVID-19 Pandemic and preparation for the resumption of normal operations. A more detailed Template for teleconferences during normal situation (after the pandemic) is provided at **Appendix B**. The Table Templates would form the basis for the development of ATFM Daily Plans.

Multi States Conference Calls:

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

Regional Level

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

18. Regional Offices organize periodic teleconferences, as deemed necessary, (preferably on weekly or bi-weekly basis) with States and Organizations concerned. During these regional discussions, the relevant ICAO State Letters as well as the matters reported by States and the challenges reported by airspace users should be addressed.

19. States should coordinate with their respective ICAO regional offices to provide, on a periodic basis, the measures undertaken with respect to COVID-19 Pandemic. Regional offices will follow-up in this regard.

20. The following websites provide supporting material on the APAC COVID-19 ATM/ATFM Status Update, EUROCONTROL Network Operating Plan-COVID-19 Business Continuity Plan and CANSO – Latin America and Caribbean Region COVID-10 Limitation Update, and should prove useful to all States/regions:

- APAC: https://www.icao.int/APAC/Pages/COVID-19-BCP.aspx
- EUR: https://www.public.nm.eurocontrol.int/PUBPORTAL/gateway/spec/index.html
- CANSO: https://www.cadenaois.org/vpublic_advisorynew.jsp

Note 3. A State could be assigned as a Collection Point for a group of States to consolidate the updates/inputs and provide them to the accredited ICAO Regional Office.

21. Also reference is made to the following links of ICAO, CANSO, EASA, IATA and IFATCA related to COVID-19:

ICAO https://www.icao.int/safety/COVID-19OPS

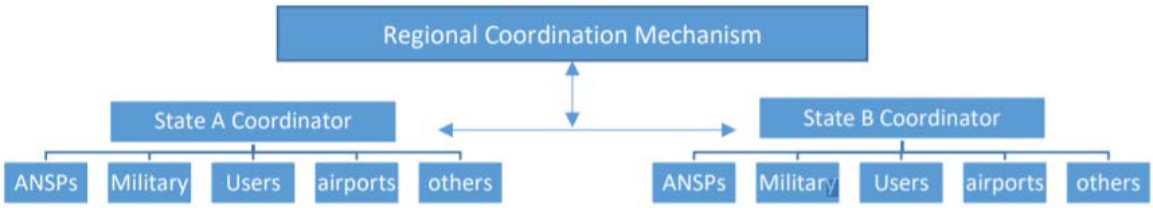
CANSO https://www.canso.org/covid-19-ensuring-continuity-ats-service-globally

EASA https://www.easa.europa.eu/the-agency/coronavirus-covid-19

IATA https://www.iata.org/en/programs/safety/health/diseases/government-measures-related-tocoronavirus

IFATCA https://www.ifatca.org/covid-19

22. The chart below illustrates the coordination process:



Recovery Phase:

23. In preparation for the recovery phase, adequate time for the gradual return of traffic should be anticipated taking into consideration the following:

a) ATC capability to handle again an increased amount of traffic after the recess period. This includes the measures taken to ensure continued competency, qualifications and skills of air traffic controllers;

b) status of aerodromes services/facilities and CNS/ATM infrastructure;

c) availability of adequate number of ATC staff ready to handle the expected increase of traffic within the en-route and terminal airspaces considering the prevention measures that might be in place;

d) availability of required air navigation services supporting ATM operations;

e) agreement between adjacent States/ANSPs on necessary ATM measures/arrangements to be implemented to ensure a safe, smooth and orderly transition to that experienced prior to the COVID-19 Pandemic;

f) development of regional transition plans for the resumption of normal operations in coordination with all regional stakeholders that should be based on the data provided by airlines and ANSPs:

   i. airlines, through IATA regional offices, could use the template at **Appendix C** to provide their planned/forecasted flights for each FIR; and

   ii. the excel sheet at **Appendix D** could be used by ANSPs to count the number of traffic at each entry/exit point to provide a better picture on the hourly distribution of traffic. Also the sheet could be beneficial for determining the impact of rerouting traffic through comparison between the situation before and after a crisis or the implementation of ATM measures.

Also reference is made to the following link to CANSO guidance related to ATFM and A-CDM and a regional cross-border initiative:
https://www.canso.org/implementing-air-traffic-flow-management-and-collaborative-decision-making

https://www.canso.org/guidelines-airport-collaborative-decision-making-cdm-key-performance-measures

https://www.cadenaois.org/index.html

APPENDIX A

Template for Daily Teleconferences between States/ANSPs during COVID-19

	Telecom.	**Ref.**	**Date**	**Action/Remark**
1	Covering period (date and time)	From:	To:	*i.e. coming 12h, 24h, 5, 7 days*
2	Between State/ANSPs	State/ANSP A: [title] [Coordinator name] [email] [Telephone/mobile]	State/ANSP B: [title] [Coordinator name] [email] [Telephone/mobile]	
3	Greetings	---	----	
4	Brief Overview of the situation			
5	Describe the measures planned/implemented due COVID-19 and/or any changes to these measures that may have impact on traffic flow during the coming period. Consider airlines reported challenges/requirements			
6	Aerodromes specific issues affecting capacity such as VIP movements, special flights, infrastructure, weather, etc.			
7	En-route specific issues such ATM restrictions, Military operations, weather, status of CNS/ATM infrastructure, etc.			
8	Changes to Coordination Processes/Communication			
9	Preparation to the normalized situation:			
	a) ANSP readiness			
	b) Measures required during transition period			
	c) Inputs from airlines			
	d) Inputs from CCTs			
	e) Common Date of implementation and publication of NOTAM			
	f) other			
10	Other topics of mutual interest			
11	Required follow-up actions till next telecom			
12	Agreement what and who will report any relevant information or decisions to the relevant ICAO Regional Office and/or CCT			
13	Summary			

APPENDIX B

Template for Daily Teleconferences between Adjacent ACCs or ATFM units

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

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

APPENDIX C

Template for Daily traffic demand between Airspace users and ANSPs

No	Flt No.	DEP	ARR	ETD	ETA	Operating Days							FR1-FR2			FR2-FR3			FR3-FR4			FR4-FR5…			Priority/phase	Remarks
						Sundays	Mondays	Tuesdays	Wednesdays	Thursdays	Fridays	Saturdays	WP/Fix	Time	FL	WP/Fix	Time	FL	WP/Fix	Time	FL	WP/Fix	time	FL		
1																										
2																										
3																										
4																										
5																										
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17																										

APPENDIX D

Hourly Distribution of traffic on Entry/Exit points FIR

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

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

MID Region RVSM Airspace Safety Assessment Related to the Expected Traffic Growth During FWC 2022

Prepared by the Middle East Regional Monitoring Agency (MIDRMA)

SUMMARY

The aim of this study is to present to the FWC 2022 TF the expected hotspots/bottlenecks generated from the predicted RVSM traffic data for FIRs expected to be affected by the traffic growth during the FWC 2022 event.

1.Introduction:

1.1 With reference to the MIDANPIRG Conclusion 17/24 related to the MID Region RVSM Airspace safety assessment during the period of the FWC 2022 event (November – December 2022), the meeting noted that the subject has been followed up by the MIDRMA Board, the FWC 2022 TF and the ATM SG; and it was found that, the MIDRMA would be able to assess the technical risk, while the operational risk would need LHD reports, which could not be available beforehand. Therefore, it would not be possible to meet the mandate given by MIDANPIRG, through Conclusion 17/24, to identify the peak periods, hotspots, bottlenecks, etc.

1.2 MIDANPIRG was informed that, as a follow-up action and in order to find a way forward to meet the mandate given by MIDANPIRG, the ICAO MID Office organized coordination meetings with the FWC2022 TF Chairman, Qatar, the MIDRMA and the MIDRAS Developer. It was agreed that it is possible to use artificial intelligence and the available historical data related to LHD, forecasted traffic and the ATS Route Network Structure to provide probabilistic/predicted LHD reports, which will enable the MIDRMA to use the current version of the MIDRAS software to conduct the required safety assessment, as per MIDANPIRG Conclusion 17/24. MIDANPIRG/18 (Virtual, 15 – 22 Feb 2021) meeting reviewed the project proposal by the MIDRAS Developer (Cost # 25,600 USD). No consensus was reached to proceed with the proposal. Based on a proposal by the MIDRMA, the meeting agreed that the MID Region RVSM Airspace safety assessment related to the FWC 2022, be developed based on a worst case scenario (using all available historical LHD reports) for the assessment of the risk of collision due to operational errors. And agreed on MIDANPIRG Conclusion 18/30: MID Region RVSM Airspace Safety assessment related to the FWC 2022

That, the MIDRMA conduct a MID Region RVSM airspace safety assessment, to ensure that the overall risk is meeting the ICAO TLS; and identify the peak periods, hotspots, bottlenecks, etc., based on a worst case scenario, using the forecasted traffic during the FWC 2022 period and all historical LHD reports available within the MIDRMA database.

2.Discussion:

2.1 According to the proposal presented by MIDRMA to MIDANPIRG/18to conduct the assessment based in a worst case scenario, the MIDRMA requested from Qatar the forecasted traffic for landing/departing all the airports in Qatar, these data will be supplemented with the forecasted RVSM traffic for all the surrounding FIRs to Qatar including Bahrain FIR which is the most affected FIR by the event.

2.2 The MIDRMA accepted the final version of Qatar predicted traffic data on 14th March 2021 which is only 8 days to hand over the assessment to ICAO MID Office for presenting it during the FWC2022 TF/5, Virtual,23 - 24 Mar 2021. Although the time was not enough to finalize this assessment, the MIDRMA decided to proceed with the study by close coordination with the ICAO MID ATM Officer to avoid further delay.

2.3 **Forecasted TDS Received from Qatar**

a- The total predicted movements received from Qatar were **30,916**, distributed as **15,541** Departures from Qatar airports and **15,375** as Arrivals.

b- Out of the **15,541** departures from Qatar airports MIDRMA found **8,190** flights will be exiting Bahrain FIR below RVSM airspace and will not be included in the assessment for Bahrain FIR but will be used for further en-route analysis beyond Bahrain FIR, the remaining **7,351** flights were used for the analysis.

c- Out **15,375** arrivals for Qatar airports MIDRMA found **7,037** movements entering Bahrain FIR below the RVSM airspace and will not be used in the assessment for Bahrain but these movements will be used in the previous FIRs, the remaining **8,338** movements were used for the assessment.

d- The total movements to/from Qatar airports used for the assessment :

7351 + 8338 = **15,689** movements

e- MIDRMA had to correct some errors found in the received data such as wrong exit/entry flight levels and points.

2.4**Forecasted TDS Used for RVSM Airspace Safety Assessment**

a- MIDRMA decided to use the archived RVSM TDS which was received to develop SMR 2019 as the TDS for SMR 2020 was not reflecting the actual/normal traffic level for the MID Region because of the Corona Pandemic.

b- After a careful review of the traffic flow of FWC 2022, MIDRMA found that most FIRs that will be affected by this event are: Bahrain, Baghdad, Kuwait, Muscat, Jeddah, Tehran

and Emirates FIRs, while other FIRs may be affected but not as severe as those mentioned due to its proximity to Qatar.

c- MIDRMA developed a software to generate the forecasted TDS taking into consideration the following:

i. Annual traffic growth of 13%.
ii. Traffic growth for the event was calculated per day/hour/minute at each entry/exit points including departure/arrival aerodromes.
iii. Distribution of entry/exit flight levels.
iv. Distribution of entry/exit times with logic longitudinal spacing.

d- MIDRMA merged the forecasted TDS received from Qatar with the forecasted TDS developed for each FIR (after applying 39% traffic growth) based in the entry/exit points and linked all the TDS for the continuity of traffic flow in the neighboring FIRs.

2.5 Operational Error Reports – Large Height Deviations (LHDs)

a- In order to calculate the overall risk for RVSM airspace during the FWC 2022 event, the archived LHD reports received from the most affected FIRs mentioned in Para 2.4 for last three years were used to obtain the results for the worst case scenario.
Note: The level of reporting LHD in the MID region for SMR 2018 reporting period was very low.

b- Calculated technical and overall TLS for each FIR:

FIR	Technical Risk Values ICAO TLS 2.5×10^{-5}	Overall Risk Values ICAO TLS 5×10^{-5}	Remarks
Bahrain	$\mathbf{1.856\times10^{-16}}$	$\mathbf{2.916\times10^{-10}}$	Both Values Above ICAO TLS
Baghdad	$\mathbf{3.87\times10^{-12}}$	$\mathbf{1.949\times10^{-10}}$	Both Values Above ICAO TLS
Kuwait	$\mathbf{7.144\times10^{-17}}$	$\mathbf{4.672\times10^{-13}}$	Both Values Above ICAO TLS
Muscat	$\mathbf{5.617\times10^{-15}}$	$\mathbf{5.762\times10^{-10}}$	Both Values Above ICAO TLS
Jeddah	$\mathbf{2.6810\times10^{-14}}$	$\mathbf{1.067\times10^{-10}}$	Both Values Above ICAO TLS
Tehran	$\mathbf{8.358\times10^{-14}}$	$\mathbf{2.008\times10^{-10}}$	Both Values Above ICAO TLS
Emirates	$\mathbf{2.715\times10^{-14}}$	$\mathbf{3.13\times10^{-13}}$	Both Values Above ICAO TLS

c- The above results reflect ICAO's TLS for assessing RVSM safety based on forecasted traffic without knowing whether the traffic volumes will return back to normal or not as the MID region lost approximately 68% of RVSM traffic during the SMR 2020 reporting period compared to SMR 2019 due to the Corona pandemic.

d- The calculated results could be severely affected if more LHD reports are received for the next period which could increase the risk values. Therefore, the above mentioned results should be considered as hypothetical results without giving any guarantee in case these results deteriorate or even improve.

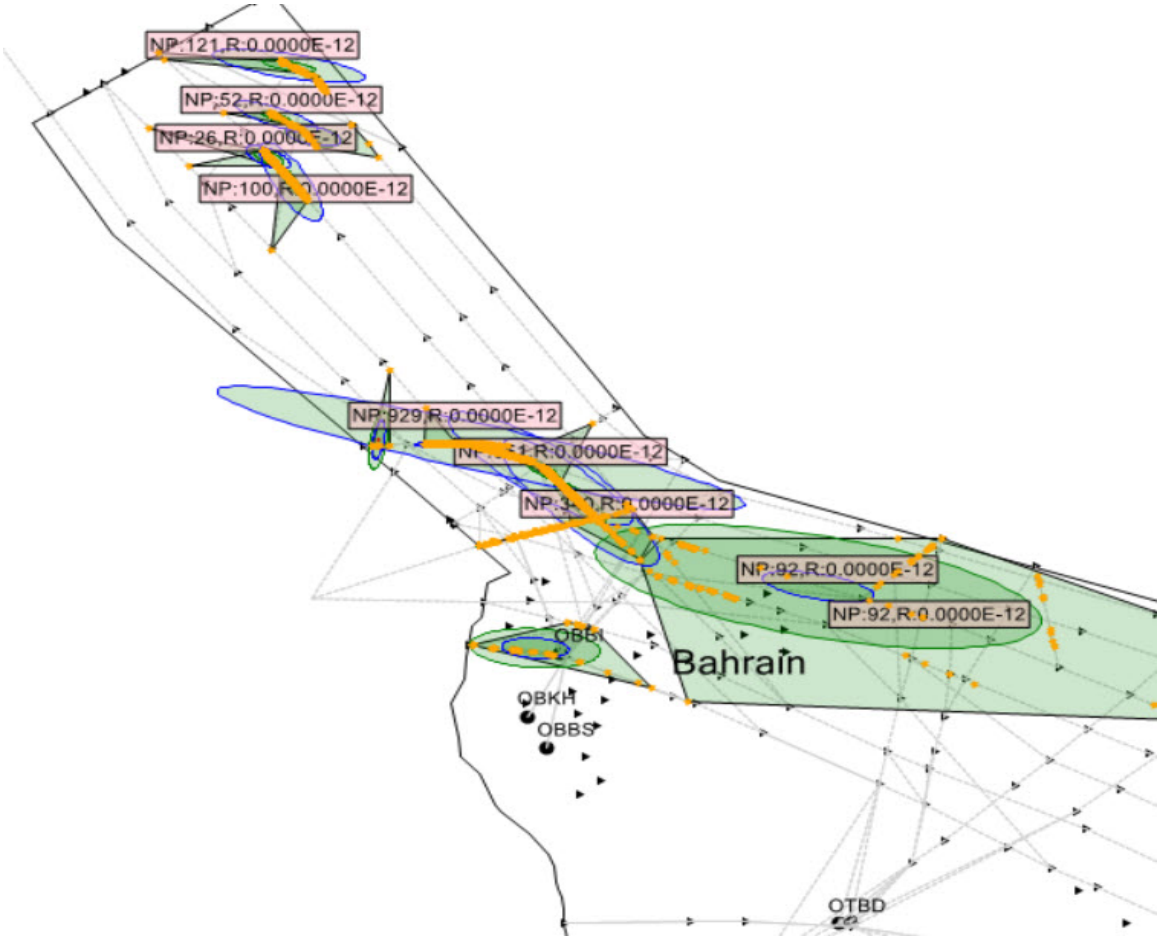
3. MIDRMA Observations for the ICAO MID RVSM Airspace ONLY.

3.1 Bahrain FIR

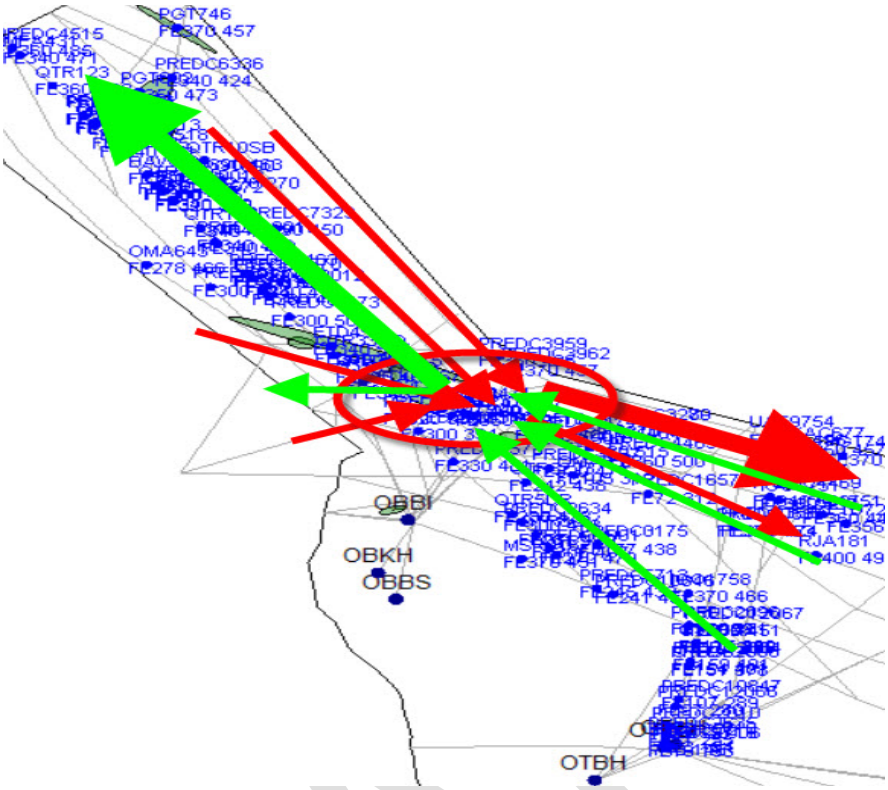
a. Bahrain FIR considered to be the most affected FIR in the Middle East region during the FWC 2022 event because large number of Qatar airports landers/departures will be either descending/climbing phase and will be mixed with departures/arrivals for adjacent aerodromes such as Bahrain and Dammam which will cause air traffic congestion below the RVSM airspace and might have serious impact to RVSM airspace as well.

b. The RVSM airspace to the north and north east of Bahrain VOR is the converging /diverging airspace of nearly all the overflying traffic within Bahrain FIR, this airspace formed one of the most complicated hotspots observed in this study (also detected during the annual MID RVSM SMRs) which caused the passing frequency to increase well above the normal figures for the annual SMRs.

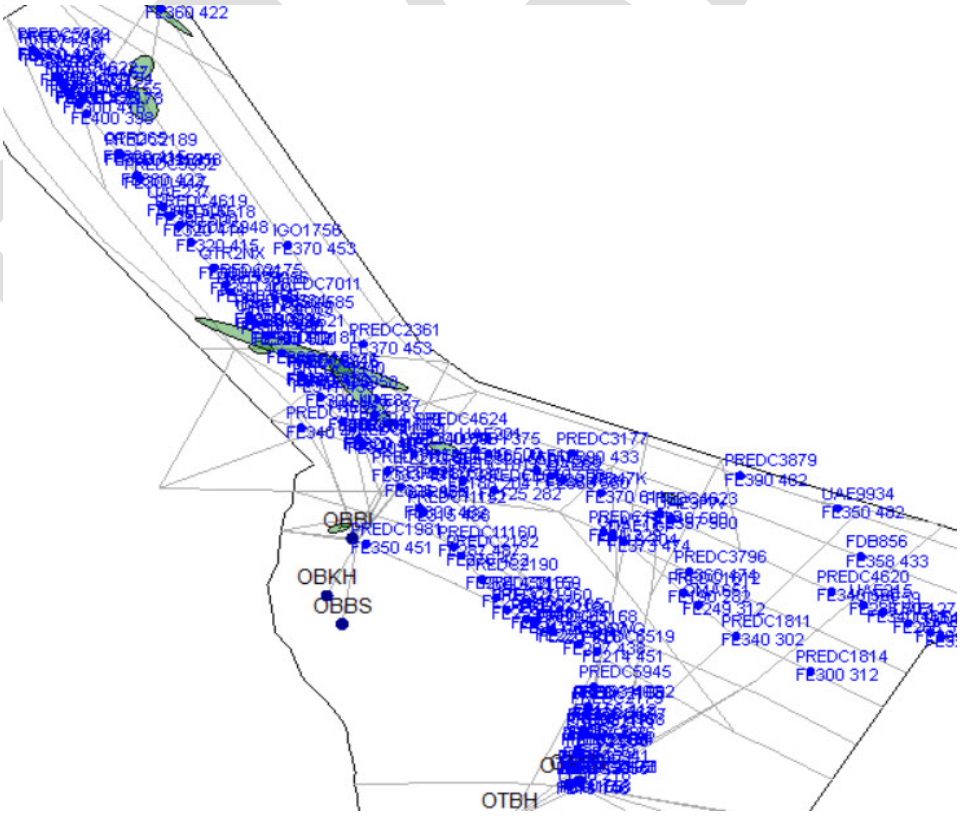
c. Map 1 below reflects the hotspots of Bahrain FIR which are marked by orange color along the traffic congestion.



Bahrain FIR Hotspots – Map 1



Bahrain FIR - Traffic Flow Simulation 1



Bahrain FIR - Traffic Flow Simulation 2

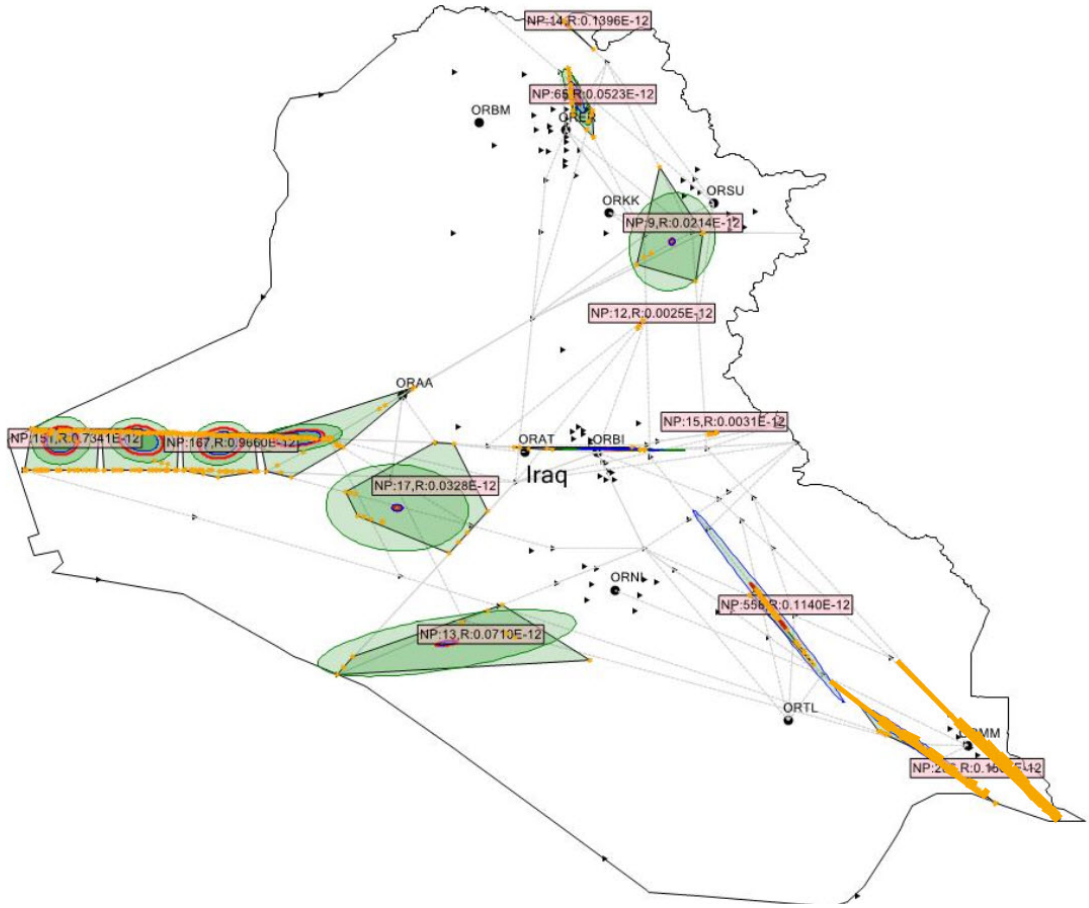
3.2 Baghdad FIR

a- The extreme majority of the traffic flow in Baghdad FIR are flowing North to South and vice versa with some considerable number of traffic crossing this flow from East to West and vice versa which is causing the Technical Risk Value to be lower than all the other FIRs in this study, this reduction is still well above the ICAO TLS and acceptable for RVSM operations.

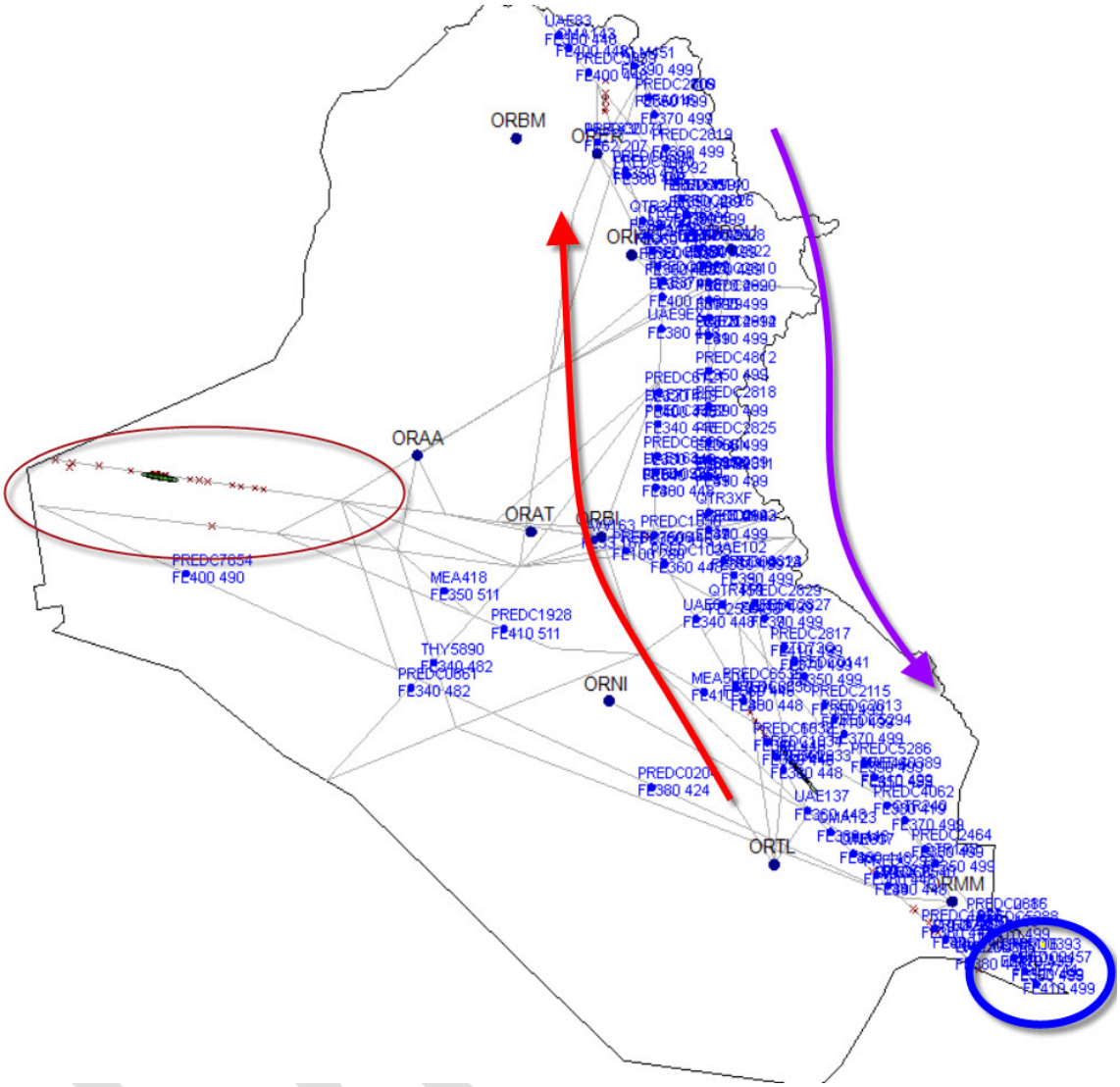
b- The passing frequency between RAPLU and MODIK increased very high and reached to a level that will require the ATM Authority in Iraq to review the flow in this airway.

c- MIDRMA suggests to split this airway into two different airways (east and west).

d- Baghdad FIR entry point TASMI at the southern FIR boundary with Kuwait is the most congested point in the Middle East RVSM airspace and so as SIDAD the exit point into Kuwait FIR, these two points cannot take any more of traffic growth and it is time for Iraq ATM to establish another points adjacent to SIDAD as an exit point and another one close to TASMI as an entry point to reduce the traffic congestion.



Baghdad FIR Hotspots – Map 2



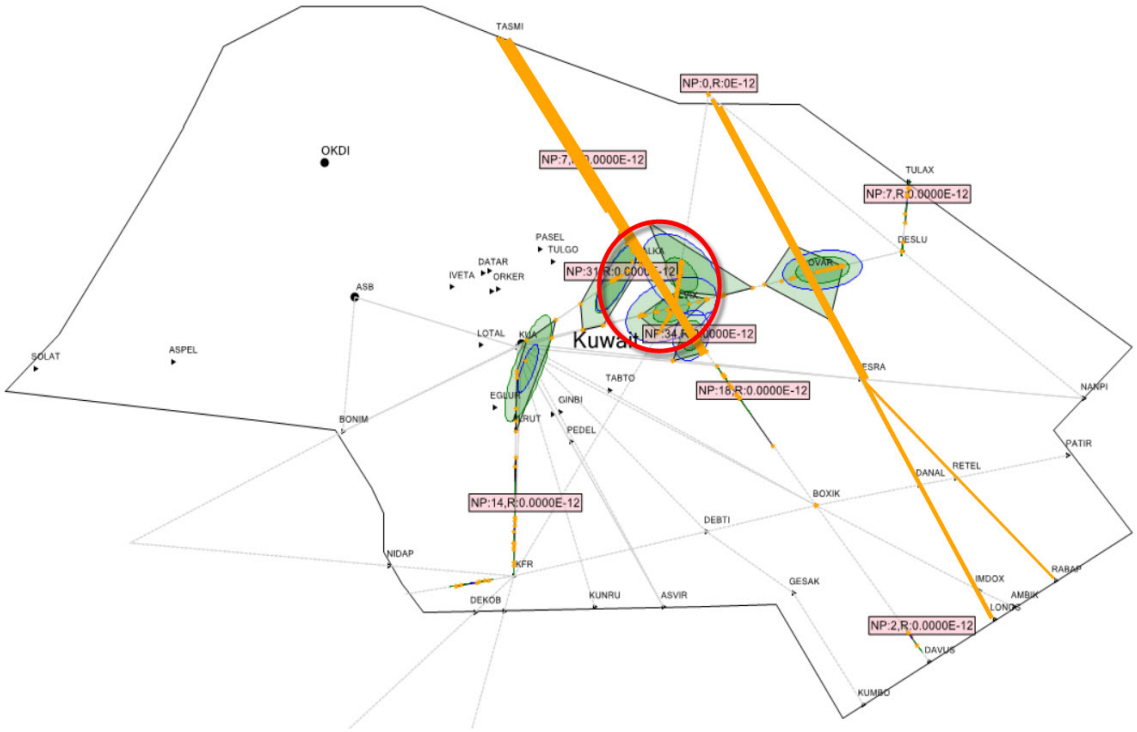
Baghdad FIR - Traffic Flow Simulation 1

3.3 Kuwait FIR

a- The traffic flow in Kuwait FIR mostly linked with Baghdad and Bahrain FIRs, and flows north and south bound with small number of traffic crossing east and west bound.

b- Traffic congestion was clearly demonstrated between TASMI and RALKA as a northbound flow and between SIDAD and SESRA as a southbound traffic flow supporting MIDRMA's proposal to establish two more points to reduce this traffic congestion.

c- The main hotspot observed in Kuwait FIR found between points ALVIX and RALKA were 63% of the crossing traffic occurred at this portion of the airspace, the passing frequency is not very high but it’s worth reviewing the airway structure to the east and north east of KUA and explore better flow options to reduce the congestion between these two points.



Kuwait FIR Hotspots – Map 3

3.4 Muscat FIR

a- Muscat FIR RVSM airspace remains at the forefront of the busiest FIRs in ICAO MID RVSM airspace in terms of its size and capacity with traffic flow nearly from every direction.

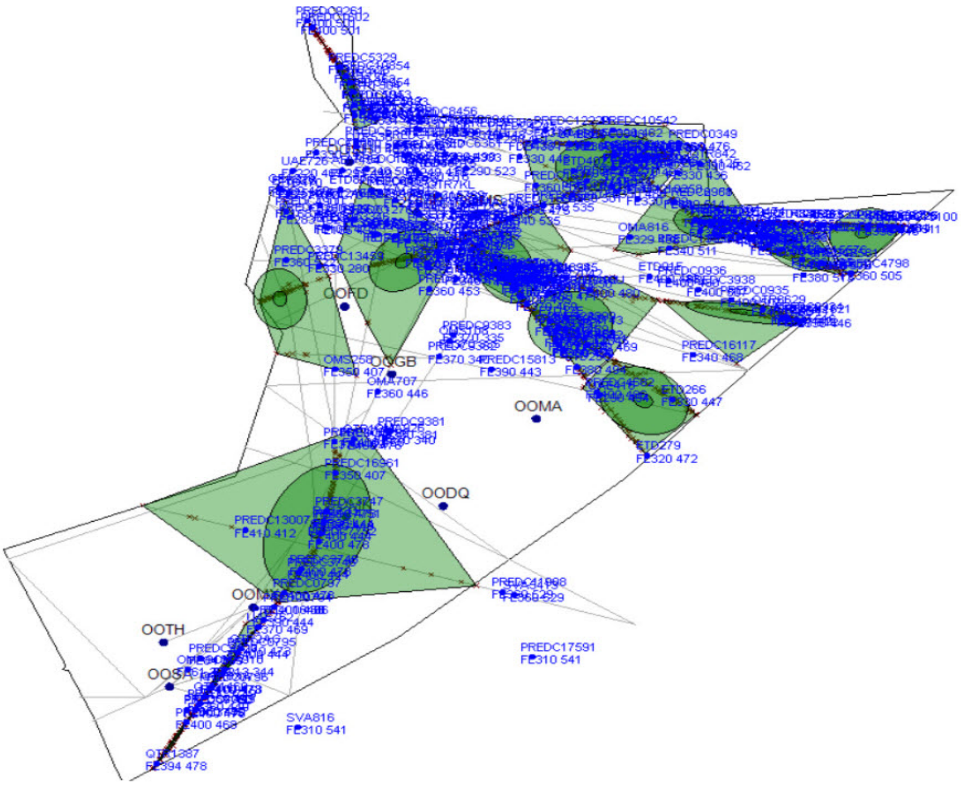
b- Muscat FIR Hotspots – Map 4 below explains itself, the traffic congestions/concentration to the west of points RASKI, PARAR, TOTOX, REXOD, ALAMA and KITAL.

c- One of the busiest hotspots detected is the triangle of OOMS, EMISO and EMURU which recorded 43% of the crossing traffic in Muscat FIR with high passing frequency and reflects the need to review the flow of RVSM traffic in this part of the FIR.

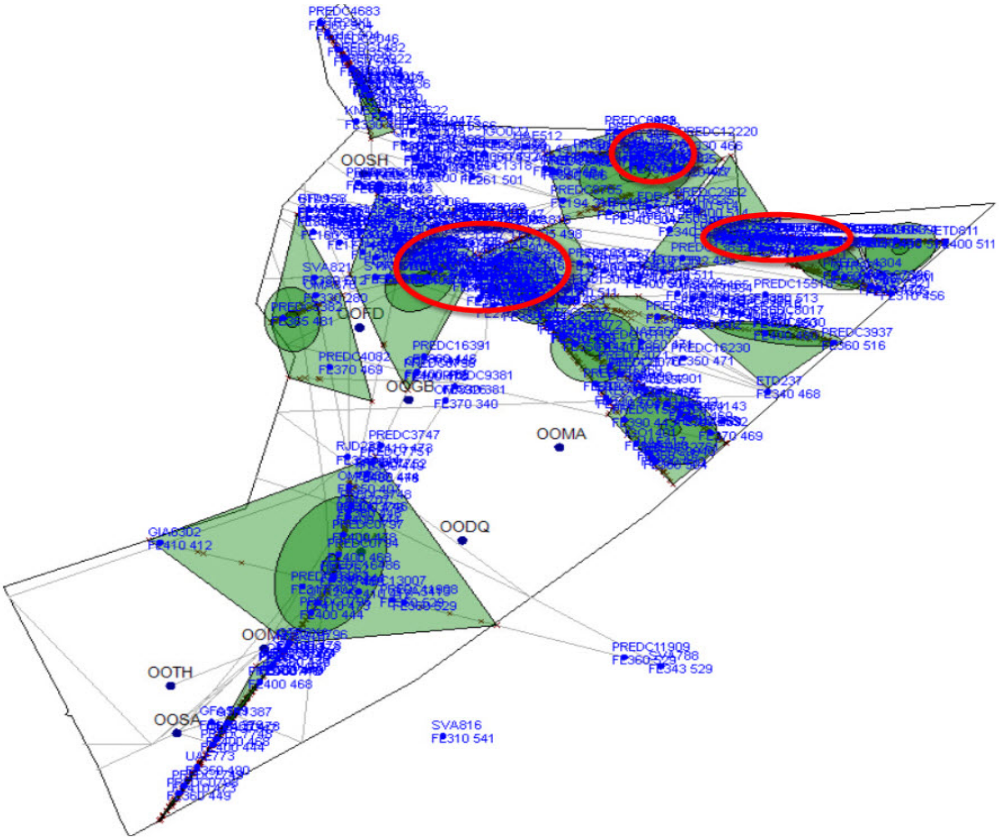
d- More hotspots to the west of RASKI and PARAR were detected and concentrated between SETSI and RAGMA, again with high passing frequency caused from the complexity of RVSM traffic flow.

e- Due to the complexity of the traffic flow within Muscat FIR, MIDRMA decided to make further analysis for each RVSM flight level (FL290 –FL410) and shall keep that in Appendix A of this study.

Muscat FIR Hotspots – Map 4



Muscat FIR Fast Simulation 1



Muscat FIR Fast Simulation 2

3.5Tehran FIR

a- The concentration of the traffic flow clearly detected to the North West of Tehran FIR and marked from N/W of OITZ all the way to Ankara FIR.

b- The RVSM airspace to the west of point ASVIB and RUKOT/NOVSU also recorded high passing frequency, due to the presence of a portion of the airways to the west of point ASVIB and GOKSO/GENEV (141 NM) treated as bidirectional airway. It is recommended to establish another point to the south of the ASVIB to remove this congestion.

c- Other hotspots observed in Tehran FIR (see Tehran FIR Hotspots Map 5 for more details) however, due to the large spacing of these hotspots in the wide airspace of Tehran FIR, their influence will be limited and not related to the traffic growth of the FWC 2022 event other than the ones in paragraph a. and b. above.

d- Further analysis to some RVSM flight levels in Tehran FIR in appendix A of this study.

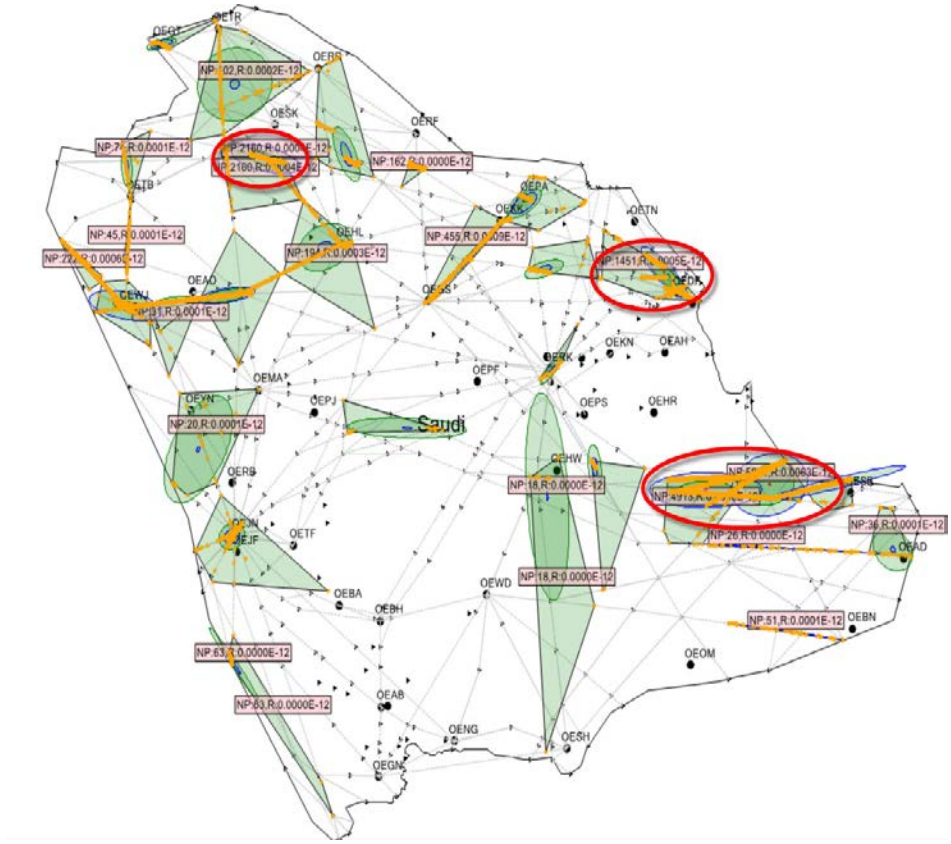
Tehran FIR Hotspots – Map 5

3.6 Jeddah FIR

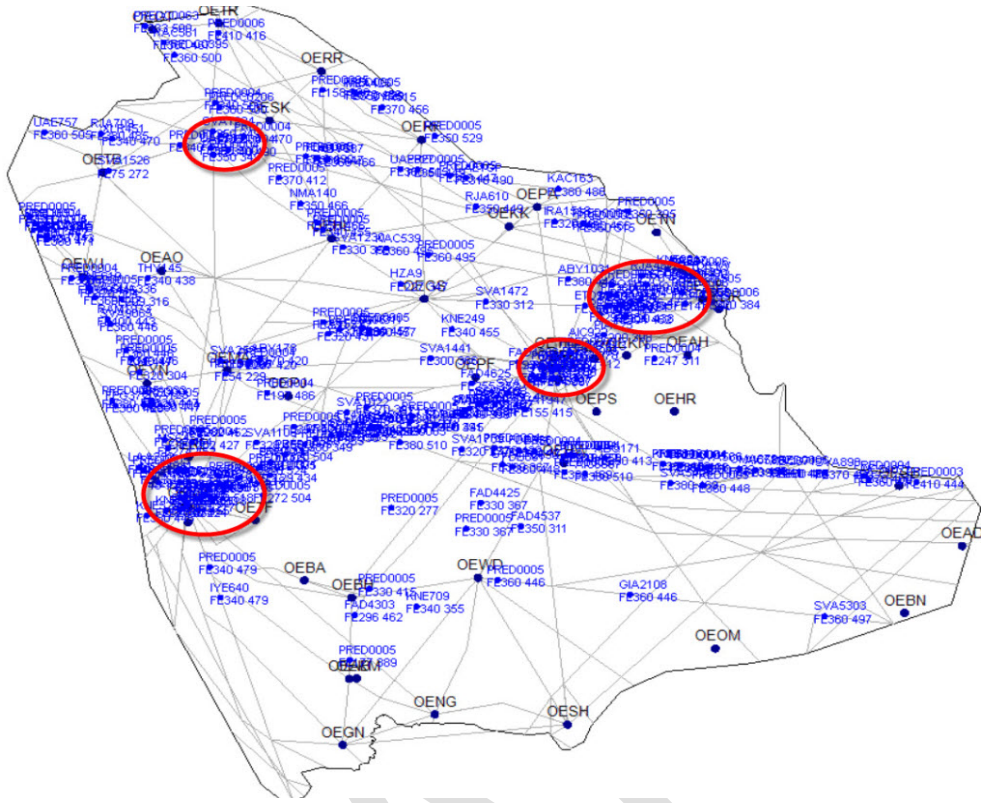
a- Four major hotspots have been discovered in the Jeddah FIR and the busiest is located in the Empty Quarter to the west of the UAE FIR (see Jeddah FIR hotspots - Map 6 for more details) but this is not related to FWC 2022 traffic growth such as the data was generated based on the level of traffic during the Hajj season, and it is useful to have an idea of the potential traffic congestion in the Empty Quarter if the traffic growth reaches close to 40% or more of the traffic for 2019.

b- The other hotspot which is definitely related to the traffic growth of the FWC 2022 is located to the N/W of Dammam and adjacent to Bahrain FIR, although the passing frequency is not high and it's within the normal average figures its necessary that both ATM Units review their needs to reduce this congestion because this hotspot is very close to the boundaries of their FIRs.

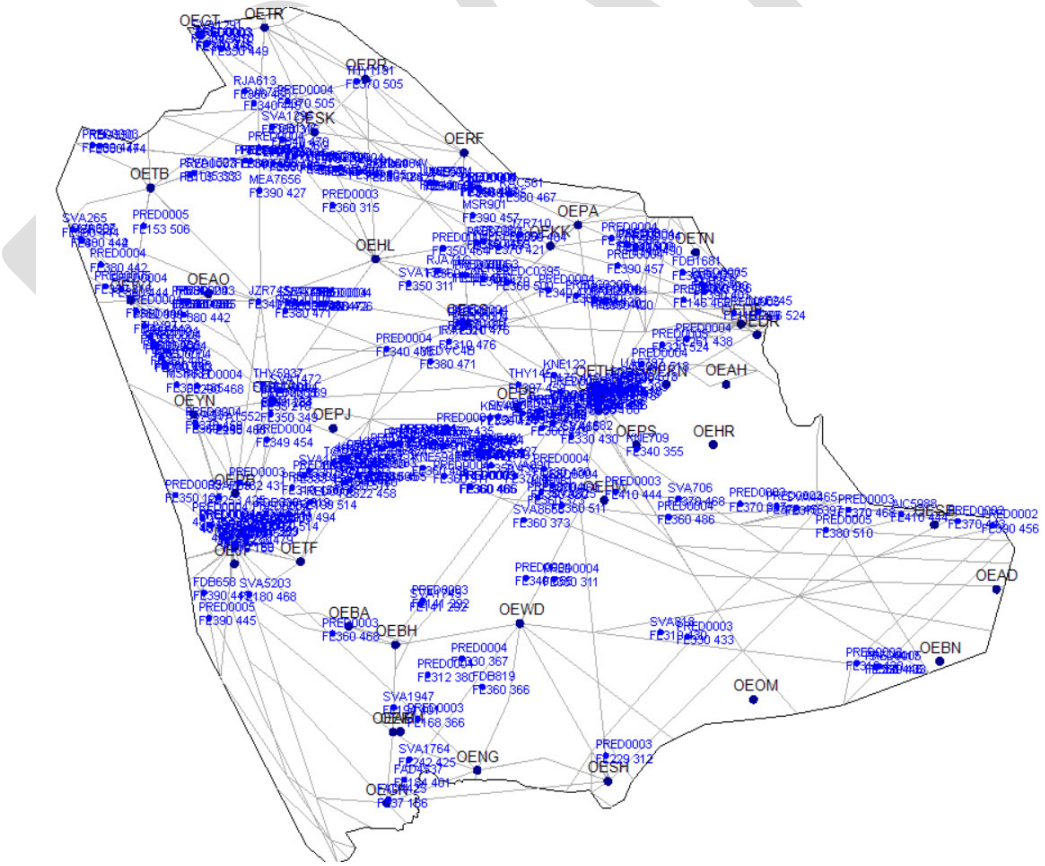
c- The other two hotspots detected to the south of OESK and between OEAD and point PASAM, the passing frequency slightly increased from the figures in SMR 2019.



Jeddah FIR Hotspots - Map 6



Jeddah FIR Fast Simulation 1



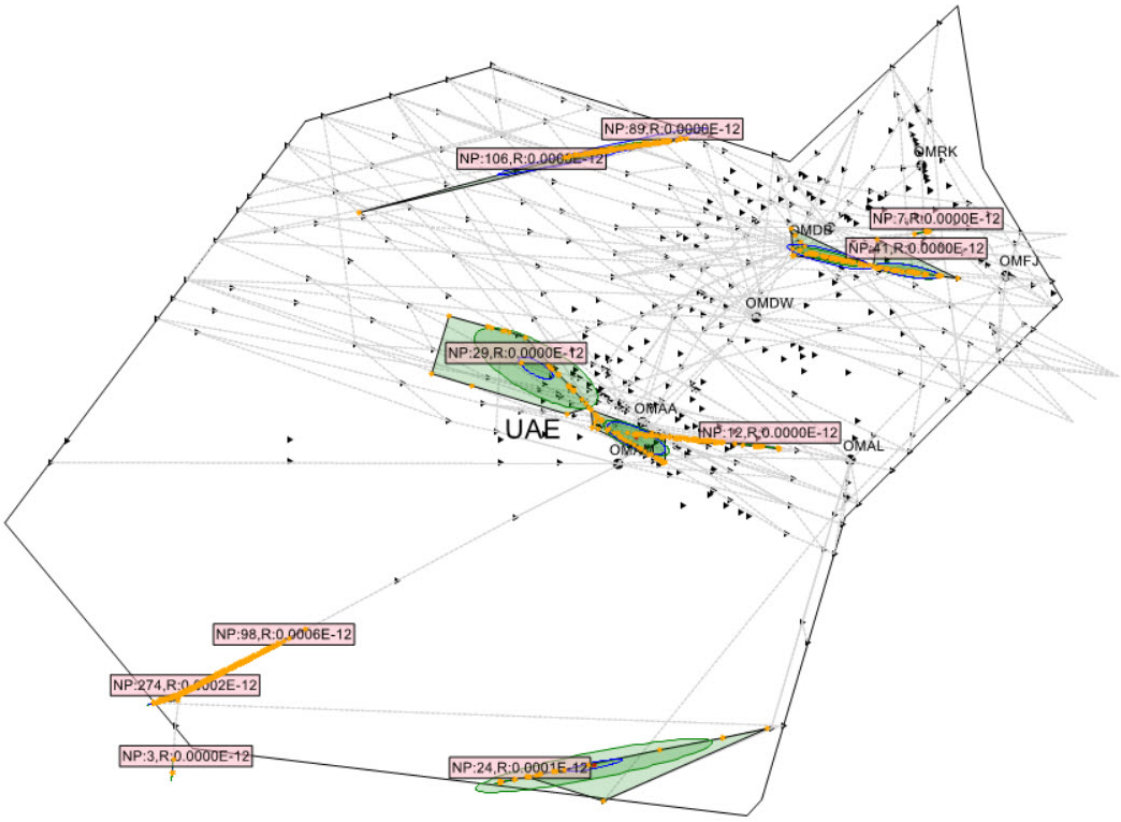
Jeddah FIR Fast Simulation 2

3.7 Emirates FIR

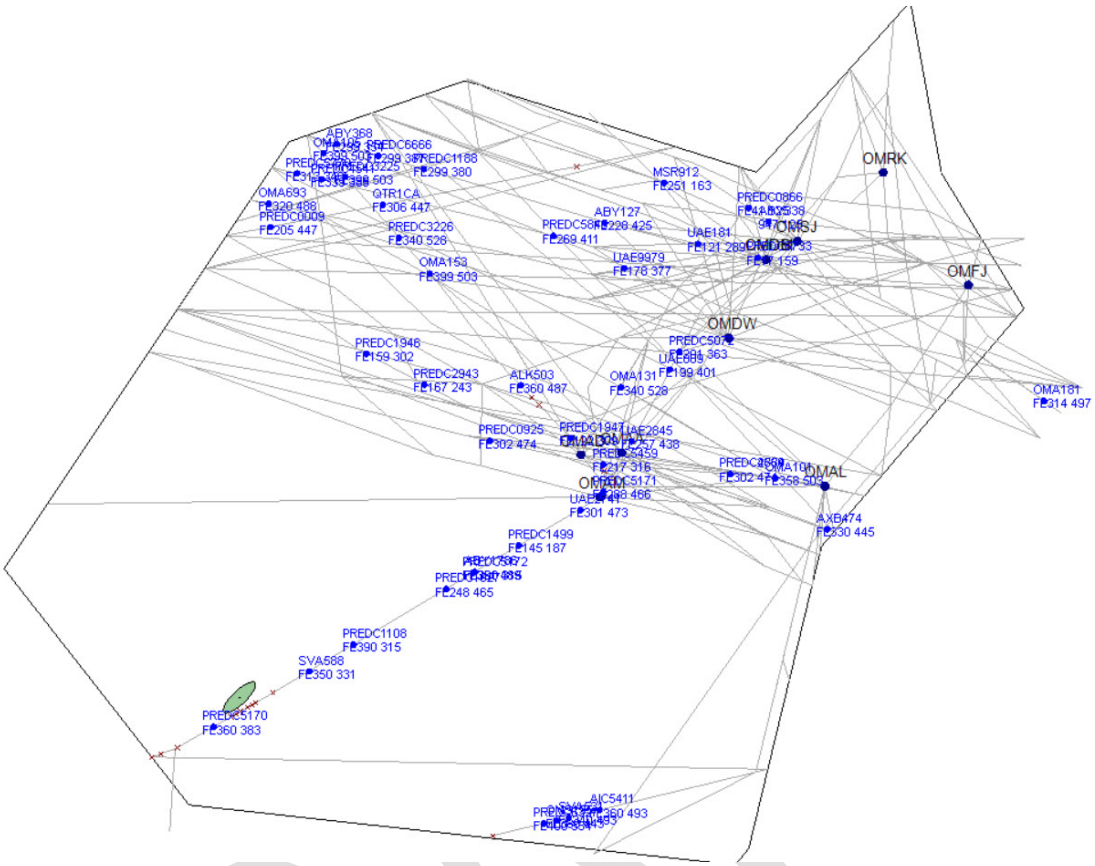
a- Emirates FIR is expected to be extremely busy during the FWC 2022 event below the RVSM airspace as it will receive all the traffic bound from/to Muscat, Tehran, Bahrain FIRs and due to the location of the Emirates FIR the majority of the RVSM traffic will be either in the descend/climb phase with more in level flight overflying the Emirates FIR.

b- The two hotspots detected to the N/W of OMAA recorded normal passing frequency and without risk as they were formed due to increased traffic.

c- The portion of AWY M318 between GOLGU and ESROM is bidirectional were RVSM traffic are either crossing at their flight levels or initiating descend from the RVSM airspace or going through the RVSM layer for their cruise levels.



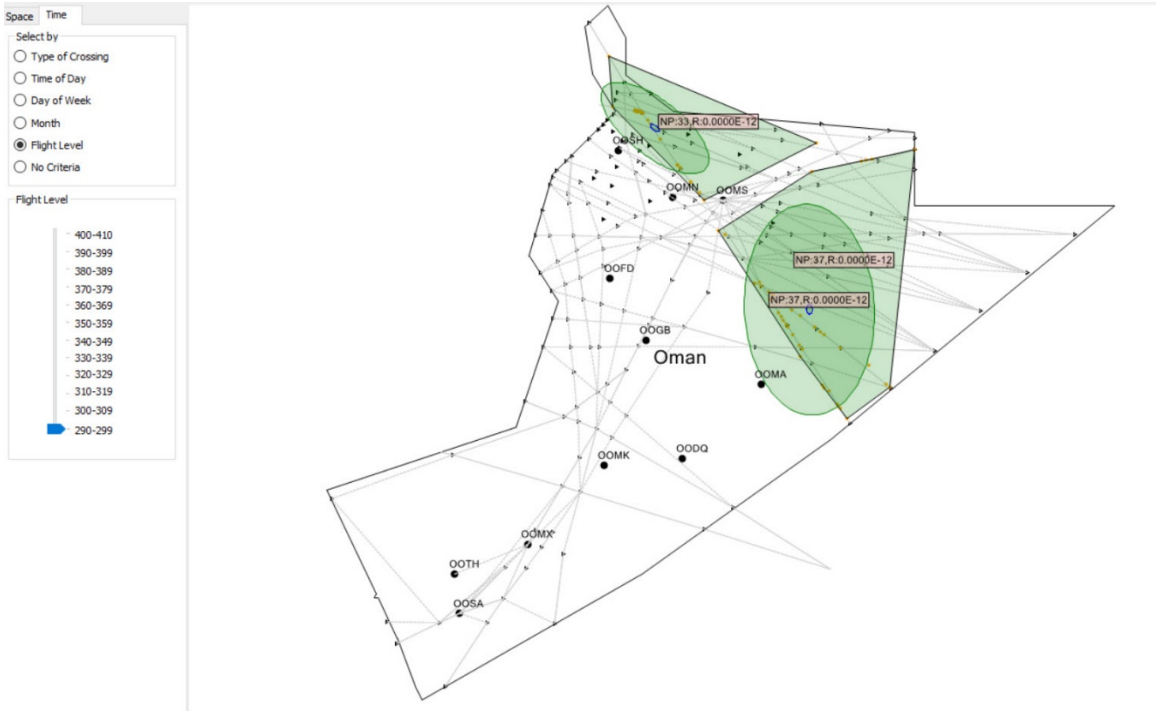
Emirates FIR Hotspots – Map 7

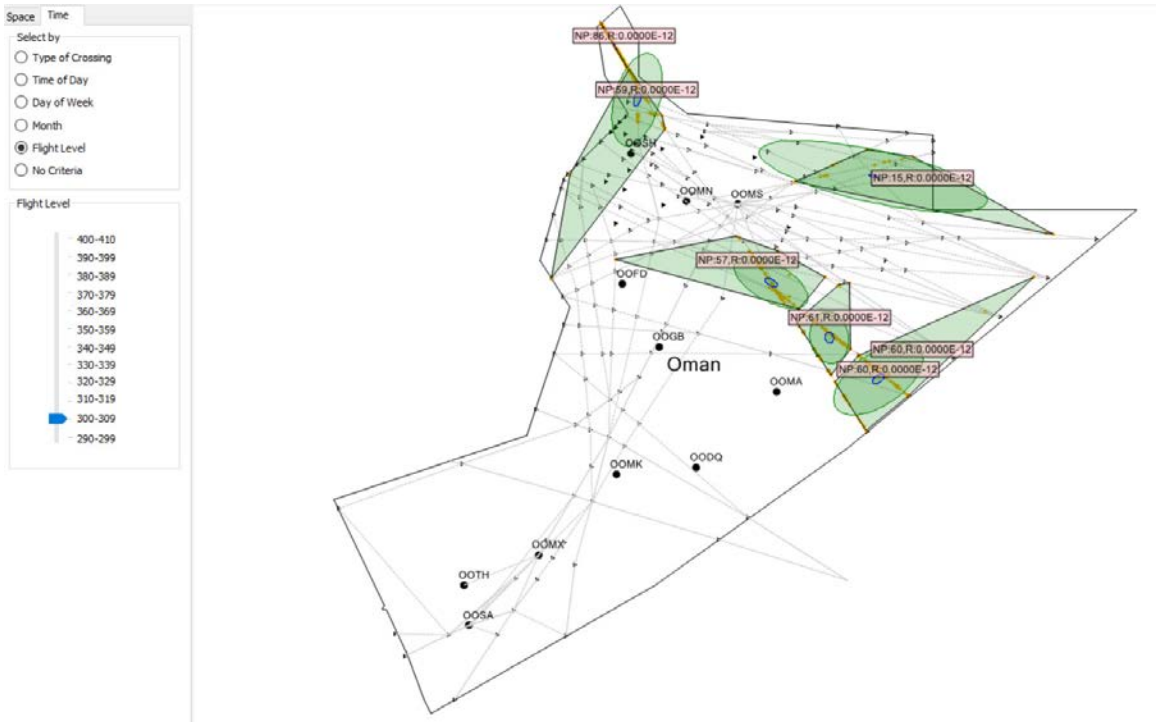


Emirates Fast Simulation 1

Appendix "A" – Analysis of RVSM Flight Levels

Muscat FIR



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380-389
370-379
360-369
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340-349
330-339
320-329
310-319
300-309
290-299
NP:40,R:0.0000E-12
NP:25,R:0.0000E-12
OOSH
NP:16,R:0.0000E-12
OOMN
OOMS
NP:50,R:0.0000E-12
NP:43,R:0.0000E-12
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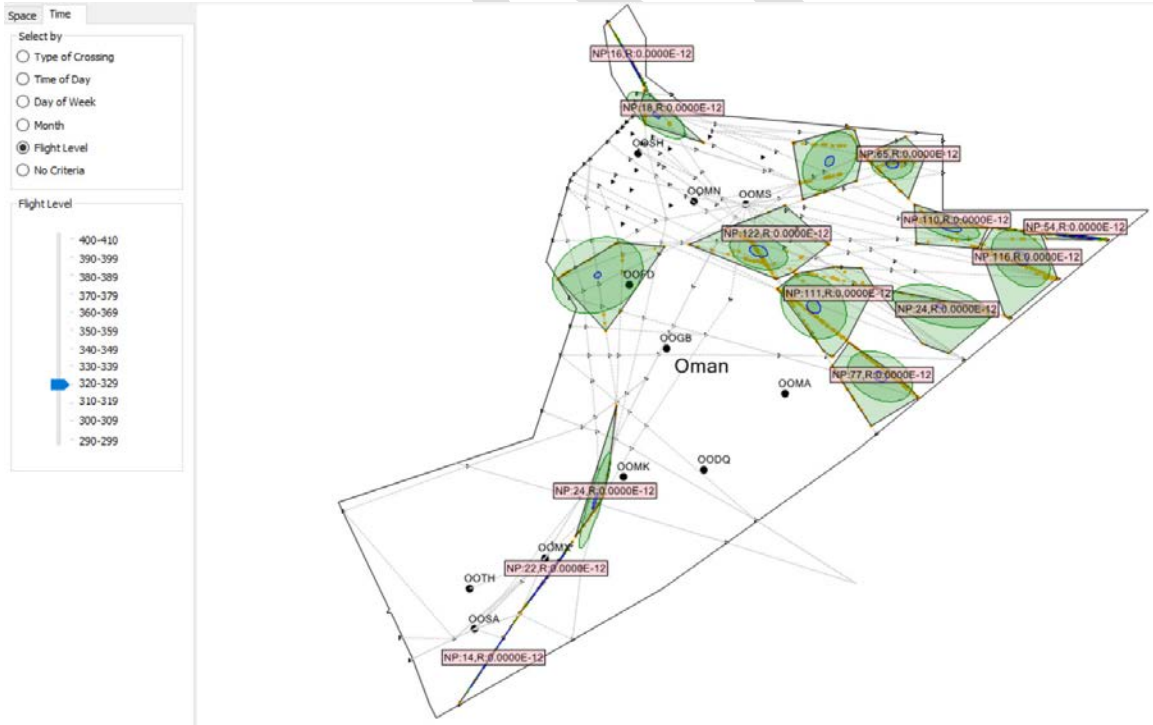
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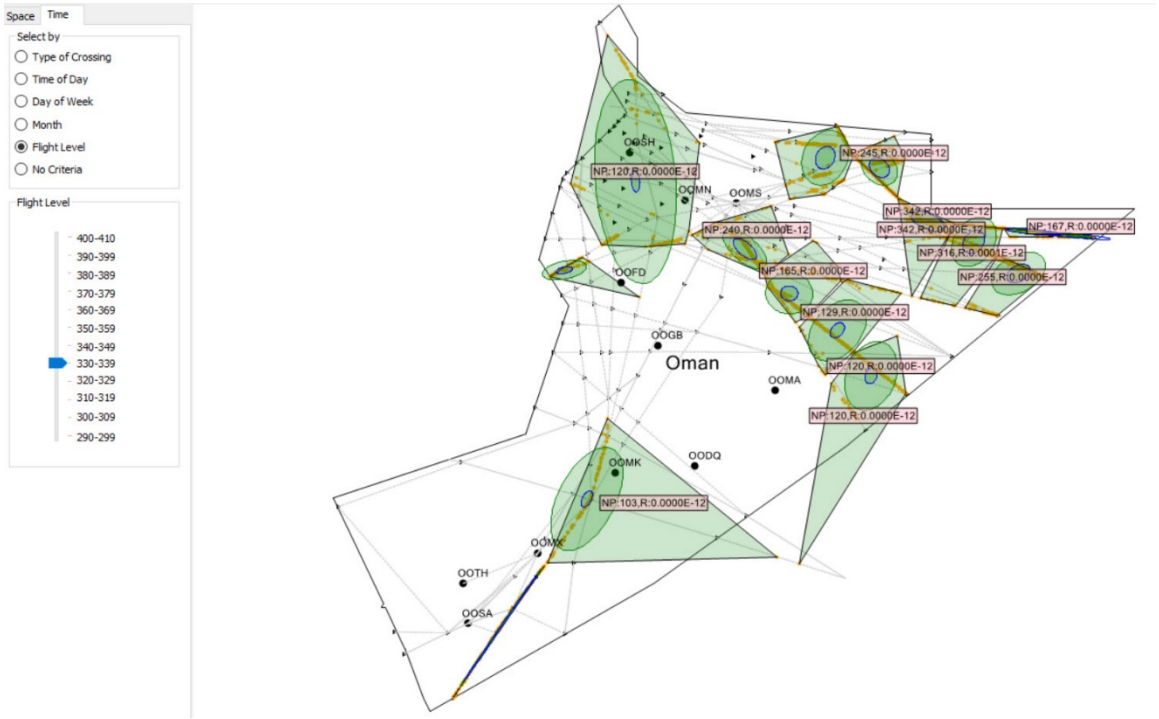
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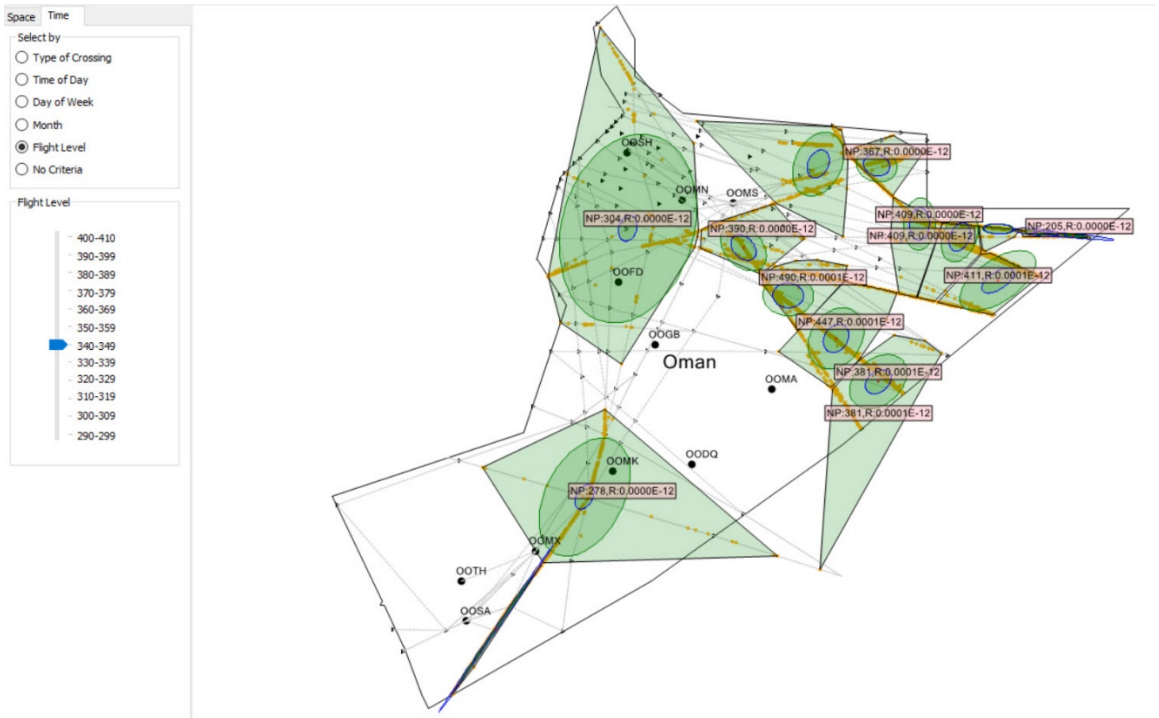
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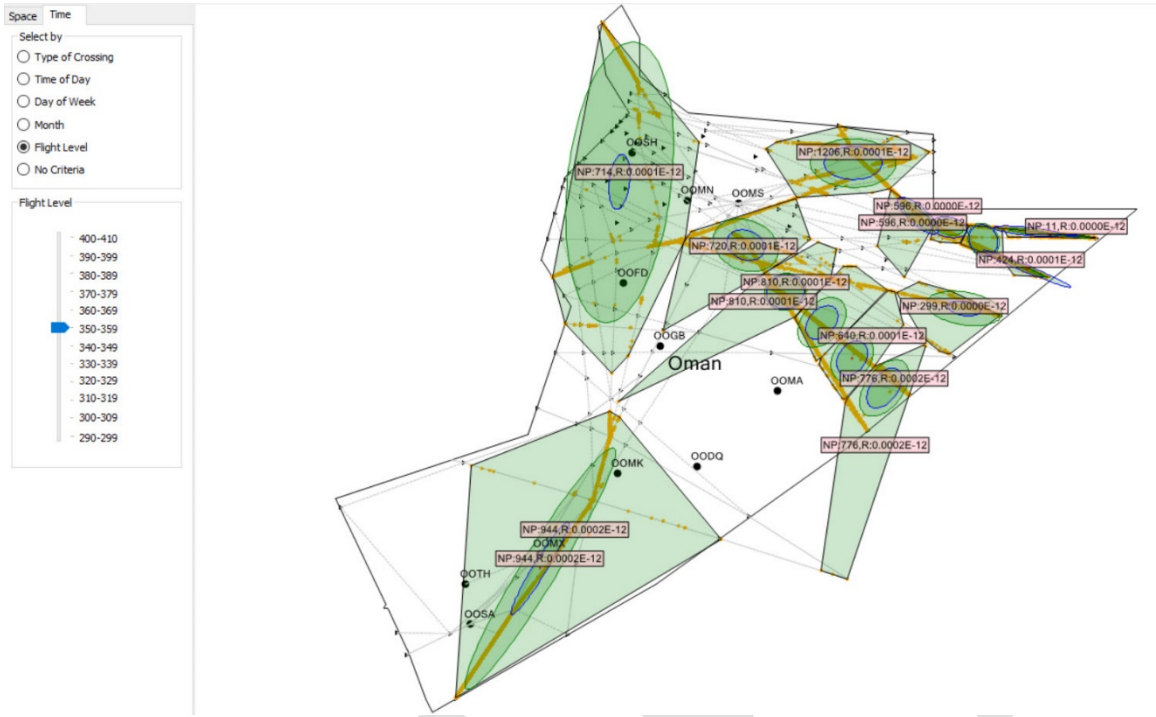
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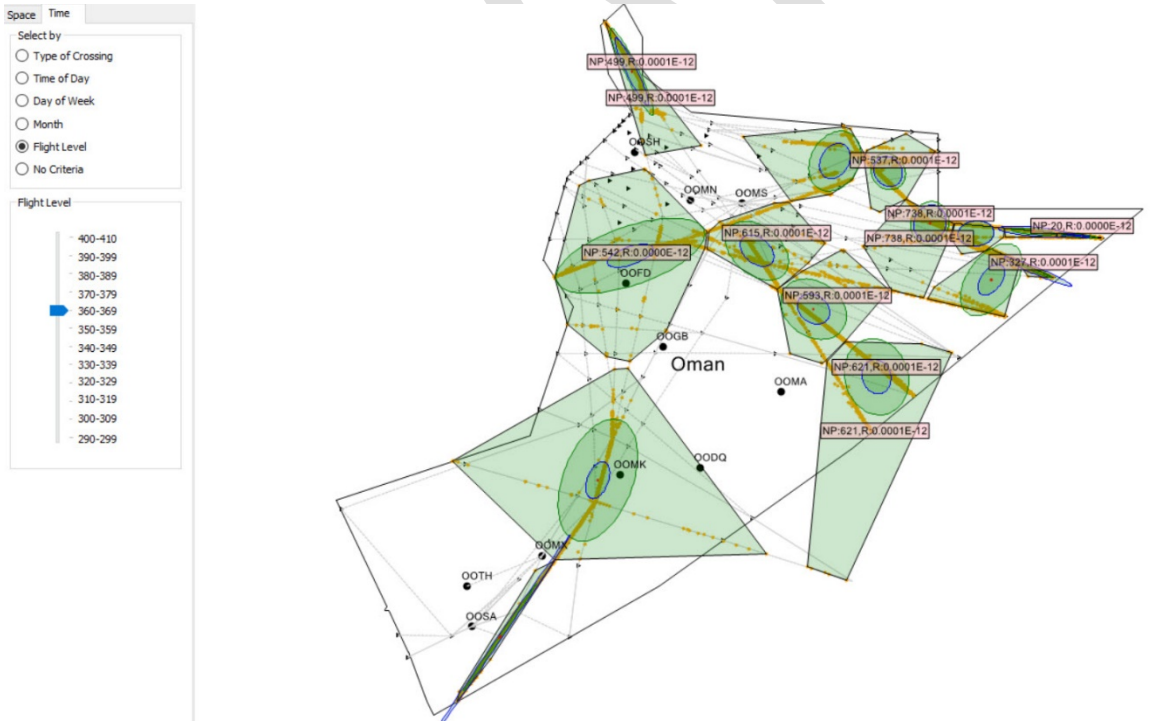
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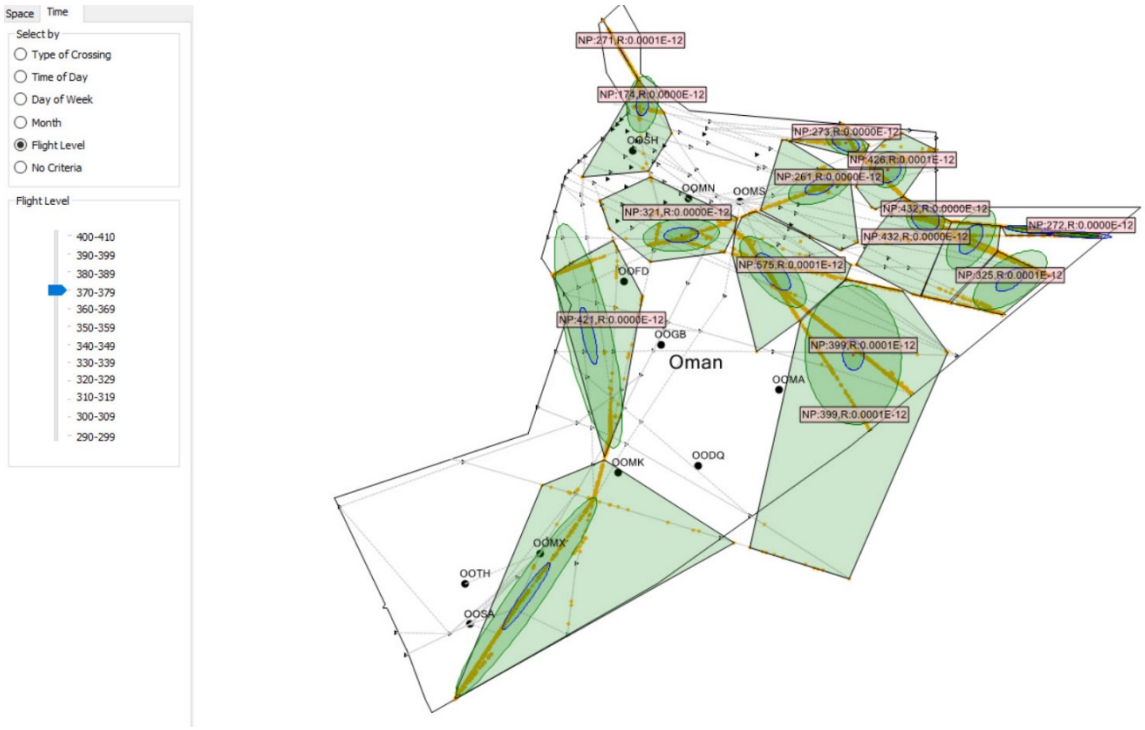
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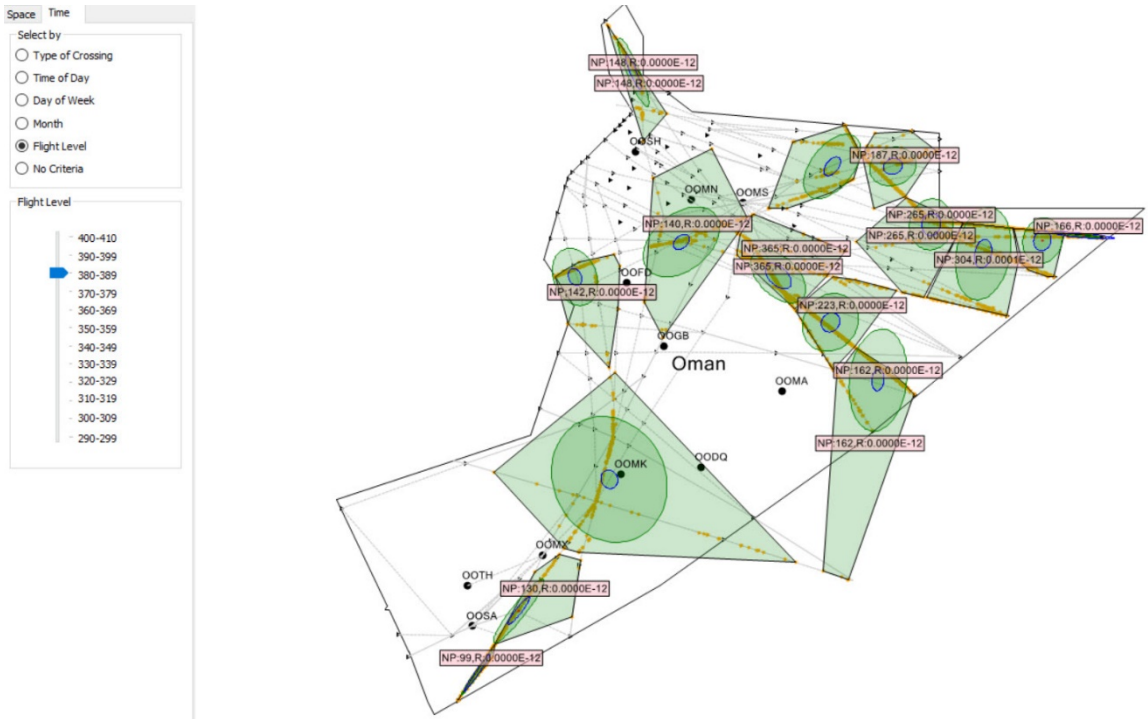
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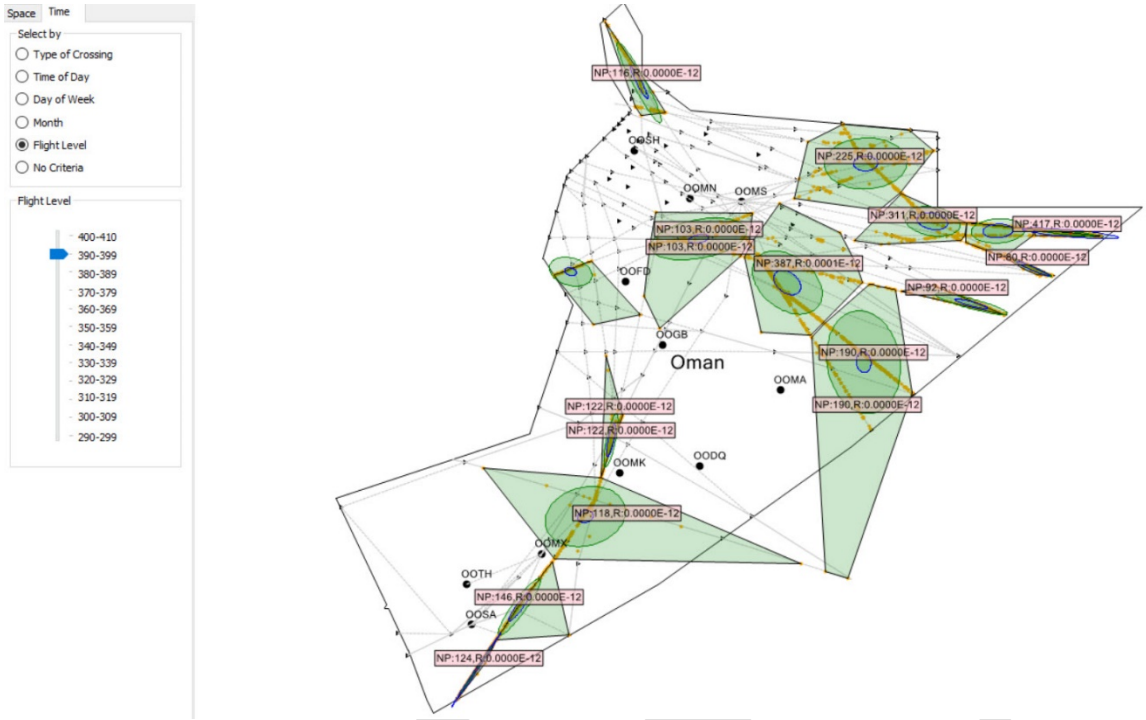
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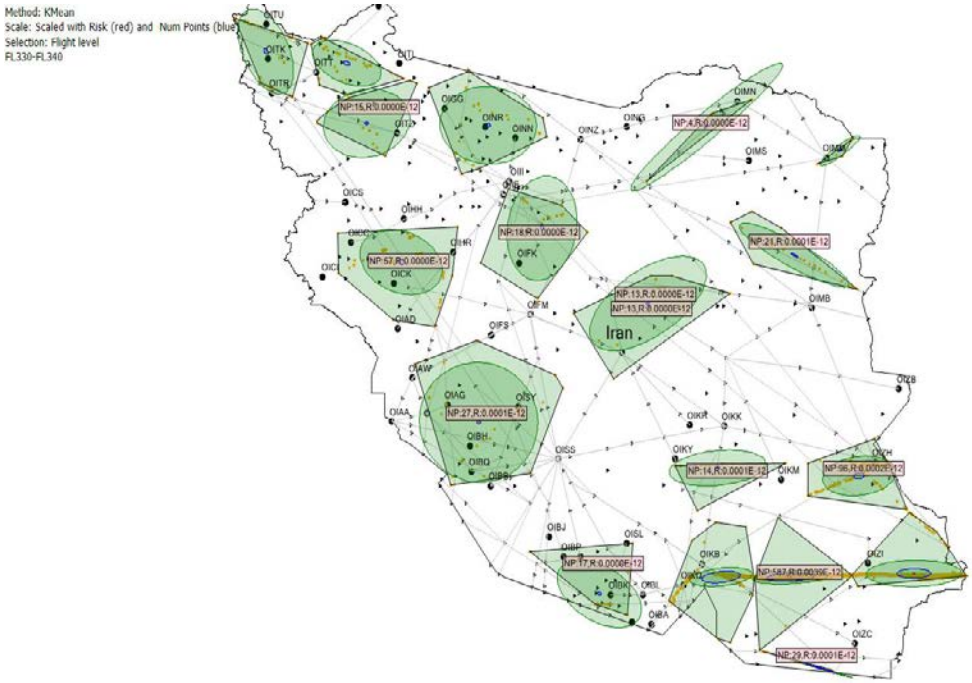
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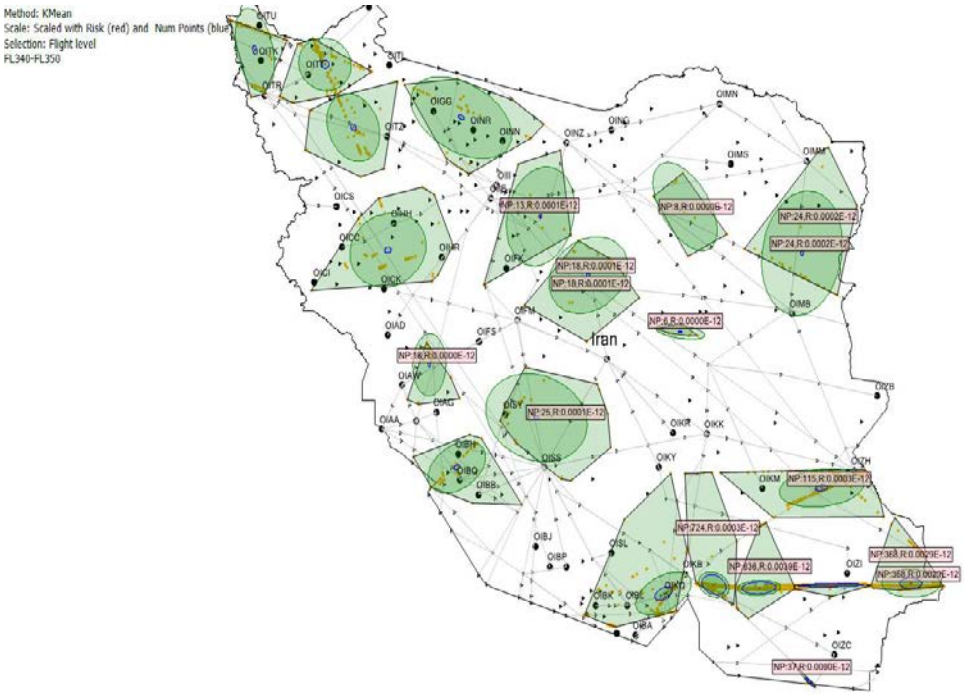
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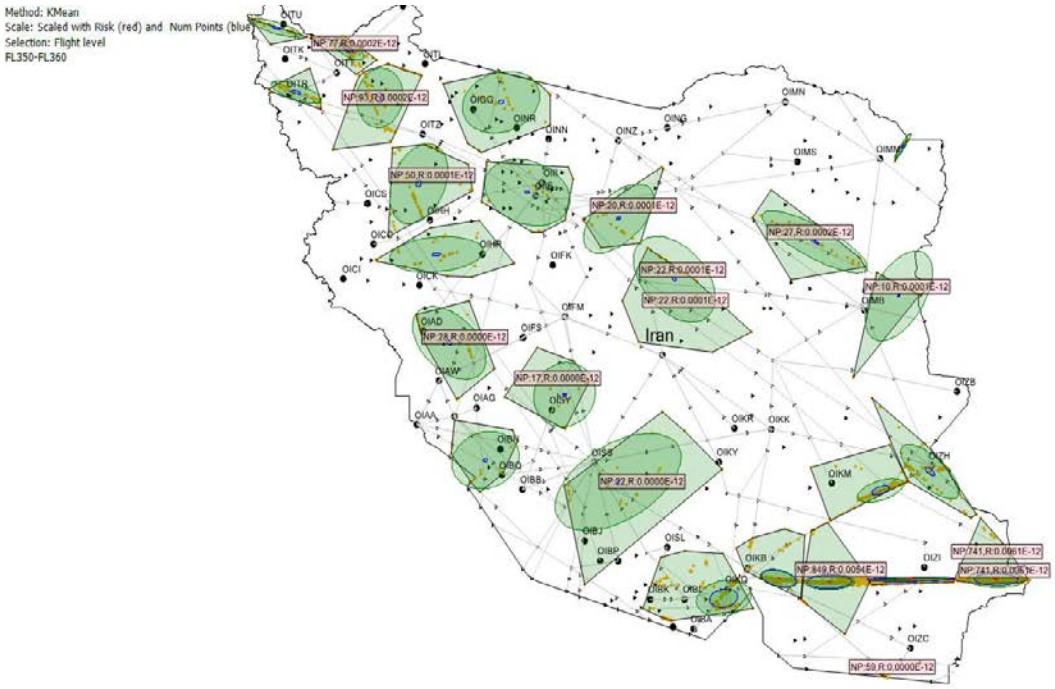
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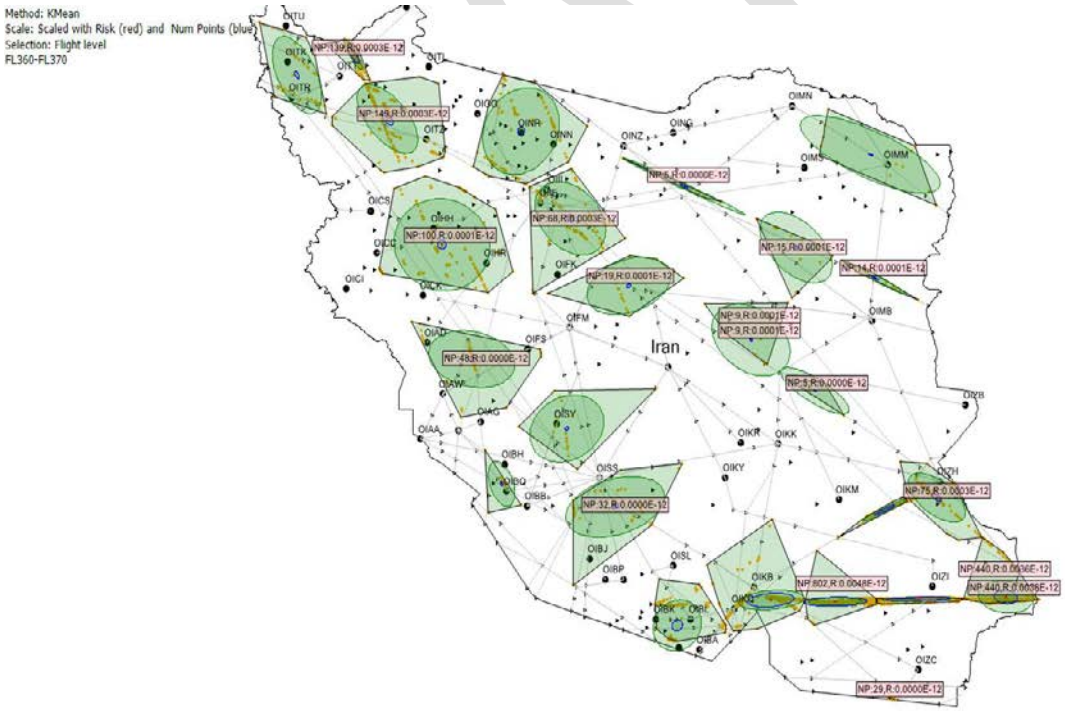
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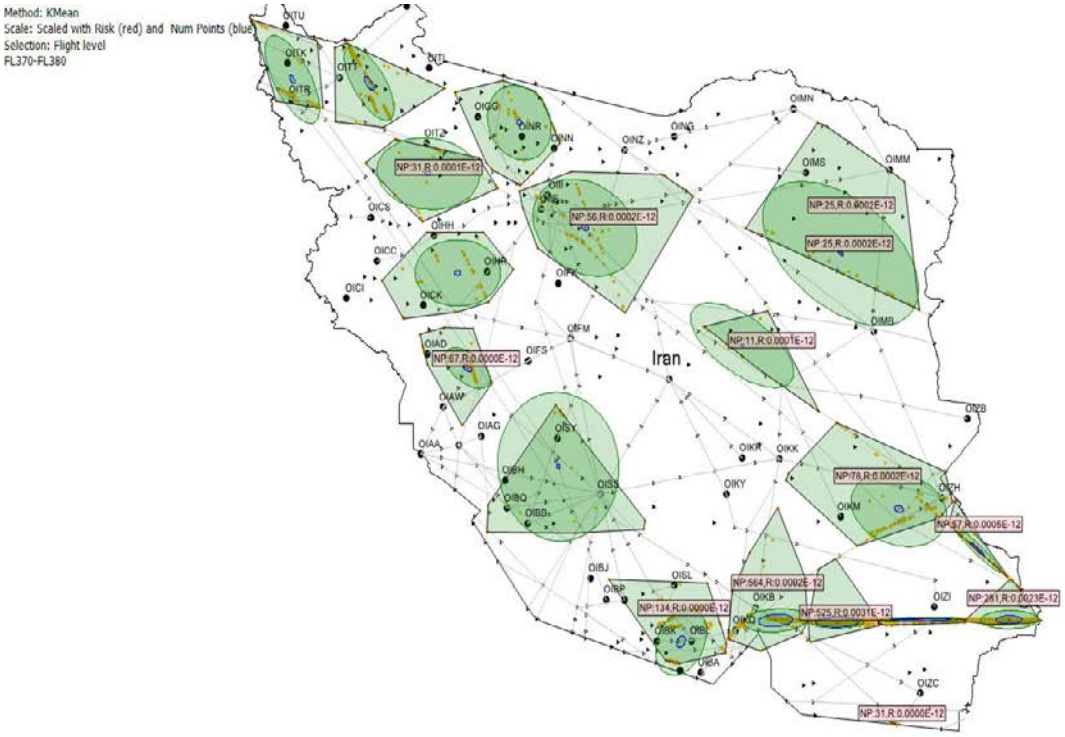
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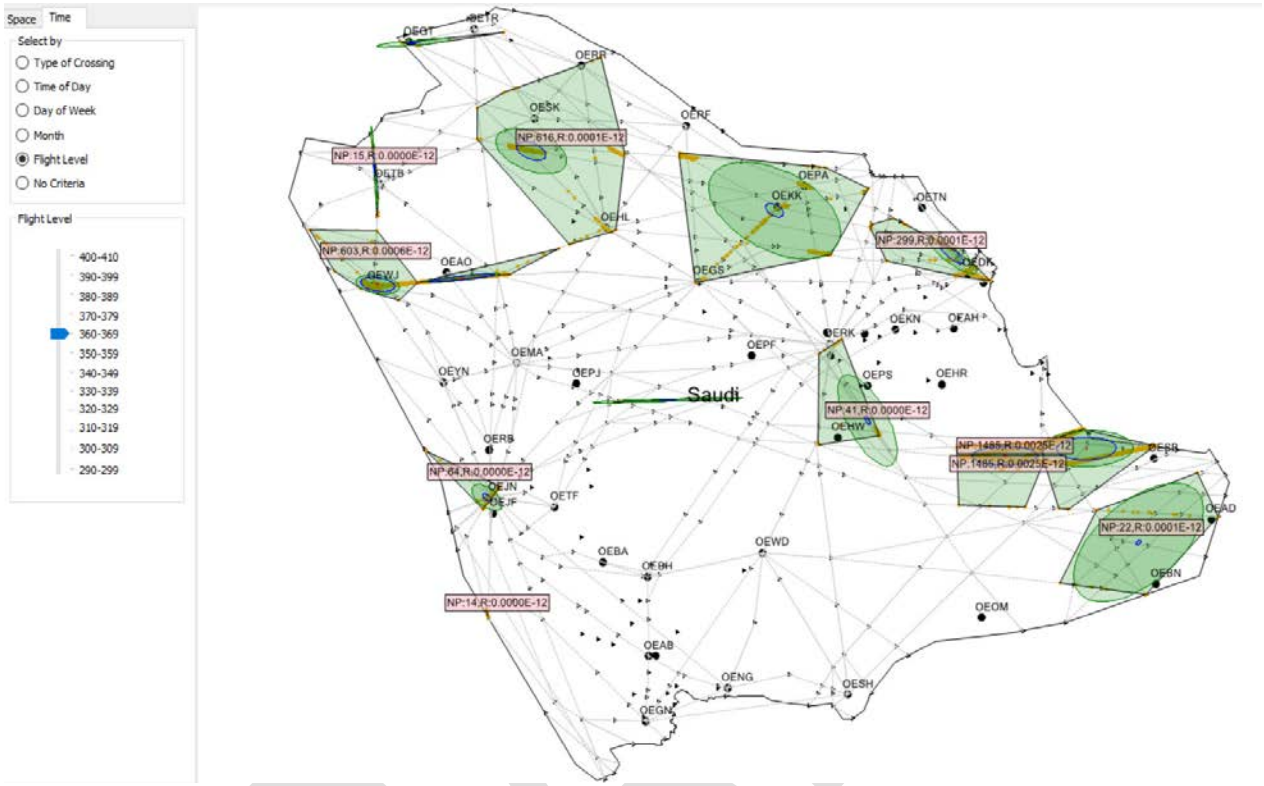
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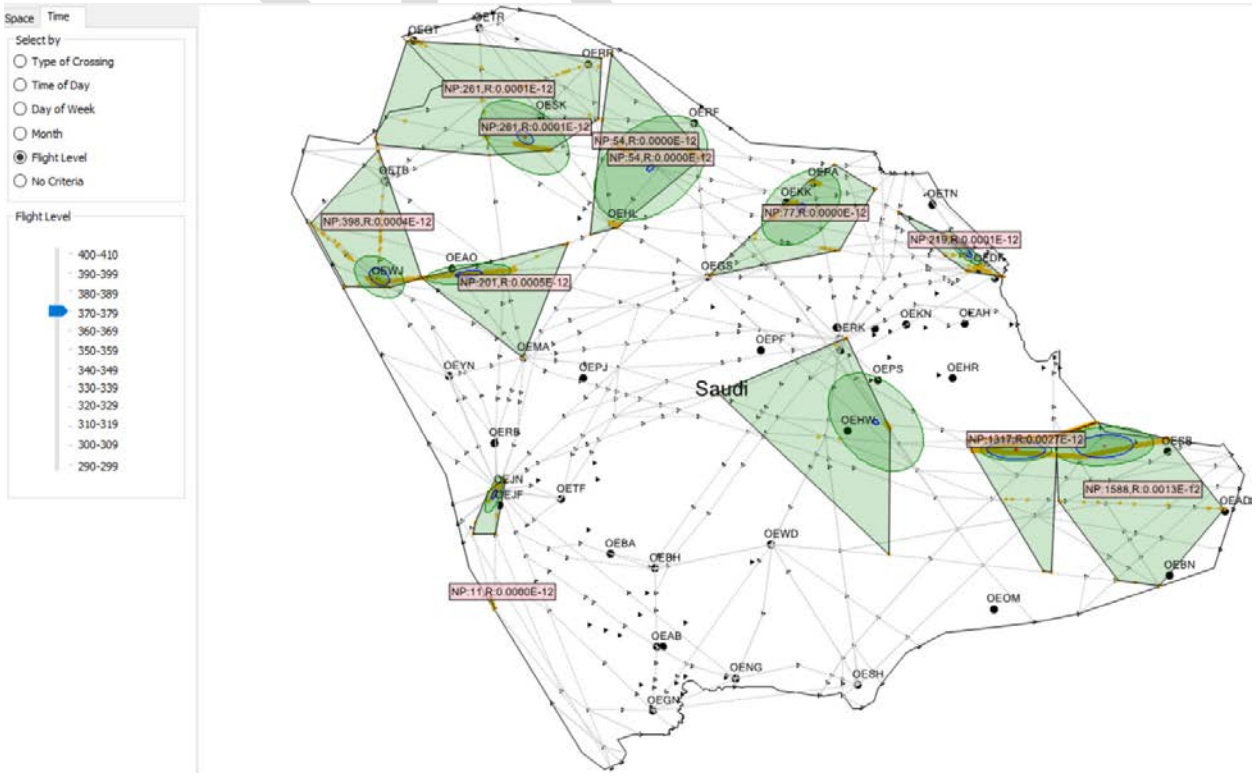
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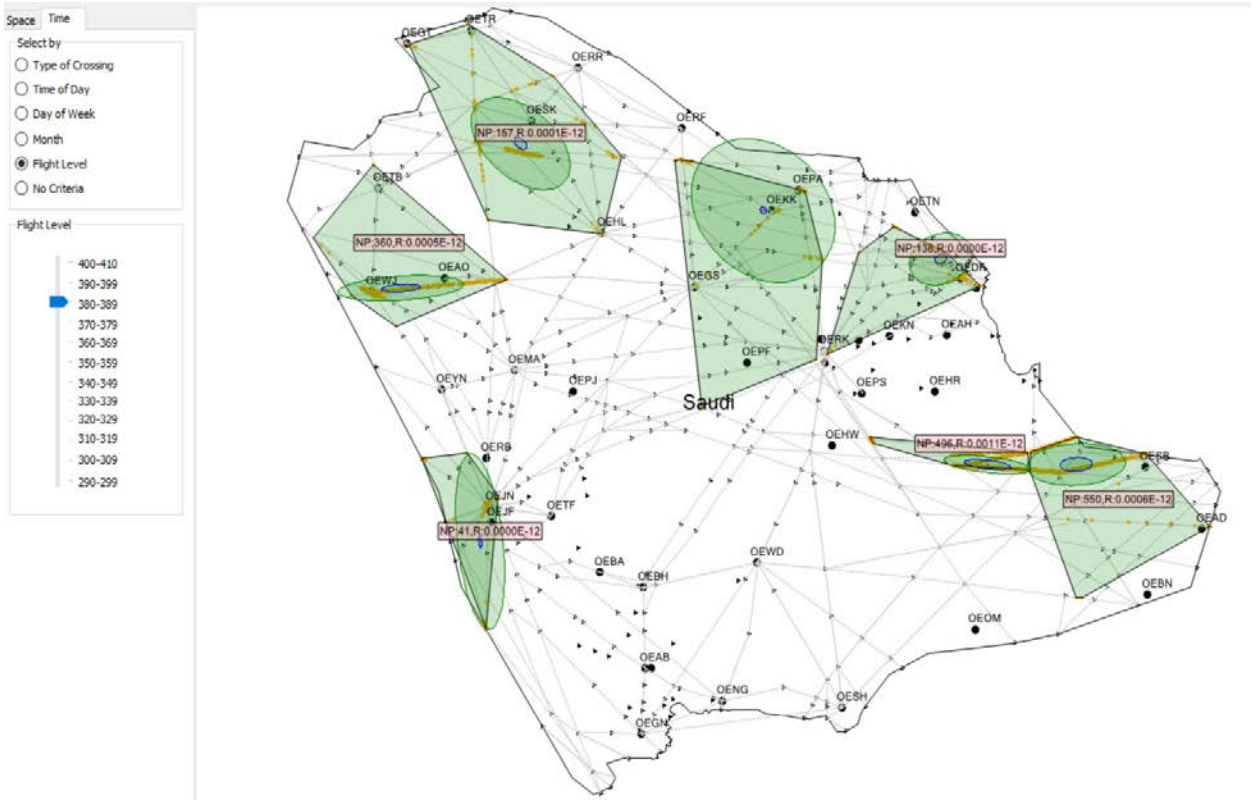
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Concept of Operations (CONOPs)

Air Traffic Flow Management

Table of Contents

1 EXECUTIVE SUMMARY

This document contains the Concept of Operations (Con Ops) for the provision of an Air Traffic Flow Management System for the State of Qatar; it will start with the current situation and then systematically progress to a detailed description of the proposed ATFM solution.

Section 2 will provide a high-level introduction to the document and describe the audience for this Con Ops and the relationship with the Strategic Programme Requirements that will be impacted by ATFM.

Section 3 will detail the current problem statement of a demand and capacity imbalance at HIA and provide a prognosis of the traffic scenarios targeted by the Strategic Programme Requirements (SPRs)

Section 4 will describe the concept of operations, the ICAO background, the Regional background and the Objectives and Principles of ATFM in the Qatari context. It will also explain the reasoning behind the selection of the multi nodal ATFM concept for the State of Qatar.

Section 5 will describe the detailed implementation process for all the elements of ATFM in Qatar as well as the relevant stages of implementation of the service.

Section 6 will describe how the normal ATFM phases will be interpreted and applied in Qatar. It will also expand on the various ATFM solutions in Qatar, how it will optimise capacity and how to deal with capacity constraints in Qatar.

Section 7 and 8 deals with the ATFM Communication and ATFM System Requirements as will be deployed, respectively.

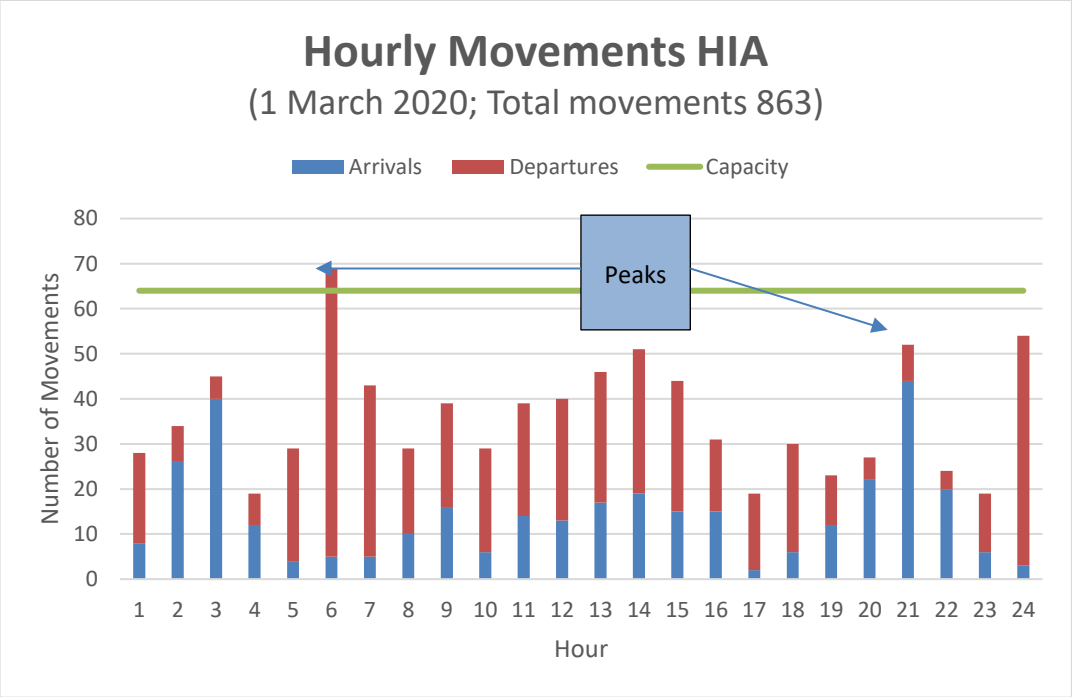
Section 9 and 10 contains the Benefits and a summary of Reference Material, respectively.

Five Annexures (A – E) contain the Project timelines, Training Plan, ATFM Messaging, ATFM Interface Requirements and the Regulatory Framework to support ATFM.

2 THE CURRENT SITUATION AT HIA

a. On 1 March 2020, 863 flights were handled at Hamad International Airport[1]. An analysis of the arrivals and departures on that day shows that the available hourly capacity of 64[2] aircraft movements were already being fully utilized during some hours.

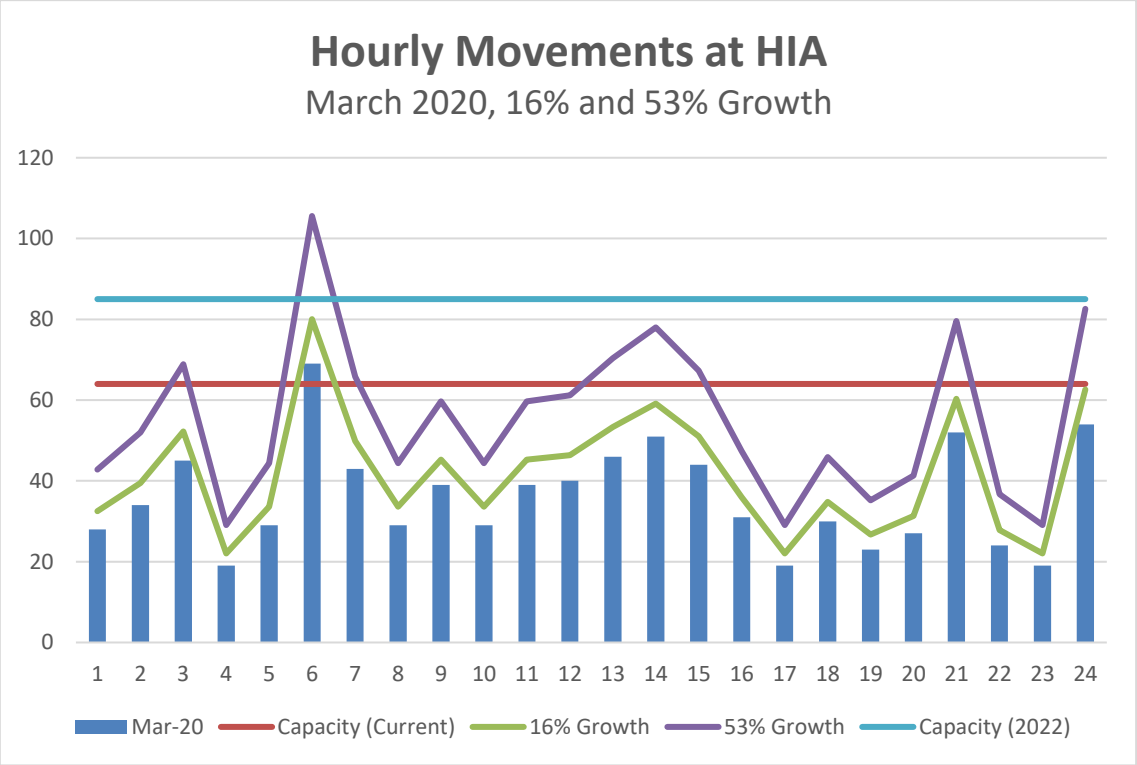
b. This will result in additional delays to departing flights if the hourly demand is not matched to the available capacity. At least two distinct peak traffic periods are identified.



Graph 1: HIA Number of Hourly Movements

[1] The date was chosen as it represents a typical day of two runway operations in pre-COVID conditions.

[2] Seasonal capacity declarations at conducted at HIA. The capacity may vary between 58 and 66. For the purpose of this submission an average of 64 movements (landings and take-offs) will be used.



Graph 2: HIA Hourly Movements

c. It needs to be considered that the peak traffic period that is indicated above is for all departures. As most of these departures are routing through the same TMA exit fix, it adds an additional en-route delay as the peak in departures requires parallel departure operations thereby exceeding the capacity of a single exit fix. This en-route delay would be significantly more as certain routes have dependencies even if departing off different runways.

d. The fundamental problem is that existing capacity is not optimally used.

3 ATFM CONCEPT

3.1 Concept of Operations

a. There is a national need to manage the increasing demand on air traffic control services by means of demand / capacity balancing over the coming years and more so for the air traffic associated with the FIFA World Cup that will be hosted by Qatar in November and December 2022. Additionally, the airspace embargo has been lifted, which will further increase the traffic volumes, further emphasizing the need for a demand and capacity balancing solution.

b. This CONOPS Document has been produced to demonstrate the need for the introduction of Air Traffic Flow Management services within the State of Qatar and to describe the proposed solution.

3.2 Development of Air Traffic Flow Management in ICAO MID Region

a. With the increasing traffic levels being experienced in the Middle East region it has been evident that demand often exceeds the existing capacity. The ICAO MID Region States have sought to address this issue by introducing Air Traffic Flow Management initiatives for the States within the ICAO MID region.

b. This subject was addressed initially with an ATFM seminar held in Dubai, UAE during December 2016. The Seminar recognized the need for a collaborative phased approach toward the implementation of a regional ATFM system in accordance with the region requirements.

c. The main outcomes from the ATFM seminar in December 2016 were:

- establishment of a MID ATFM Task Force Working Group (TF/WG) under the ATM Steering Group.
- development of ATFM Concept of Operations taking into consideration Asia Pacific and Europe experiences.
- expedite MID IFPS project implementation.

d. During this meeting, a conclusion that given the present geopolitical circumstances the Cross-Border Multi-Nodal Model for ATFM was the preferred choice due to the present geopolitical circumstances in the MID region.

3.3 Air Traffic Flow Management Objectives and Principles

a. ATFM is an enabler of Air Traffic Management (ATM) efficiency and effectiveness. It contributes to the safety, efficiency, cost-effectiveness, and environmental sustainability of an ATM system. It is also a major enabler of global interoperability of the air transport industry.

b. Annex 11 to the Convention on International Civil Aviation says, "ATFM shall be implemented for airspace where air traffic demand at times exceeds, or is expected to exceed, the declared capacity of the air traffic control services concerned.[3]" This is supported by ICAO Document 9971 Manual on Collaborative Air Traffic Flow Management, which states, "As a general rule, ATFM is needed whenever airspace users are faced with constraints on their operations, and in areas where traffic flows are significant".

c. As the practice of ATFM has grown since its first implementation, ICAO has recognised that it is necessary for all air navigation service providers (ANSP) to have a common understanding of what ATFM is. To that end, ICAO published the following definition[4]:

> ***"ATFM is a service established with the objective of contributing to a safe, orderly, and expeditious flow of air traffic by ensuring that air traffic control (ATC) capacity is utilised to the maximum extent possible, and that the traffic volume is compatible with the capacities declared by the appropriate air traffic services (ATS) authority."***

3.3.1 The objectives of ATFM in Qatar

The objectives of ATFM are:

a. enhancing the safety of the ATM system by ensuring the delivery of safe traffic densities and minimising traffic surges. Typical example of a surge is the high-density departure period at HIA between 06H00 to 08H00 in the mornings;

[3] Paragraph 3.7.5

[4] ICAO, Official definition, PANS-ATM Procedures for Air Navigation Services — Air Traffic Management [Doc 4444] 2001, 14th ed. (Amendment 3, 29/06/2004)

b. ensuring an optimum flow of air traffic throughout all phases of the operation of a flight by balancing demand and capacity. When this is achieved, unnecessary fuel burn at the runway holding points at HIA can be minimized, airborne holding is reduced, and ATC capacity is utilized to the fullest ensuring optimal traffic flow when demand is expected to exceed the available capacity of the ATC system.
c. facilitating collaboration among system stakeholders to achieve an efficient flow of air traffic through multiple volumes of airspace in a timely and flexible manner that supports the achievement of the business or mission objectives of airspace users and provides optimum operational choices. Importantly, for QAG this will introduce predictability and consistency of operations.
d. balancing the legitimate but sometimes conflicting requirements of all airspace users, thus promoting equitable treatment.
e. reconciling ATM system resource constraints with economic and environmental priorities. The potential savings from a relatively small base has been demonstrated, it will undoubtedly be larger when the SPR traffic volume targets are being met.
f. facilitating, by collaborating with all stakeholders, the management of constraints, inefficiencies, and unforeseen events that affect system capacity to minimize negative impacts of disruptions and changing conditions; and
g. facilitating the achievement of a seamless and harmonized ATM system while ensuring compatibility with international developments. Traffic arriving from neighbouring airports can be coordinated at departure point, to ensure a smooth traffic flow at HIA and in the HIA Terminal Airspace. Significant airborne delay avoidance will be achieved.

3.4 Air Traffic Flow Management for Qatar

3.4.1 Scenario Choices

Each of the possible scenarios were assessed against 30 criteria, advantages and challenges as discussed above, with a scoring and weighting assessment system. The result was favourable to the Multi-Nodal Cross-Border scenario and was presented to the MIDANPIRG/17 Meeting held in Cairo in April 2019, where the decision was ratified.

3.4.2 Cross Border Multi-Nodal Regional ATFM/CDM

a. A state/ANSP implements and operates an ATFM system based on the application of remote CTOT delivery impacting multiple flight information regions (FIRs) / sectors of airspace or airports coordinated via one single node within the country, illustrated below:

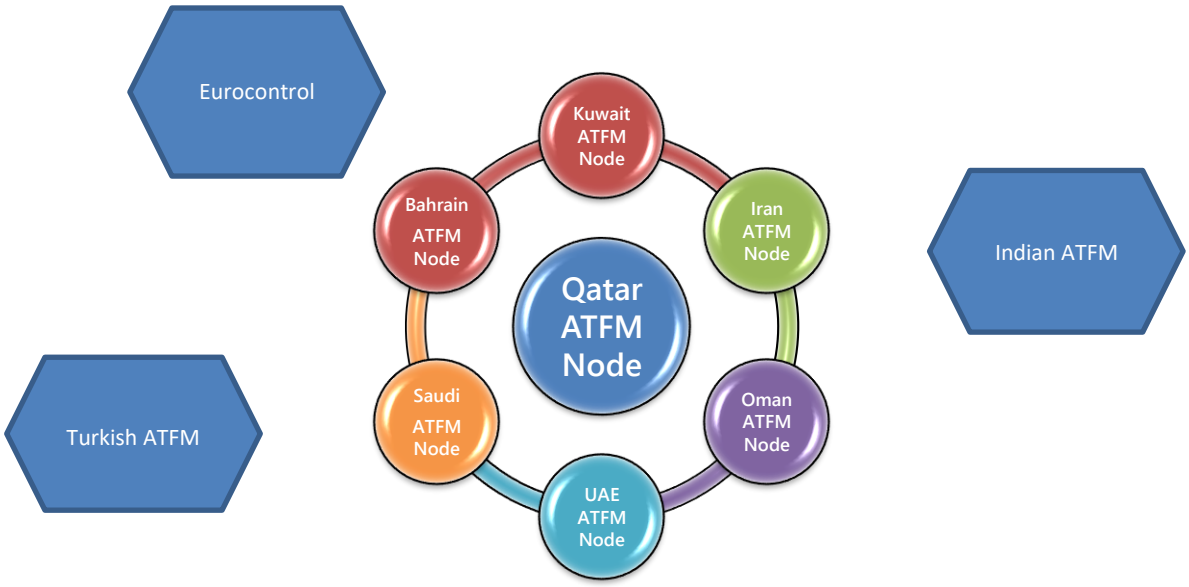


Figure 1: Multi Nodal ATFM

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

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

3.4.3 Key Components of the Cross-Border Multi-Nodal Regional Concepts

a. The concept of multi-nodal regional ATFM/CDM is already in use by ANSPs in the ICAO Asia Pacific Region. It should be noted that what follows here describes a mature multi-nodal ATFM system.

b. The key components of the cross-border multi-nodal regional concept are as follows:
    - Multi-nodal stakeholders are interconnected via a virtual communication framework
    - Each ANSP has an independent ATFM system.
    - Each ANSP independently manages demand/ capacity of its own airport(s) / airspace.
    - There is a common agreement to share essential data for ATFM by all multi-nodal stakeholders.
    - Stakeholders and ANSPs in the network communicate via agreed / established communication network.
    - There is harmonised and integrated data exchange between all stakeholders in the multi-nodal network.
    - Accurate prediction can be done either using flight progress via manual input or via an automated data feed such as flight data processing system (FDP), aeronautical fixed telecommunication network (ATFN), or space-based ADS-B.

3.5 Distributed Multi-Nodal ATFM Network

a. The Distributed Multi-Nodal ATFM Network concept is based on a network of ANSPs leading independent ATFM operations within their domain and connected to other ANSPs and stakeholders through effective information sharing mechanism. ATFM in Qatar will consist of two basic components:

- Procedures Common operating procedures and common ATFM operational guidelines and procedures, detailing responsibilities to be borne by QCAA and the stakeholders involved
- System An interconnected information sharing framework is a fully interconnected information sharing mechanism or protocols between stakeholders that ensure efficient communication of ATFM information. This include simple e-mails and

AFTN message exchanges up to automated system-to-system information sharing based on the system-wide information management (SWIM) concept.

b. Through these two components, QCAA will independently implement ATFM measures to regulate traffic into resources where demand exceeds capacity, while other ANSPs and stakeholders in the network can effectively comply with the measures by following the common operating procedure developed. Additionally, an effective communication and information sharing framework allows stakeholders to be involved in the decision-making process during all four phases of ATFM.

c. Below is a graphical representation of the procedures and systems under this concept. In this environment, an arrival ATFM unit (arrival ATFMU) responsible for the constrained resource would implement and publish ATFM measure(s) on a cloud-based information sharing network, while the departure ATFMU and relevant stakeholders subscribe or receive the information and adjust their operations accordingly.

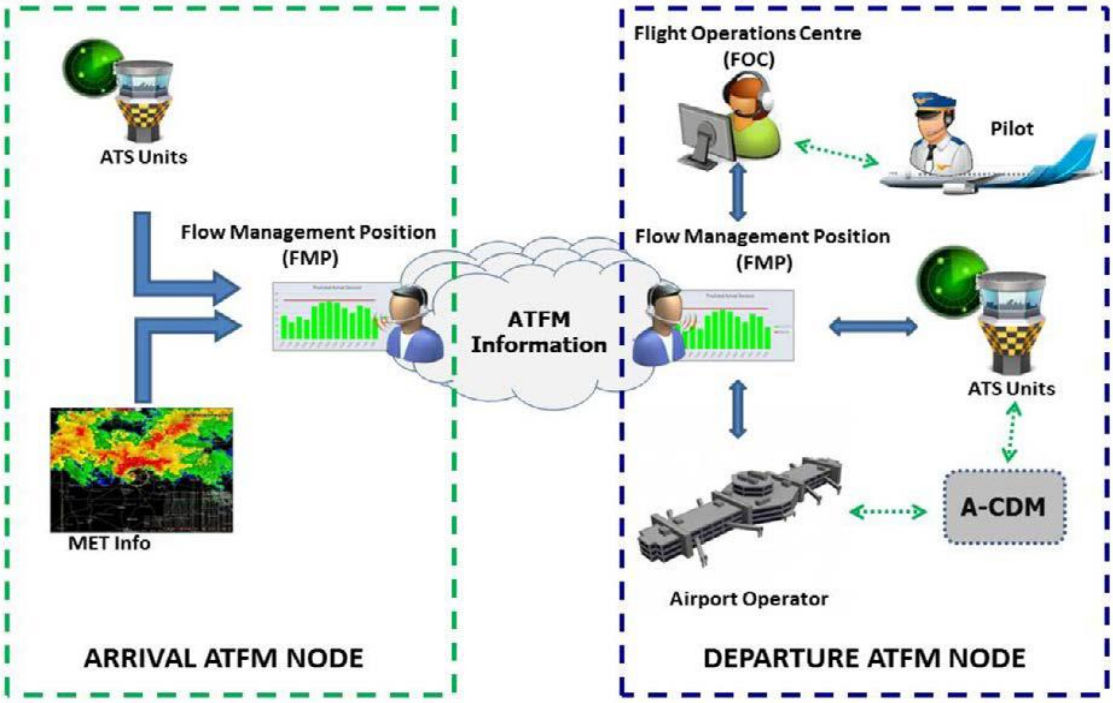


Figure 2: ATFM Nodes

d. The information sharing network also allows for a collaborative decision-making (CDM) process to take place between all relevant parties during the operations.

4 AIR TRAFFIC FLOW MANAGEMENT IMPLEMENTATION PRINCIPLES FOR QATAR

4.1 General Requirements

a. Implementing ATFM in an international environment requires a common understanding and robust coordination among all relevant stakeholders. ATFM implementation shall be supported by QCAA quality and change management processes.
b. ATFM is performed as a CDM process where HIA, QCAA, Airspace Users, military entities, and other stakeholders collaborate to improve the overall performance of the ATM network in the region.
c. ATFM in QCAA will support QR's business model as the primary operator at HIA.
d. The level of an ATFM service required will depend on several factors. Initially it will be a phased solution that balances HIA demand and capacity.
e. Appropriate acceptance will be sought from the Regulator. Such approval includes drafting of new ATFM Regulations and certification of the ATFM Service.

4.2 QATAR ATFM Implementation Elements

The following general elements will underscore the implementation of ATFM in Qatar:

a. a project management approach clearly defines the tasks for each stakeholder and contain milestones. This role will be fulfilled by IBG.
b. QCAA will oversee the implementation process in collaboration with the relevant oversight authorities, involving, when relevant, affected stakeholders. In this regard QCAA will play a vital role with the on boarding of the regulator and stakeholders; and
c. the ATFM Structure in QCAA and personnel who will lead the development of ATFM shall be identified by QCAA.
d. The ATFM/CDM requirements have been assessed, QCAA (or its delegated representative - IBG) will develop the ATFM Implementation Plan.
e. In its initial application, ATFM needs a phased approach processes, procedures or tools. The goal is to collaborate with stakeholders and to communicate operational information to QAG, QCAA, and to other stakeholders in a timely manner.
f. The proposed ATFM system will automate all ATFM related processes. Additional to the automated processes, e-mail and point-to-point telephone calls designed to exchange

information of operational significance and to relay information on factors affecting capacity, system constraints and significant meteorological conditions can be used as redundancy options.

5 AIR TRAFFIC FLOW MANAGEMENT IN QCAA

5.1 General

a. Collaborative Decision Making (CDM) is a key enabler in any ATFM strategy, allowing for the sharing of all relevant information among decision makers and supporting an ongoing dialogue between the various stakeholders throughout all phases of flight. CDM enables the various organizations to keep each other continuously updated on events resulting from the strategic to tactical phases.

b. CDM is built on the principle that all users have equitable access to the airspace and recognizes that stakeholders may have different priorities. It also acknowledges that the ultimate responsibility for the safety of air navigation services lies with the QCAA, which must take the final decision on initiatives to manage the flow of traffic.

> *Note: The goal of Global ATM Operational Concept is an evolution to a holistic, cooperative and collaborative decision-making environment, where the expectations of the members of the ATM community would be balanced to achieve the best outcome based on equity and access. Hence the need to follow a collaborative process to satisfy the requirements of the affected stakeholders. PANS-ATM, Doc 4444 states that ATFM should be implemented on the basis of a regional air navigation agreement or, when appropriate, as a multilateral agreement.*

c. Timely and regular operational briefings and conferences can not only provide an overview of both the current and future ATM situation, but they also allow for the discussion of any issues and may provide an outlook on operations for the coming period. Traffic patterns and the severity of demand and capacity imbalances will dictate the frequency of those meetings. They will occur on a daily basis at minimum but may also become more frequent depending on the situation (e.g., evolving meteorological events).

d. The outcome of these daily conferences will result in the publication of an ATFM daily plan (ADP) complete with subsequent updates. The ADP will be a proposed set of ATFM solutions prepared by the Qatar ATFM unit, with input from all stakeholders. It will align with the solutions established during the strategic phase and be kept under review, periodically updated and republished as required.

e. Feedback and review from ANSPs, AUs, and the ATFM unit during the post-operation analysis phase of the ATFM process can be used for the continuous improvement of pre-

tactical and tactical planning. This feedback helps the ATFM unit identify the reason(s) for ATFM solutions. The unit can then determine corrective actions to avoid reoccurrence, if possible, and improve the implemented solutions.

f. In addition to the daily conferences, the ATFM unit will hold periodic and post-event analysis meetings to review the effectiveness of ATFM processes, the compliance of AUs and ATC units, the accuracy of meteorological forecasts, etc. The objective shall be to ensure the effectiveness of the chosen ATFM processes after having taken stakeholders' requirements into consideration.

g. ATFM takes place during all phases of the ATM process. In the strategic phase, long-term planning and monitoring of resource capacities takes place. Where possible, long-term measures are implemented to match resource capacities to foreseen traffic demand. Examples include strategic airport slot allocation, military exercises, sporting events, air shows, significant weather systems, planned sectorisation, and ATC roster adjustment. In certain cases, such as planned large-scale airspace/airport disruption (runway/taxiway rehabilitation, CNS maintenance), traffic demands are adjusted via strategic means such as airport slot allocation or flight schedule adjustment long before the day of operations.

h. The process of demand-capacity monitoring continues in the pre-tactical phase, taking into consideration plans developed in the strategic phase, short-term constraints such as weather and equipage serviceability as well as updated traffic demands from adjusted airline schedules, flight permissions, and early submitted flight plans. If demand - capacity imbalance is apparent in the pre-tactical phase, ATFM solutions/measures can be prepared and communicated before execution.

5.2 Graphic depiction of ATFM Phases

The following figure provides a holistic perspective of ATFM Planning and the associated phases. Each of the elements will be discussed in greater detail below.

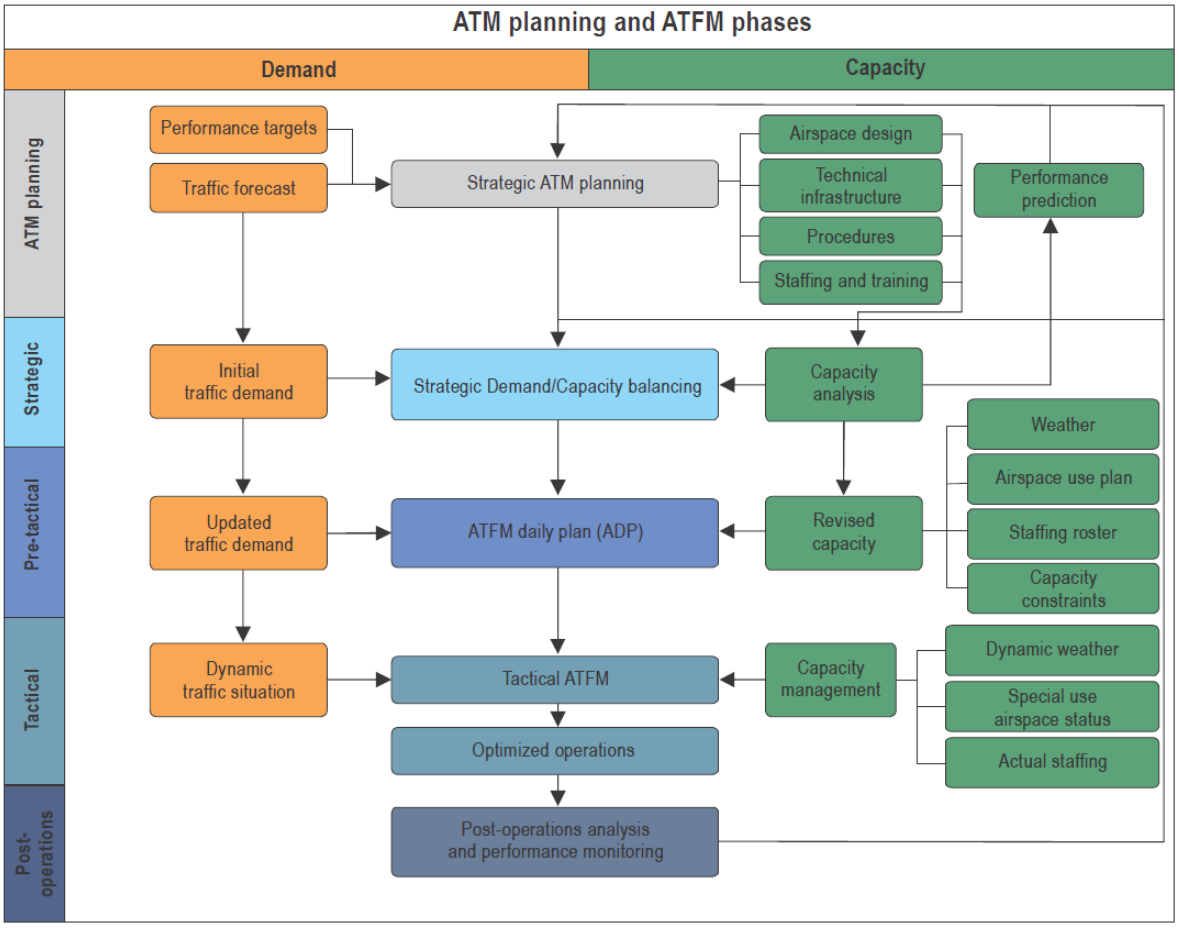


Figure 3: ATFM Planning and ATFM Phases

5.3 ATFM Phases

To balance demand and capacity a methodology is required to minimise the effects of the constraints within the Qatar ATM system. This methodology has several phases which lead to measures taken and solutions provided. ATFM will be carried out in several phases:

5.3.1 ATFM Planning

This is a preparatory activity required for the implementation of ATFM and is a continual process of the long-term planning activities within QCAA. The development of this CONOPS document is the beginning of the process, followed by a review of the airspace design (route structure and sectors); the technical infrastructure; and ATM procedures to search for potential capacity improvements. At this stage it is necessary for all to establish an accurate picture of the expected traffic demand through the collection, collation and analysis of the air traffic data, before moving onto the ATFM execution phase.

5.3.2 Strategic Planning

Strategic planning is normally carried out well in advance, typically from 1 week up to 6 months in advance. This occurs during the 6-monthly scheduling meeting. The strategic phase of planning does not only include scheduling e.g. winter and summer schedule, it can also be for a specific event or situation that can be planned for e.g. FIFA or also equipment upgrades, or loss planned. Strategic planning is carried out in conjunction with QCAA and QAG. It shall consist of examining the demand for the forthcoming season, assessing where and when demand is likely to exceed the available ATC capacity and taking steps to resolve the imbalance by:

a. arranging with the ATC authority to provide adequate capacity at the required place and time.
b. re-routing certain traffic flows (traffic orientation).
c. scheduling or rescheduling flights as appropriate. The operator needs to book a slot to arrive at the airport, but scheduling is not a function of ATFM and it depends on the airport if it is a level 3 co-ordinated airport. Rerouting of flows of traffic can only be done when the routing becomes available and is part of the pre-tactical planning;

Where a traffic orientation scheme (TOS) is to be introduced, the routes shall, as far as practicable, minimize the time and distance penalties for the flights concerned, and allow some degree of flexibility in the choice of routes, particularly for long-range flights.

5.3.3 Pre-tactical Planning

Pre-tactical planning entails fine-tuning the strategic plan in the light of updated demand data and would take place a week before operations. The ATFM Unit staff are responsible for this activity, and changes to the daily plan is communicated via existing ATFM channels. During this phase:

a) During this phase, the traffic demand for the day is analysed and compared to the predicted available capacity. The plan, developed during the strategic phase, is then adapted and adjusted accordingly.
b) The main objective of the pre-tactical phase is to optimize capacity through an effective organization of resources (e.g., sector configuration management, use of alternate flight procedures).

Note: While a CONOPS document is ideally a blueprint for the work methodology, when the work methodology is based on a CDM process

established between the stakeholders (e.g., flow management unit (FMU), airspace managers, AUs), better outcomes have resulted.

c) The tasks to be performed during this phase may include the following:
   i. determining the capacity available in the various areas, based on the particular situation that day;
   ii. determining or estimating the demand;
   iii. studying the airspace or the flows expected to be affected, the aerodrome expected to be saturated, calculating the acceptance rates to be applied according to system capacity;
   iv. conducting a comparative demand/capacity analysis;
   v. preparing a summary of ATFM measures to be proposed and submitting them to the ATFM community for collaborative analysis and discussion; and
   vi. at an agreed-upon number of hours before operations, conducting a last review consultation involving the affected ATS units and the relevant stakeholders, in order to fine-tune and determine which ATFM measures shall be published through the corresponding ATFM messaging system.

d) The final element of this phase is the ATFM daily plan (ADP), which describes the necessary capacity resources and, if needed, the measures to manage the traffic. The plan is based on hypotheses developed in the strategic phase, refined to the expected situation. It should be noted that the time limits of the pre-tactical phase may vary, as they depend on the precision of the forecasts, on the nature of operations within the airspace and on the capabilities of the various stakeholders.

e) The ADP must be developed collaboratively and aims to optimize the efficiency of the ATM system while balancing demand and capacity. The objective is to develop strategic and tactical outlooks for a given airspace volume or airport that can be used by stakeholders as a planning forecast.

f) It is recommended that the ADP cover a 24-hour period, at the very minimum. The plan may, however, cover a shorter period of time, provided that appropriate mechanisms are in place to update the plan on a regular basis.

g) The operational intentions of AUs shall be consistent with the ADP (developed during the strategic phase and adjusted during the pre-tactical phase).

h) Once the process has been completed, the agreed measures, including the ATFM measures, shall be disseminated using an ATFM message, which may be distributed using the various aeronautical communication networks or any other suitable means of communication, such as the Internet, e-mail, etc.

5.3.4 Tactical Operations

Tactical ATFM operations take place on the day it will take effect and shall consist of:

a. executing the agreed tactical measures to provide a balanced and even flow of traffic where demand would otherwise have exceeded capacity;
b. monitoring the evolution of the air traffic situation to ensure that the ATFM measures applied are having the desired effect and to take or initiate remedial action when long delays are reported, including re-routing of traffic and flight level allocation, to utilize the available ATC capacity to the maximum extent.

When the traffic demand exceeds, or is foreseen to exceed, the capacity of a particular sector or the airport the responsible ATC unit shall advise the ATFM unit, and other ATC units concerned. ATC to also advise ATFM in any unusual events e.g. weather, staff or equipment outages. Flight crews of aircraft planned to fly in the affected area and operators shall be advised, as soon as practicable, of the delays expected or the restrictions which will be applied.

5.3.5 Post Operations

During this phase, an analytical process is carried out to measure, investigate and report on operational processes and activities. This process is the cornerstone in developing best practices and/or lessons learned that will further improve the operational processes and activities. It shall cover all ATFM domains and all the affected stakeholders (Annexure F). Post-operations analysis may be used to:

a. identify operational trends or opportunities for improvement;
b. further investigate the cause-and-effect relationship of ATFM measures to aid in the selection and development of future actions and strategies;
c. gather additional information with the goal of optimizing ATM system efficiency in general or for ongoing events;
d. perform the analysis of specific areas of interest, such as irregular operations, special events, or the use of re-route proposals; and
e. make recommendations on how to optimize ATM system performance and to further improve the impact of ATFM measures on operations.

5.3.6 Summary of ATFM Phases

Phase	Who	When	Where	Why
ATFM Planning	ATFM Management and staff	Continuous	At organizational level	To develop the CONOPS, the required airspace infrastructure, the required Technical infrastructure, ATM procedures, staffing practices and associated training
Strategic Planning	Executive management in conjunction with ATFM management	Six months to 1 week before operation	At the ATFM Unit	a. The collection and processing of data with regular review of procedures. b. A review of available capacity. Where there is an imbalance ATFM will try to optimize/maximize the capacity e.g. new procedures or more staff. c. Result of this stage is a plan with what is expected to happen and when/where the imbalance may be.
Pre-tactical Planning	Conducted by ATFM staff	ATFM daily coordination and next day planning	At the ATFM Unit	• Usually a week until day before operation. • Utilizing the plan from the strategic phase, compare the available data to further optimise the plan. • Capacity can be optimized with sectorization, better management of staff etc. • Conduct an analysis of demand vs. capacity and assess the flow that might be affected or airport that might be saturated and calculate the expected maximum rate. • Communicate the proposed solution (CDM). • After consulting final changes or fine tuning can be completed. • The output of this phase is the ATFM Daily Plan.
Tactical Operations	ATFM Staff	Day of operation	At the ATFM Unit / at a flow control position in Operations	In the tactical phase, any plans formulated in the strategic and pre-tactical phases are refined, demand-capacity monitoring and balancing continues with the execution of various ATFM solutions/measures such as capacity enhancements, ground delay programme (GDP), Ground Stop (GSt), or other

Phase	Who	When	Where	Why
				measures prescribed elsewhere in this document and in ICAO Doc 9971.
Post Operations	Data collection by ATFM unit Presentation of findings to executive management Proposal of changes, as required.	Subsequent to Operations, both dynamic and periodic	At the ATFM Unit	To ensure post-operations analysis carried out can provide a view of how a chosen ATFM measure(s) have achieved the desired performance objective

5.4 Air Traffic Flow Management Solutions for Qatar

5.4.1 ATFM Solution Categories

When demand exceeds capacity either at an airport or within a given airspace, a solution needs to be found to correct the imbalance. The QCAA traffic managers and stakeholders shall adopt the least restrictive mitigation and exit strategy for the situation. Typically, ATFM solutions can be categorised into capacity optimisation and ATFM measures. A brief explanation will follow each solution.

5.4.2 Capacity Optimisation

Capacity optimisation is the process of identifying additional capacity to meet the demand placed on the resource; usually by doing this, little or no impact is borne by the airspace users. Typical capacity optimisations for Qatar, as used in ATFM are as follows.

- **Sectorisation** Should it be identified that demand is going to exceed capacity in a particular sector of airspace, active measures such as splitting the sector into two or

more sectors or changing the configuration of the sector to spread the demand may be warranted.

- **Flexible Usage of Airspace** Flexible usage of airspace is one of the most effective ways of increasing capacity. Should demand exceed capacity, Collaborative Decision - Making discussions shall take place with authorities which have primary control over danger, restricted and/or prohibited airspace. This is typically the military or recreational airspace users. By negotiating the use of this airspace during peak demand, additional routings or vertical airspace can be affected and sectors can be amended to facilitate optimisation of airspace.
- **Balancing Arrival and Departure Capacity** Advance planning and facility directives at HIA dictates the establishment of "shared" use runways. This mixed mode operation significantly increases airport capacity and minimise delay.
- **Staff Optimisation** Additional ATC operational staff can be appointed to assist a controller should demand exceed capacity. For example, an executive controller can be appointed to a sector to assist with coordination, clearance creation and delivery.

5.4.3 ATFM Measures

ATFM mitigation strategies, when needed, are necessary measures for managing the flow of air traffic. Use of ATFM initiatives is considered based on both the level of intervention needed and the impact on stakeholders. The measures shall only be implemented when other solutions to optimise the capacity of a resource have been exhausted. An explanation and recommendation for when each ATFM measure shall be implemented is given below.

- **Minimum Departure Intervals (MDIs)** MDIs are tactical ATFM measure applied by setting a MINIT or MIT rate to departure flow.
- **Rerouting** Route-based ATFM measures (horizontal or vertical) aim to remove several flights scheduled to arrive at a constrained ATM resource.
- **Alternative or Advisory Routing Scenarios** Alternative routing scenarios are routes which are made available to airspace users on an optional basis to offload traffic from certain areas.
- **Fix Balancing** Fix balancing is a tactical ATFM measure usually applied during flight that aims to distribute demand and avoid holding and delays. The aircraft is assigned a different arrival or departure fix than the one indicated in the flight plan.

- **Ground Delay Programmes (GDP)** A ground delay programme is a pre-tactical or tactical ATFM measure used to manage capacity and demand in a volume of airspace or at an airport. Aircraft are issued departure times (ATC slots) which correspond to entry times at the constrained airspace or arrival time at the airport. A GDP aims to reduce costly airborne holding and tactical ATC actions (radar vectoring, speed control, etc.) by delivering a manageable flow to the point of constraint for the conditions.
- **Ground Stop (GSt)** Ground Stop is an ATFM measure implemented when a severe unpredicted constraint is encountered in a sector of airspace or at an airport.
- **STAM (Short term ATFM Measures)** An approach to smooth sector workloads by reducing traffic peaks through short-term application of minor ground delays, appropriate flight level capping and exiguous rerouting to a limited number of flights.

5.5 ATFM Measure Selection Flowchart

a. The figure below shows the information to be taken into consideration in deciding whether an ATFM flow measure is required and the measure to be applied.
b. The flow chart is divided into the two resources which are monitored during the ATFM process – airports and airspace. The flow chart will assist flow managers in their decision-making process to manage the resource with least effect on airspace users.

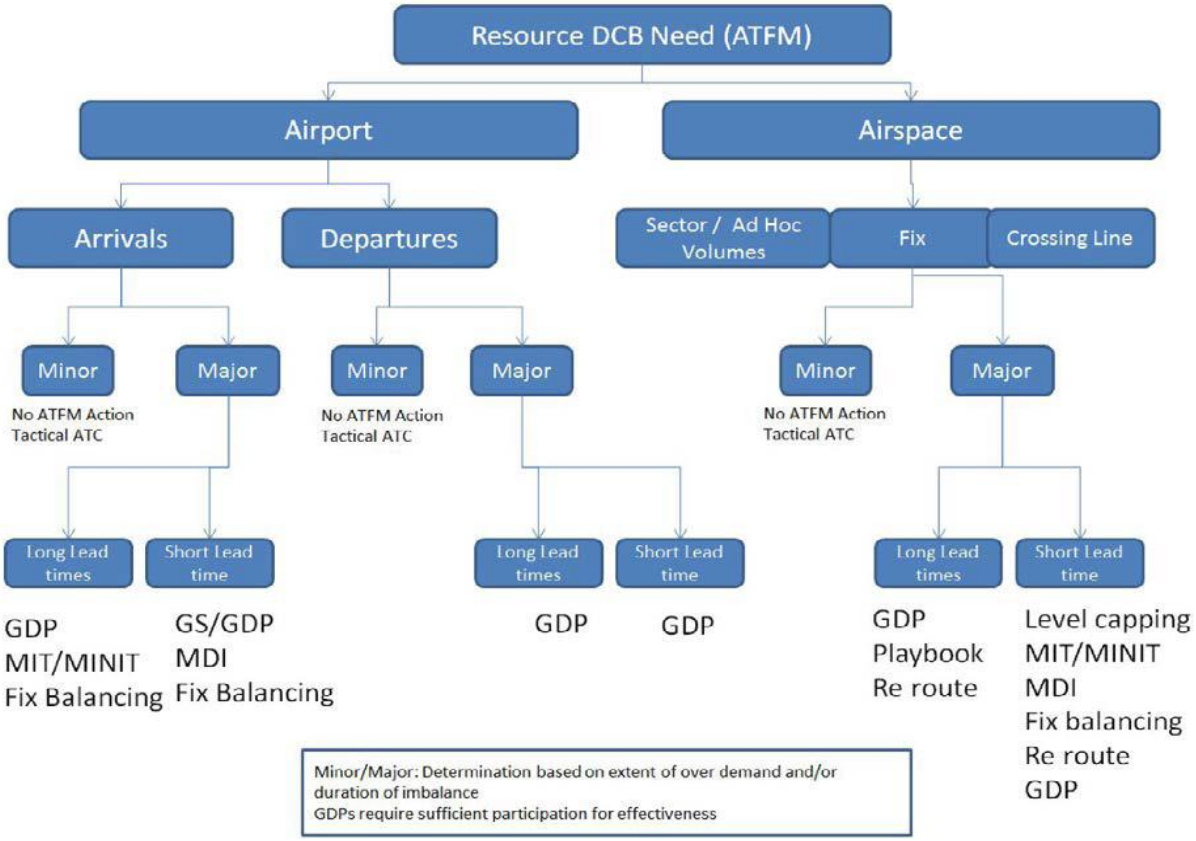


Figure 4: ATFM Measure Flowchart

6 AIR TRAFFIC FLOW MANAGEMENT COMMUNICATION

The ATFM procedures that will be developed for use in Qatar will apply to all flights subject to Air Traffic Flow Control and slot allocation departing from within Qatar or from within an agreed adjacent area. These procedures will describe the functions and responsibilities of ATFM across all stages of ATFM, and most of the functionality and communication and information exchange will be normal system functions. It is however recognized that from time to time some communication and information sharing functions may require ATFM staff to manually interact with the ATFM system to ensure the optimal outcome.

6.1 Communication Exchange

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

b. The ATFM unit requires several layers of communication. As a basis for the exchange of information, notices to airmen (NOTAMs) and AIP supplements could initially be used to distribute instructions relating to the application of ATFM measures. For example, strategic ATFM routing information and certain ATFM operating procedures could be published as a NOTAM or in the AIP supplement.

c. The State of Qatar AIP will include information on specific arrangements for dealing with ATFM issues and coordination matters, in the same section as is located the brief description of the ATFM system. The AIP shall also include the telephone numbers of relevant ATFM units, in the event that they would need to be consulted for advice and/or information.

d. For consistency, the QCAA shall ensure that a single entity oversees the dissemination of ATFM information as well as its measures, and is responsible for monitoring, collecting and disseminating the information. This will ensure that applicable information is shared by all

ANSPs and operational stakeholders in a timely and efficient manner. As a best practice, this information shall be available electronically and kept current.[5]

6.2 ATFM Information

ATFM information in QCAA will include:

a. meteorological (MET) information having an effect on capacities (e.g., winds, runway visual range (RVR), thunderstorms (TS);
b. aerodrome and approach control (APP) infrastructure issues affecting routings or capacity;
c. capacity-limited APP areas including SIDs and STARs;
d. current and planned aerodrome runway configurations;
e. airport arrival and departure rates;
f. airport arrival and departure demand; and
g. applicable ATFM measures and off-load options;
h. en-route sector configurations, capacities and demands;
i. infrastructure issues affecting routings or capacity; and
j. airspace issues affecting routings or capacity (e.g., reserved airspace).

[5] A non-exhaustive list of the ATFM messages can be found in Annexure C.

7 AIR TRAFFIC FLOW MANAGEMENT SYSTEM REQUIREMENTS

7.1 General Capabilities

The ATFM system will have the following capabilities:

a. Demand prediction and monitoring for airport and airspace resources in the strategic, pre-tactical, and tactical timeframes[6]
b. Perform Demand / Capacity Balancing of a selected resources through modelling, initiation, monitoring, and revision of automated ATFM Measure during the strategic, pre-tactical, and tactical phase
c. To take tactical ATFM/CDM actions (GDP/AFP/GS) at short notice (i.e., within a 5-minute time-period).
d. Automated CDM with Aircraft Operators, Airport Operators, and other ANSPs.
e. Common situational awareness for stakeholders, for example but not limited to, awareness of demand and capacity at airports/airspaces/fixes/routes, anticipated delays, allocated COBT, CTOT, CTO, ETA, etc.
f. Record operational data
g. Post Operations analysis and performance reporting
h. Automated reporting on the performance of an ATFM Measure and the benefits of an ATFM measure, both of which are capable of drill-down type analysis
i. System administration, monitor, and control
j. Adaptation reference data administration

[6] Timeframes are defined based on ICAO 9971: Tactical = day of operations, pre-tactical = one day to one week prior to the day of operations, strategic = any time more than one week prior to the day of operations, post-operations = begins after flight has arrived at the gate or after the ATFM Measure has ended, depending on the context.

7.2 Collaborative Decision Making in ATFM

Group decision-making (or collaborative decision-making) is a situation faced when affected role players collectively make a choice from the alternatives before them. The decision is then no longer attributable to any single individual who is a member of the group.

a. The system will provide a web-based interface for authorized users to access flight-specific data for the purpose of decision making. Users of the web-based interface include, but are not limited to, ANSP users (e.g., Flow Managers, Area Control Centre users, Approach Control users, Air Traffic Control Tower users), aircraft operator users (e.g., operations centres users, airport operations users), and airport users.
b. The system provides a system-to-system interface for authorized external systems (e.g., other ANSP ATFM/CDM systems, aircraft operator systems, airport systems, A-CDM) to exchange data related to flights, resources, and ATFM Measures.
c. The system provides authorized users with the capability to dynamically configure, filter, and sort the web-based Flight List.
d. The system provides authorized aircraft operator users the capability to update flight-specific data, pre-departure, for their flights.
e. The system provides authorized aircraft operator users the capability to provide batch flight schedules and flight schedule updates.
f. The system provides authorized aircraft operator users the capability to cancel a flight. If the flight is part of an implemented ATFM Measure, the assigned slot can be held for a period of time for subsequent use by the aircraft operator.
g. The system provides authorized aircraft operator users with the capability to substitute slots associated with their own flights. Specifically, A CDM platform for the aircraft operator users to optimize their schedules through slot substitutions etc.
h. The system provides authorized aircraft operator users with the capability to substitute a flight's slot with an unassigned slot.
i. The system provides authorized aircraft operator users with the capability to perform a blind trade of their slot for a later slot in a user-specific time window that results in delay reductions to one or more other flights.
j. The system provides authorized aircraft operator users with an indication if their flight's delay has been reduced due to a blind trade requested for another flight.
k. The system provides authorized aircraft operator users with the capability to specify a flight-specific operational time that the system will not move a flight earlier than to protect

an aircraft operator's operational decision. Aircraft operators can move their own flights earlier than this time.

l. The system provides authorized ANSP users with the capability to specify the maximum delay permitted to be absorbed at the parking stand, on the surface – not at the parking stand. The remaining allocated delay is expected to be absorbed in flight via flight planning intent.
m. The system provides the ability for authorized users to exchange an ATFM daily plan (ADP).
n. The system provides the ability for authorized users to view an Operational Information System, on which relevant NOTAMs, ADP and ATFM measures are provided for informational purposes.
o. The system provides the ability for an authorized user to curate NOTAMs such that a specific subset of all available NOTAMs are displayed on the OIS.
p. The system provides the ability for an authorized user to provide text-based comments on individual flights for display through the OIS page.

7.3 Equipment

7.3.1 System Architecture Requirements

The vendor will define the system architecture for the ATFM system including system hardware, networking, network devices (e.g., routers, firewalls, switches), storage, external interface connectivity, required bandwidth to support end users, and end user positions and connectivity.

7.3.2 Three distinct environments

The system architecture will support the following distinct environments:

a. Operational: The primary environment used for operational ATFM. Requirements for availability, user load, flight load, and long-term data storage apply to this instance.
b. Test/Training: A second instance of the ATFM that supports user training and testing of software/adaptation/system updates prior to use on the Operational instance.
c. Backup (Recommended): A Backup instance is required to support a complete failure of the Operational instance.

7.3.3 Location

The system architecture will support the following distinct environments:

a. Operational: The primary environment used for operational ATFM. Requirements for availability, user load, flight load, and long-term data storage apply to this instance.
    i. Operational ATFM includes the Flow Management Unit (FMU) and the Flow Management Positions (FMP). The FMU houses two FMPs in a dedicated office space and is the primary FMP.
    ii. ATFM System access is also available at the ATC Supervisor's workstation at the supervisor's desk in the operations room for tactical ATFM applications.

7.4 ATFM Data Requirements

a. Multi-nodal ATFM provides a path for ANSPs in a common geographic region to autonomously deploy ATFM/CDM systems and processes. It sets technical requirements for the implementation of the regional ATFM operational concept in Qatar for cross-border ATFM.
b. In order for QCAA to develop ATFM services which operate in a multi-nodal environment, a standard interface definition is required for ATFM-service-to-ATFM-service data and control exchange. Regional and global interoperability of communications is critical to the implementation of effective, network-based cross-border ATFM. The Standard Interface Definition can be found in Annexure D
c. The ATFM-service-to-ATFM-service interface definition at HIA will address the following data types and controls:

    1) flight information (e.g., flight identification, aircraft type, departure aerodrome (ADEP), destination aerodrome (ADES), expected event time (e.g., off-block time (OBT), take-off time (TOT), landing time (LDT), and in block time (IBT)), route of flight, source of flight intent information);
    2) resource information (e.g., aerodrome configurations, airspace configurations, capacity, route availability);
    3) ATFM measure information (e.g., constrained resource (e.g., aerodrome or airspace), start and end times, type (e.g., GDP, GSt, MINIT or MIT); and d) CDM actions (e.g., pre-flight flight cancellations, slot substitutions, flight intent updates).

7.5 Data Management

The primary data for ATFM services in Qatar and elsewhere is reliable and accurate flight intent data. This data will be provided by the various organizations responsible for the authorization or execution of flights. The following data associated with flight intent are to be provided to ATFM services for use in demand predictions:

a. Airspace Users marketing schedule data; (Official Airline Guide OAG, or something similar);
b. Airport strategic slot data or any strategic slot allocation system;
c. ATM automation system data (e.g., ATS messages via aeronautical fixed telecommunication network (AFTN) or ATS message handling systems (AMHS), or data provided by the flight data processing (FDP) component) including:

    1) flight plans (FPL ATS message or comparable data);
    2) flight plan amendments (CHG ATS message or comparable data);
    3) flight plan cancellation (CNL ATS message or comparable data);
    4) indication of departure (DEP ATS message or comparable data)
    5) indication of arrival (ARR ATS message or comparable data);
    6) indication of flight delay (DLA ATS message or comparable data); and
    7) flight coordination (CPL and EST ATS messages or comparable data);

d. forecast weather data (usually GRIB-2 formatted);
e. FIR aeronautical data in electronic format and in AIX 5.1 format; and
f. correlated surveillance data (e.g., ADS-B, SSR, WAM, MLAT) via a surveillance feed via TCP/IP in CAT-062 format.

7.5.1 Graphic depiction of ATFM Data Requirements

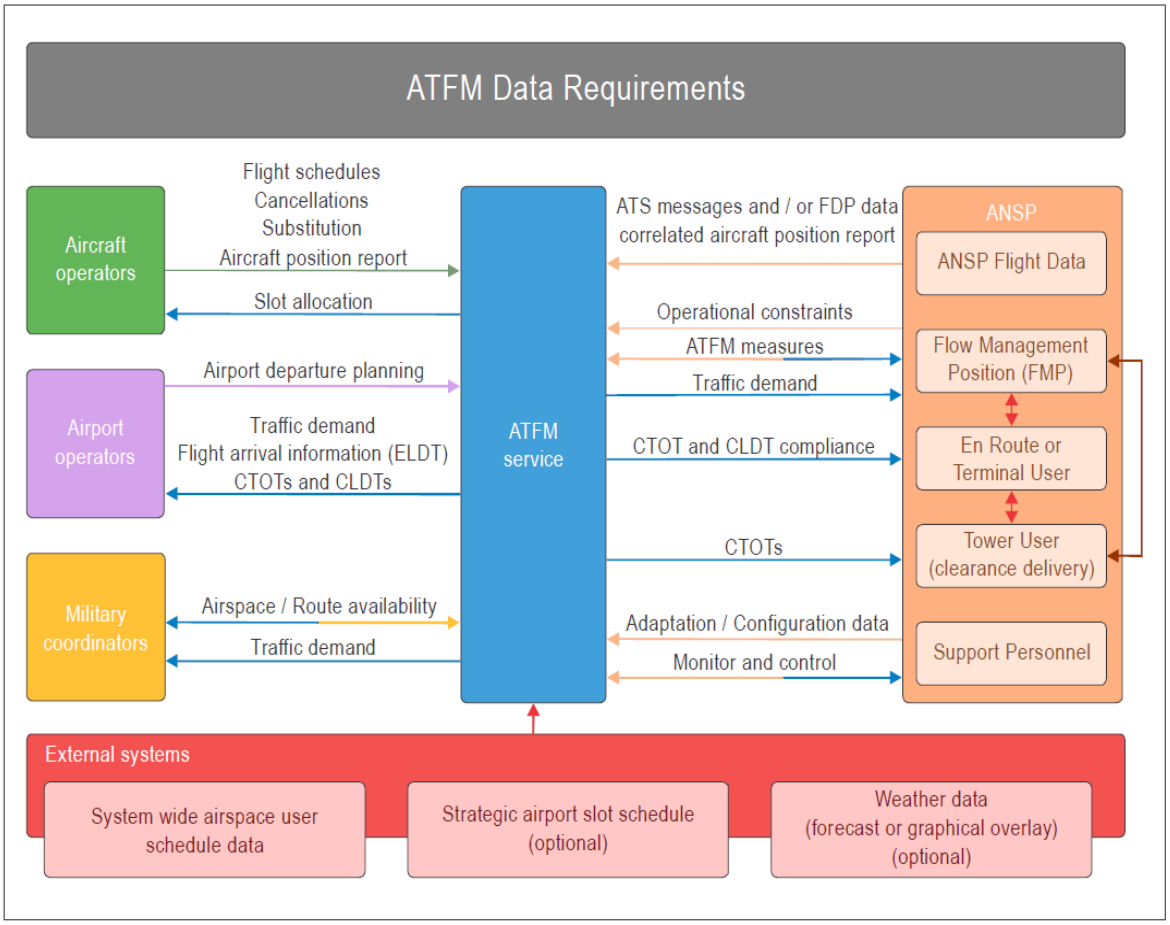


Figure 5: ATFM data Requirements

8 CONCLUSION

8.1 Production of the CONOPS

This CONOPS was developed by the user community to communicate the vision for the operational system to the acquisition and developer community.

8.2 Stakeholders

The stakeholder identification, roles and responsibilities are described in Annexure F.

8.3 Assumptions to be tested

There are no known assumptions in this CONOPS which need to be tested.

8.4 Risks due to disrupted / abnormal operational concepts

There are no known risks to normal operations foreseen in this CONOPS.

8.5 Items to be further described in other project documents

The following items need to be described in other project documents:

a. Training Plan
b. Interface Control Documentation
c. Implementation Plan
d. Standard Operating Procedures

8.6 Sign-off from stakeholders

The normal document approval process will apply to this document.

8.7 AIR TRAFFIC FLOW MANAGEMENT BENEFITS

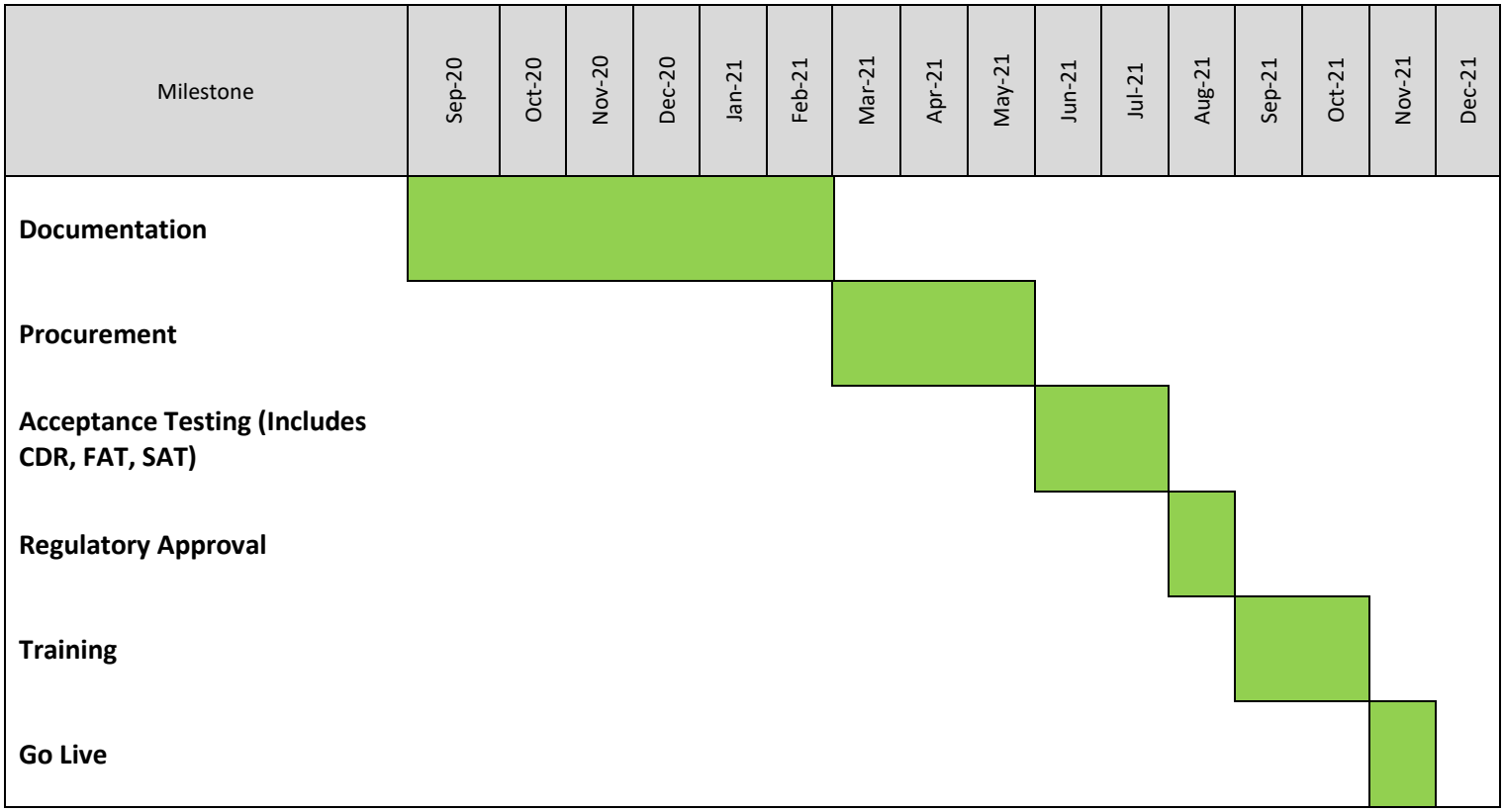
The operational benefits of ATFM in Qatar cover various domains of the ATM system which include:

a. enhanced ATM system safety throughout the ATM Value Chain from increased system operational efficiency and predictability through CDM processes for all stakeholders. These include, but are not limited to QAG, HIA, other role players;
b. effective management of capacity and demand through data analysis and planning with airlines avoiding significant fuel burn on the ground;
c. increased situational awareness among stakeholders and a coordinated, collaborative decision-making process;
d. development and execution of operational plans provides predictability to all stakeholders with fewer surprises and an ability to have a reasonable expectation around a day's operations;
e. improved punctuality, reduced fuel burn and other airspace user operating costs;
f. effective management of irregular operations and effective mitigation of system constraints and consequences of unforeseen events; and
g. provision of post-operational data related to traffic movements available to stakeholders.

9 APPLICABLE DOCUMENTS, STANDARDS AND REGULATIONS

- ICAO Global Air Navigation Plan (GANP)
- ICAO Air Traffic Management Operational Concept (ATMOC);
- Doc 4444 (Procedures for Air Traffic Management),
- Annex 2 (Rules of the Air),
- Annex 11 (Air Traffic Services).
- Local Air Traffic Control Instructions (LATCI) Edition 15
- ICAO Global Air Navigation Plan (GANP);
- ICAO Air Traffic Management Operational Concept (ATMOC);
- ICAO Doc 9971 Manual on Collaborative Air Traffic Flow Management (ATFM);
- Implementing Air Traffic Flow Management and Collaborative Decision Making, CANSO;
- Updated QCAR, as developed, approved and published.
- Manual on the System-Wide Information Management (SWIM) Concept (Doc 10039)

10 ANNEXURE A: WP 1.2.2 TIMELINES



11 ANNEXURE C: ATFM MESSAGES[7]

Number	Message	Description
1.	SAM – Slot Allocation Message	The SAM is used to inform AOs and ATS of the Calculated Take-Off Time (CTOT)
2.	SRM - Slot Revision Message	To notify all concerned of either a significant change (>5') to the original CTOT.
3.	SLC – Slot Cancellation message	An SLC is sent to AOs/ATS to advise that a flight which has received a CTOT is no longer subject to an ATFM restriction.
4.	SIP – Slot Improvement Message	A Slot Improvement Proposal message is sent to the AO by the ATFM UNIT for a flight to propose a new take-off time if it is possible to improve the existing.
5.	REA – Ready message	The REA message can only be sent by ATC following a request from AO. AO may ask ATC to send REA in 2 situations: 1. The flight is ready to depart before the EOBT (maximum 15 minutes before) 2. The flight is ready to depart before its CTOT
6.	FLS - Flight Suspension Message	The ETFMS indicates with an FLS that this flight is considered as not taking off. The flight data are kept in the database but suspended (non-availability of an aerodrome for a long period).
7.	DES - De-Suspension Message	This ATFM message indicates that a flight which was previously suspended is now de-suspended.
8.	RRP - Rerouting Proposal Message	This message is sent to an AO to offer a different CTOT or to avoid the need for a slot on a new route.
9.	RRN - Rerouting Notification Message	This message is sent to an AO to notify a rerouting triggered through the NM Client Application.
10.	ERR - Error Message	The error message indicates that an error has been found in a message previously received by ETFMS.
11.	SMM - Slot Missed Message	This message is originated by an AO when a slot time given in the SAM cannot be achieved but where a new EOBT cannot be supplied.
12.	SPA - Slot Improvement Proposal Acceptance Message	This message is a positive response to a Slot Improvement Proposal (SIP) message.
13.	SRJ - Slot Proposal Rejection Message	This message is confirmation that an AO cannot comply with a Slot Improvement Proposal (SIP) message.
14.	RFI - Request for information Message	The RFI message is used by the AO to change the flight's readiness status from SWM (RFI NO) to RFI. The RFI status of the flight will be set to YES.

[7] This is a non-exhaustive list. Final Operational Procedures will refine this list.

Number	Message	Description
15.	SWM - Sip Wanted Message	The SWM message is used by the AO to indicate that it cannot accept SRM when an improvement is possible but wants to be in a position to refuse an improvement. The RFI status of the flight will be set to NO.
16.	FCM - Flight Confirmation Message	An AO indicates to ETFMS the RVR capability of a flight with an EOBT in the future.
17.	RJT - Rerouting Rejection Message	Used by an AO to reject an RRP message.

12 ANNEXURE E: REGULATORY REQUIREMENTS TO SUPPORT ATFM

a. A national Qatari Regulation that describes and regulates the service will be developed, submitted for approval and adopted. The Regulations will describe, among other:
    i. Air traffic flow management framework
    ii. General obligations of the Air Navigation Services
    iii. Obligations of the Air Navigation Services concerning the ATFM Unit
    iv. General obligations of ATS units
    v. General obligations of operators
    vi. General obligations of airport operators
    vii. Consistency between flight plans and airport slots
    viii. Obligations concerning critical events
    ix. Monitoring of compliance to ATFM measures
    x. Performance assessment
    xi. Safety requirements
    xii. Additional requirements
    xiii. Penalties
    xiv. Entry into force and application
b. ICAO provisions for ATFM are contained in Chapter 3, Section 3.2 of Doc 4444. Regional ATFM provisions will be published by means of Doc 7030 by each ICAO region where ATFM is established.
c. Detailed procedures for the application of flow management in Qatar will be published by means of the QCAA ATFM operations manual and temporary operational instructions for each flow management area.
d. Due to the wide and collaborative nature of ATFM provisions, the operational procedures will be published and will be freely available to all ATFM stakeholders.
e. A summary of flow management procedures will be published in the Qatar AIP (Annex 15, Section ENR 1.9).
f. ATFM will be subject to the oversight of the responsible national or regional regulatory oversight body. Whereas ATFM does not have the same safety impact as ATC, it is nevertheless suggested that an appropriate level of regulatory oversight be established.
g. Regulatory authorities are important stakeholders in ATFM. They will therefore be fully involved in the development and implementation of the ATFM process, as soon as possible from the project's conception.

13 ANNEXURE F: ROLES AND RESPONSIBILITIES OF STAKEHOLDERS IN THE QATARI ATFM SERVICE

a. This section describes the roles and responsibilities of the various stakeholders relevant to ATFM operations in Qatar. These stakeholders form the backbone of the Collaborative Decision Making (CDM) processes established to support ATFM.
b. When local experience dictates that stakeholders other than those presented in this section are needed, the affected parties will be included in the stakeholder approach by means of a collaborative process.

13.1 Flow management unit (FMU)/flow management position (FMP)

The QCAA FMUs/FMPs monitor and balance traffic flows within their areas of responsibility in accordance with ATM directives. They also direct traffic flows and implement approved traffic management measures. Their operations are overseen by the appropriate authority. FMU/FMP duties will include:

a. liaising with the ATS units within their area of responsibility to understand the current and anticipated capacity conditions;
b. collecting all relevant information, such as meteorological conditions, capacity constraints,
c. 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, or automated data gathering;
d. ensuring the distribution of all relevant information to the appropriate stakeholders, relying on the CDM processes supporting ATFM operations, and on the structures implemented to disseminate the information (such as websites, for example);
e. coordinating, with the affected stakeholders relying on CDM processes, the formulation of strategies to manage the flows in order to deal with, in accordance with the scenarios established at a strategic level, anticipated capacity/demand imbalance including those processes pertaining to routine operations, significant meteorological conditions, abnormal levels of traffic demand, and more generally to significant capacity constraints, planned or unplanned. Such coordination generally involves daily telephone and/or web conferences as required;
f. creating and distributing the ATFM daily plan (ADP) based on the previous coordination;
g. executing the daily plan and continuously monitoring, in real time, the ATM system, managing ATFM measures (implementing or cancelling them when no longer required,

adjusting hourly capacities, etc.) in coordination with the relevant units (meteorological units, adjacent ATS and ATFM units, etc.);

h. documenting, in real time, a complete description of all ATFM measures (for example, ground delay programmes, miles-in-trail) in a designated log. This shall include, among other data, for each measure, the start and end times, the affected stakeholders and flights, and its justification; and
i. managing regular (daily as well as at ad hoc intervals) post-operations analyses, participating in continuous improvement programmes.

13.2 Airspace users (AUs)

AUs in Qatar participate in the ATFM process by providing and updating flight plan or airspace utilization information as well as by participating in CDM processes (e.g., discussing ATFM strategies to improve flight efficiency and participating to share their priorities with the other stakeholders). AUs are essential stakeholders in the CDM processes and generally participate in telephone conferences and/or provide input and participate as CDM web-based interfaces.

The term “airspace user” is a broad denomination and encompasses different actors, both civil and military. Their actions can therefore be broken down by function, into airline operation centres, pilots, and military authorities. AUs encompass all entities that make use of airspace and that affect the availability of airspace.

The role of the AU is to:

a. provide strategic input into capacity/demand scenarios and mitigation plans, including internal measures such as schedule compression;
b. ensure that the latest schedule information and flight planning information are supplied to the ATFM service;
c. participate in ATFM/CDM teleconferences;
d. provide tactical input into capacity/demand scenarios and the selection of required appropriate ATFM measures;
e. perform mitigating actions supported by the ATFM service;
f. ensure ATFM information such as ATFM measures (calculated take-off time (CTOT)) is distributed to each affected flight;
g. comply with the ATFM measures in place, for example, CTOT compliance; and
h. participate in post-event analyses.

13.2.1 Pilots

Pilots play a specific role in ATFM insofar as they are to operate their flights in compliance with relevant ATFM measures. This may include adhering to controlled times, re-routes, or altitude capping restrictions. Pilots also have the responsibility to communicate with ATC if they foresee not being in a position to comply with a given measure.

They shall be aware of the ATFM measures intended to affect them, in order to ensure that the flight is not operated in a way that intentionally negates the delay absorption measure (e.g., accelerating to offset the effects of a GDP).

13.2.2 Military

The Qatari military users have specific requirements and require an environment wherein their mandate can be fulfilled. Their needs and the impact of their actions on the network can carry significant consequences. Military users therefore have a specific role to play in ATFM. Their use of airspace ranges from reserving blocks of airspace needed for the conduct of specific missions to operating flights in the exact same way as a civilian operator. For the purpose of simplicity, in this section the term military user refers, without distinguishing among them, to military authorities, flying units and non-flying airspace users (such as ranges, etc.). As far as ATFM is concerned, military users are therefore expected to:

a. provide airspace utilization plans to the appropriate ATC and ATFM units in a timely manner in accordance with flexible use of airspace (FUA) principles when relevant;
b. ensure that operations comply with the agreed-upon FUA plan and advise the appropriate unit immediately of completion or cancellation of FUA operations;
c. participate in ATFM/CDM teleconferences or provide input to the calls;
d. ensure that the latest flight information is supplied to the ATFM system;
e. ensure that the flights comply with the ATFM plan in place;
f. coordinate with the ATFM/ATC unit(s) for tactical release of airspace or permission to fly through restricted/active airspace when required by circumstances; and
g. participate in post-event analyses.

13.3 ATS units

QCAA ATS units providing the various ATC services play a central role in ATFM. Whereas each unit controls flights at different moments, the roles and responsibilities of ATS units are similar within their specific area of responsibility (aerodrome, approach, area). They are expected to:

a. participate in relevant ATFM/CDM teleconferences;
b. provide input regarding capacity and configuration for their area of responsibility;
c. provide strategic input into capacity/demand scenarios;
d. provide pre-tactical input into capacity/demand scenarios;
e. provide tactical input into capacity/demand scenarios;
f. deliver aircraft as per the ADP, ensuring compliance with ATFM measures;
g. monitor resource throughput and ATC workload during ATFM situations and request amendments, when necessary;
h. liaise with the unit responsible for ATFM to ensure that the ATFM plan is suitable, if not part of an ACC/approach control unit; and
i. participate in post-event analyses.

13.4 HIA / DIA Airport operators

Airport operators' involvement can be direct, or when they operate from an airport collaborative decision-making (A-CDM) standpoint, coordination can occur through the A-CDM structures. In terms of ATFM, airport operators are expected to:

a. participate in relevant ATFM/CDM teleconferences;
b. provide input to the strategic capacity declaration of airports;
c. coordinate with the pertinent ATFM/ATC unit and affected airspace users to schedule activities such as construction, maintenance and repairs or snow removal that will affect the flow of traffic or the airport capacity;
d. participate in CDM coordination discussions where the airport capacity will be affected by meteorological conditions, maintenance or other airport-related issues; and
e. participate in post-event analyses.

13.5 Meteorological service provider

There are a variety of meteorological phenomena that can impact traffic and trigger the need for flow management. As a result, MET information providers play a crucial role in ATFM, both in

forecasting those events to mitigate their consequences, as well as in providing accurate real-time meteorological information. Adverse meteorological conditions can impact an aerodrome — in which case MET service providers would be involved in ACDM if it has been set up for that aerodrome (thunderstorms, fog, significant changes in surface wind speed or direction) — or can cover large portions of airspace (squall lines, tropical cyclones, frontal systems, etc.). The involvement of MET services in ATFM is systematically relevant, whether it is direct or indirect (in the case of A-CDM processes, for example).

In the Qatari ATFM service, QCAA Meteorology service is expected to:

a. participate in ATFM/CDM coordination discussions (teleconferences) where meteorological conditions will affect capacity;
b. provide accurate and timely information on meteorological conditions at aerodromes, digital gridded forecasts of upper wind and temperature, and information about significant meteorological conditions that have an influence on capacity of a given volume of airspace or an airport; and
c. participate in post-event analyses.

13.6 States

Even though States and State authorities are not required to be systematically involved in the daily operations of ATFM, they still have specific responsibilities, the first of which is, to ensure that ATFM is “implemented for airspace where air traffic demand at times exceeds, or is expected to exceed, the declared capacity of the air traffic control services concerned.”

States are also responsible for the publication of ATFM procedures and information in the State AIP. The QCAA as delegated service provider will be responsible for this role.

- END -

ACTION PLAN FOR IMPLEMENTATION OF ATFM IN THE MID REGION

Key Activities	Action		Target date	Deliverable	Champion	Supported by	Status / RMK
	No	**Description**					
Key Activity 1 Agreement on the ATFM Regional Framework	**1.1**	Recommending the best Scenario for a regional ATFM framework	20 Mar 2019	Recommendation	ATFM TF/2 meeting		Completed
	1.2	Presentation to the ACAO ANC/40	21 Mar 2019	Support	ACAO		Completed
	1.3	Preparing a Working Paper to MIDANPIRG/17	30 Mar 2019	WP	Secretariat	Chairman	Completed
	1.4	Agreement on the regional ATFM framework by MIDANPIRG	18 Apr 2019	MIDANPIRG Conclusion	MIDANPIRG/17	Secretariat	Completed
	1.5	Presentation to the ACAO Executive Council	28-29 Apr 2019	For support	ACAO		Completed
	1.6	Notifying States about MIDANPIRG/17 Conclusion and that the development of ATFM CONOPS started	30 Apr 2019	State Letter	ICAO	Chairman	Completed
Key Activity 2 Development of CONOPS	**2.1**	Review of the CONOPS V0.1 during ATFM TF/3	12 Jan 2020	ATFM CONOPS draft V0.1	ATFM TF/3		Completed
	2.2	Further review V0.1 and develop V0.2 for presentation to the ATFM TF/4	20 Feb 2020	ATFM CONOPS draft V0.2	ATFM Core Team		Completed
	2.3	Review V0.2 by the ATFM TF/4	20 Sep 2020	ATFM CONOPS draft V0.2			Completed
	2.4	Presentation to ACAO ANC	28 Sep 2020	For Info and Support	ACAO		Completed
	2.5	Development of the CONOPS draft V0.3	20 Oct 2020	Chairperson and Secretariat			Completed
	2.6	Circulate the MID ATFM CONOPS draft V0.3 to ATFM TF members	20 Oct 2020	email to TF members for final comments	Secretariat	ACAO	Completed
	2.7	Feedback form Task Force members on the MID ATFM CONOPS draft V 0.3	31 Oct 2020	Feedback/comments	Task Force members		Completed
	2.8	Presentation of MID ATFM CONOPS draft V0.3 to ATM SG/6 for review	9 Nov 2020	Consolidated version of ATFM CONOPS V0.3	Chairman and Secretariat	ATFM Core Team	Completed
	2.9	Endorsement of the MID ATFM CONOPS V1.0 by MIDANPIRG/18	Feb 2021	ATFM CONOPS V1.0	MIDANPIRG/18		Completed
	2.10	Circulation of the MID ATFM CONOPS V1.0 to States	Mar 2021	ICAO Doc 014: MID Region ATFM CONOPS v1.0	posted under ICAO Docs		
	2.11	Presentation to ACAO Executive Council	29 – 30 June 2021	For Info and Support	ACAO		On-going

Key Activities	Action		Target date	Deliverable	Champion	Supported by	Status / RMK
	No	**Description**					
Key Activity 3 Development of ATFM Regional Framework and Common Operating Procedures	**3.1**	Development of ATFM Regional Framework and Common Operating Procedures initial draft V0.1 to be presented to the ATM SG/6	1 July 2021	ATFM Regional Framework and Common Operating Procedures initial draft V0.1	Chairperson and Secretariat		On going
	3.2	Circulation of the ATFM Regional Framework and Common Operating Procedures initial draft V0.1 to ATFM TF members	1 July 2021	email to ATFM TF members for comments	Secretariat		
	3.3	Feedback form Task Force members on ATFM Regional Framework and Common Operating Procedures initial draft V0.1	1 August 2021	Feedback/comments * consolidate the inputs (after receiving feedback)			
	3.4	Development of: - ATFM Regional Framework draft V0.2, - ATFM Common Operating Procedures draft V0.2.		- ATFM Regional Framework draft V0.2, - ATFM Common Operating Procedures draft V0.2.	ATFM Core Team	Volunteers (States/ ANSPs/ ORGs)	On going
	3.5	Presentation to ATFM TF/5 VTC of: - ATFM Regional Framework draft V0.3, - ATFM Common Operating Procedures draft V0.3.		- ATFM Regional Framework draft V0.3, - ATFM Common Operating Procedures draft V0.3.	ATFM TF/5 Virtual meeting		
	3.6	Presentation to ACAO ANC	Q2 2022	For Info and Support	ACAO		
	3.7	Circulation of the: - ATFM Regional Framework draft V0.3, - ATFM Common Operating Procedures draft V0.3. to ATFM TF members.		email to ATFM TF members	ICAO	ACAO	
	3.8	Feedback on V0.3.		Feedback/comments	ATFM TF members		
	3.9	Consolidation of: - ATFM Regional Framework draft V0.4, - ATFM Common Operating	Nov 2021	Consolidated version of Draft ATFM Regional Framework and draft Common Operating	Chairman and Secretariat	Chairman ATFM Core Team	

Key Activities	Action		Target date	Deliverable	Champion	Supported by	Status / RMK
	No	Description					
		Procedures draft V0.4. for presentation to ATM SG/7 meeting.		Procedures			
	3.10	Presentation to ACAO Executive Council.	TBD	For Info and Support	ACAO		
	3.11	Endorsement of MID ATFM Regional Framework and Common Operating Procedures V1.0 by MIDANPIRG/19	Q1 2022	ATFM Regional Framework and Common Operating Procedures V1.0	MIDANPIRG/19		
	3.12	Circulation of the endorsed versions of CONOPS, Regional Framework and Common Operating Procedures and posting on the ICAO MID Website.	Q1 2022	State Letter	ICAO	ACAO	
	3.13	Presentation to ACAO Executive Council	May 2022	For Info and Support	ACAO		
Key Activity 4 Implementation of ATFM in the MID Region	**4.1**	Development of MID ATM Operational Data Exchange process	9 Nov 2020	MID ATM Operational Data exchange	Chairperson and Secretariat		Completed
	4.2	Presenting to the MIDANPIRG/18 for endorcemnet	Feb 2021	MIDANPIRG Conclusion 18/XX			Complate
	4.3	Establishment of the webpage under ICAO secure portal, including the ATM and Airspace user data	Feb 2021	Group name			Complate
	4.4	State nominated FPs briefings	26 May – 15 June 2021				On-going
	4.5	Teleconferences between concerned stakeholders to exchange ATM related info	2021	Teleconferences to exchange info	ICAO MID	States - IATA	
	4.6	Implementation of the MID ATFM Regional Framework and Common Operating Procedures	Cont.	Implementation roadmap	States		

Key Activities	Action		Target date	Deliverable	Champion	Supported by	Status / RMK
	No	Description					
	4.7	Implementation of ATFM framework at national level	Cont.	National ATFM framework	States		
Key Activity 5 Post Implementation Review of the MID ATFM Regional Framework	**5.1**	Post implementation review	Each 3 months	Post Implementation review	ATFM Core Team		
	5.2	Improvement of the ATFM Regional Framework and Common Operating Procedures	TBD 2022	Proposal for improved ATFM Regional Framework and Common Operating Procedures	ATFM TF	ATFM Core Team	
	5.3	Review and continuous improvement of the ATFM Implementation in the MID Region with consideration of establishment of centralized ATFM system for the MID Region	TBD	Continuous improvement	ATFM TF	ATFM Core Team	
Key Activity 6 Training and raising awareness related to ATFM	**6.1**	Development of National ATFM Implementation Plan and Training Programme Template for qualifying ATFM Specialist	TBD 2021	Training Programme Template for ATFM Specialist	ATFM TF / ATFM Core Team		
	6.2	Development of working arrangement for the ATFM Visits to States that would include ATFM Workshop and/or training courses	TBD 2021	working arrangement for the ATFM Visits	ATFM TF / ATFM Core Team		
	6.3	Organizing an ATFM Workshop with the planned A-CDM Workshop	21-23 Oct 2019	A-CDM/ATFM Workshop	ICAO/ACAO	ATFM TF	Completed
	6.4	Organizing ATFM Workshop/Training/wibnars Awaerness Courses: - Capacity calculation and declaration - ATFM Publications issues - Flight Planning systems capabilities	Q3-2021	ATFM Training Awaerness/Courses	ICAO/ACAO/IATA	TBD	
	6.5	Conduct ATFM Support visits to States	TBD 2021	ATFM Support visits	ATFM support Team	TBD	

Key Activities	Action		Target date	Deliverable	Champion	Supported by	Status / RMK
	No	**Description**					
	6.6	Conduct familiarization visits/webinars of ICAO ATM/CDM CADENA, Singapore, India, EUROCONTROL, FAA, etc.	TBD	ATFM Familiarization Visits	ACAO ICAO		

TERMS OF REFERENCE (TOR) OF THE MIDANPIRG AIR TRAFFIC FLOW MANAGEMENT TASK FORCE (ATFM TF)

I. TERMS OF REFERENCE

1.1 Perform a joint assessment and confirmation of the Pre-requisites for a regional ATFM solution. This shall include:

a) Assessment of the performance objectives of the individual participating States and definition of common performance objectives for a regional ATFM service.

b) Perform a data collection and analysis to identify hot-spot areas and critical times in a regional ATFM service area where demand consistently exceeds capacity. The reasons and contributing factors for unbalanced demand and capacity are to be identified.

c) Analysis of air traffic flows within the designated area of the regional ATFM service that is causing unbalanced demand and capacity. The analysis shall identify the traffic fractions that due to their uniformity are candidates for effective ATFM measures to increase the efficiency without violating the equity principle.

1.2 Develop an ATFM Concept of Operations and a Framework which addresses ATFM minimum requirements for the implementation of ATFM in the ICAO MID Region.

1.3 Agree on a mechanism to support the phased implementation of ATFM measures in the MID Region, when and where required.

1.4 Identify, research and recommend appropriate guidance regarding:

a) aerodromes Aerodromes and enroute capacities Airspace capacity under the normal circumstances and adjustment factors affecting the capacity;

b) regular review for all aerodromes and ATC sectors where traffic demand is expected to reach capacity, or is resulting in traffic congestion;

c) regular review of the implemented ATFM measures and the related publications; to support implementation of the required mesures and reflection by the data houses (such as: Flight Planning Systems) and compliance of the airspace users;

d) mechanisms for ATFM data gathering, and exchanging operational data related to airspaces/aerdromes availablility and air operation data between States, ANSPs, Airspace users, Organizations and ICAO, which may include:

i. adjusted aerodromes and enroute capacity due to factors affecting capacity such as:

- Amid and after crisis management measures (mainly related to ANS Business Continouty Plans and recovery);
- special use airspace status, runway closures; or
- weather phenominas.

ii. traffic demand information which may include flight schedules, flight plan data, repetitive flight plan data as well as associated surveillance updates of flight status; and

iii. ATFM Daily Plan.

e) measure compliance of airspace users with the applicable ATFM measures; and

f) any other guidance relevant to the Regional ATFM Framework.

1.5 Consider existing and planned ATFM initiative in the Region, and make specific recommendations to ensure their alignment.

1.6 Ensure inter-regional ATFM harmonization with adjacent ICAO Regions.

1.7 Recommend appropriate inputs related to the implementations of ASBU ~~Modules~~ Elements / Threads relevant to ATFM such as NOPS, A-CDM, etc.

1.8 Report to the ATM SG.

1.9 Review periodically its Terms of Reference and propose amendments as necessary.

~~1.10~~ Coordinate as deemed necessary with the ~~Aerodromes Sefety, Planning and Implementation Group (ASPIG) and the Meteorology Sub-Group (MET SG) the issues of mutual interest~~ relevant MIDANPIRG Sub-Groups and the Regional initiatives, metters of mutual interest.

II. COMPOSITION

2.1 The Task Force is composed of MID ATFM focal points and experts from:

a) MIDANPIRG Member States;

b) India, FAA, AACO, ACAO, AEROTHAI, CANSO, EUROCONTROL, IATA, and ICAO (Bangkok, Cairo, Paris Offices and HQ); and

c) other representatives from provider States and Industry may be invited on ad hoc basis, as observers, when required.

2.2 The Task Force shall elect a Chairperson to act as the point of contact on behalf the Task Force.

2.3 ICAO MID Office will act as the Secretary of the ATFM Task Force meetings.

III. WORKING ARRANGMENTS

3.1 The Chairperson, in close co-operation with the Secretary, shall make all necessary arrangements for the most efficient working of the Task Force. The Task Force shall at all times conduct its activities in the most efficient manner possible with a minimum of formality and paper work (paperless meetings). Permanent contact shall be maintained between the Chairpeson, Secretary and Members of the Task Force to advance the work. Best advantage should be taken of modern communications facilities, particularly video-conferencing (Virtual Meetings) and e-mails.

3.2 Face-to-face meetings will be conducted when it is necessary to do so.

LIST OF PARTICIPANTS

State	Name	Title
BAHRAIN	Mr. Ahmed Mohammed Bucheeri	Chief Air Traffic Management
	Mr. Abdulla Hasan Al Qadhi	Chief, Aeronautical Information Management & Airspace Planning
	Mr. Rashid Saleh Al Choban	Chief, Standards, Licensing & Development
EGYPT	Mr. Ahmed Al-Sayed Ahmed Khalifa	Senior ATCO – NANSC
	Mr. Amr Ibrahim Abdel Latiff	ANS Inspector – ECAA
	Mr. Ehab Raslan Mohamed	General Manager of Research and Development – NANSC
	Mr. Mahmoud Ahmed Nabil	ATCO – NANSC
	Mr. Mohamed Abdelfattah Mohamed	Senior ATCO – NANSC
	Mr. Mostafa Mohamed Assem	ATCO – R &D Specialist – NANSC
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	Mr. Hasrat Ali Khan	Assistant Manager (ATM)
	Mr. M K Nelli	Joint GM (ATM)
	Ms. Veena Bisht	DGM (ATM-ATFM)

State	Name	Title
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	Mr. Hassan Ghorbani	Chief of Surveillance and ATM Automation System Dep. - Airports and Air Navigation Company
	Mr. Mohsen HasanBeigi	Expert In-charge of Automation - Airports and Air Navigation Company
	Mr. Shahram Najafi	Tehran ACC radar controller
IRAQ	Mr. Mohammed Mahmood	AIR Traffic System Manager – GCANS
JORDAN	Mr. Ahmad Odeh	OJT Supervisor
	Mr. Ali Taleb Emrazeeq	Chief Amman Terminal Area Control Center
	Mr. Khaled Arabiyat	ATM Director
	Mr. Marwan Hani Al-Masri	Air Traffic Control Officer ATCO, Jordan MIDRMA Focal Point Amman Terminal Area Control Center
	Mr. Mohammed Farouq Othman Doqa	Air Traffic Control Officer ATCO Amman Terminal Area Control Center
	Mr. Mohammed Ali Yousef Almomani	Chief of Safety & Standard ATM
	Ms. Narman As'ad	Chief of ATM Training Division
	Mr. Nart Omar Younis Bzadogh	Director Quality & Safety Management System
	Mr. Tamer Alnabelsi	Chief of ANS Airspace Design Division

State	Name	Title
KUWAIT	Mr. Tareq Faisal. Alghareeb	Head of Radar Operations
LEBANON	Mr. Abdallah Kobaissi	Supervisor at Beirut ACC/APP
	Mr. Bassem Nasser	Chief of AIM
	Mr. Pierre Bou Saba	Chief Aerodrome Services
	Mr. Tarek Mrad	Head Section Beirut ACC
OMAN	Mr. Abdullah Said Al-Hasani	Standard Officer – ATFM
	Mr. Nasser Salim Al-Mazroui	Act. Director Air Traffic Control
QATAR	Mr. Dhiraj Ramdoyal	NCMC/Head ANS Inspectorate/SSP Administrator
	Mr. Kevin Cooper	ATM Advisor
	Mr. Mohamed Abdulaziz Almuhamadi	ATC / Head of Training, Air Navigation Department
	Mr. Pieter Jacobus de Bruyn	ATFM Specialist
	Dr. Ramy Saad	ANS Inspector
	Mr. Saleh Mohammed Alnisf	Head of IMS/Senior ATC

State	Name	Title
SAUDI ARABIA	Mr. Ahmad Sami Abughallab	Air Traffic Flow and Capacity Management Section Supervisor – SANS
	Mr. Bassam Ahmed Abdulllah Alghamdi	Air Navigation Safety Inspector – GACA
	Mr. Mazen Mohammed Alshihri	Airspace Management and Planning Manager – SANS
	Mr. Terad Ali J. Alghamedi	Analysis & Planning Supervisor/Airspace Management – SANS
SYRIA	Mr. Muhammad Salamah	Deputy of Air Traffic Management Director
UAE	Mr. Ahmed Al Obeidli	Manager – Air Navigation Section
	Mr. Ahmed Saleh Al Shehhi	Senior Airspace Coordinator
	Mr. Hamad Rashid Al Belushi	Air Navigation Services Specialist
	Mrs. Khawla Abdullateef Al Hammadi	Analyst – Flight Data Quality and Reporting
	Mr. Werner Pitz	Head of ANSP Research & Dataset
USA/FAA	Mr. Greg Hebert	Global Operations Liaison
	Ms. Midori Tanino	CADENCE TF Co-chair ATO International Global ATM Program Manager
	Mr. Robert Roxbrough	Regional Attaché – Abu Dhabi Office of International Affairs
YEMEN	Mr. Abdullah Abdulwareth AlEryani	Director of ACC/FIC

State	Name	Title
	Mr. Mahmood A Razak	Consultant of Director General of Air Navigation
	Mr. Saleem Saleh Saleem	Air Navigation Safety Manager
	Mr. Younis Al-Khader	Director General of Air Navigation

Org.	Name	Title
AACO	Mr. Mohamad Akel	Specialist – Economics and Technical Departments
	Mr. Walid ElHoss	Manager – Economics and Technical Departments
ACAO	Mr. Hicham Bennani	Safety and Air Navigation Expert
AEROTHAI	Mr. Piyawut Tantimekabut (Toon)	Air Traffic Management Network Manager Aeronautical Radio of Thailand Ltd (AEROTHAI)
CANSO	Mr. Joe Hof	CADENCE co-chair, CGH Technologies
	Mr. Stuart Ratcliffe	CANSO Co-Chair ATFM/A-CDM Work Group
EUROCO-NTROL	Mr. Keith Crawford	Senior ATFCM Expert
IATA	Ms. Zainab Khudhair	Manager Safety & Flight Operations (Africa & Middle East)
IFATCA	Mr. Raouf Helmy	IFATCA Representative, Middle East

Org.	Name	Title
ICAO MID	Mr. Mohamed Smaoui	Acting Regional Director (ARD)
	Ms. Muna Annadaf	Regional Officer, Communication, Navigation and Surveillance (RO/CNS)
	Mr. Radhouan Aissaoui	Regional Officer, Information Management (RO/IM)
	Mr. Ahmad Amireh	Regional Officer, Air Traffic Management and Search and Rescue (RO/ATM/SAR)
	Mr. Ahmad Kavehfirouz	Regional Officer, Air Traffic Management (RO/ATM)
	Ms. Dina Elkarimy	Technical Assistant (ATM/SAR/ASF)

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