



International Civil Aviation Organization

MIDANPIRG/20 and RASG-MID/10 Meetings

(Muscat, Oman, 14-17 May 2023)

Agenda Item 6.5: ATM/SAR

**METHODOLOGIES ADOPTED BY CAA OMAN TO CALCULATE THE ATC
CAPACITY OF ACC SECTORS**

(Presented by Sultanate of Oman)

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SUMMARY

This working paper is targeted to present Oman CAA's commitment for implementing ATC sector capacity, and methodologies adopted to develop the capacity to implement flow control measures and to effectively manage traffic within the Sultanate of Oman.

Action by the meeting is at Paragraph 4.

REFERENCES

- MIDANPIRG Air Traffic Flow Management Implementation Workshop (6-7 Feb 2023, Doha, Qatar)
- ICAO Annex 11- Air Traffic Services (AMDT. 2020).
- ICAO Doc 9971- Manual on Collaborative Air Traffic Flow Management (2018)
- ICAO Doc 4444- PANS ATM (AMDT. 2022)
- ICAO Doc 9426- ATS Planning Manual (1984)
- Sector Capacity - Air Traffic Flow Management (ATFM) Seminar, ICAO MID Office, Cairo, Egypt. (2009)
- FAA and Brazilian Model of ATC Capacity Determination Methodologies

1. INTRODUCTION

1.1. ICAO Annex 11- Air Traffic Services and Doc 4444- PANS ATM prescribe ATS authority to develop and implement ATC capacity.

1.2. As such, CAA Oman has adopted the available methodologies to determine the capacity of ACC sectors which made it possible to obtain a reference value for the sector's capacity.

1.3. It consists in obtaining a value, calculated a mathematical model, whose basic data are extracted from a research carried out by a group at the ATC staff, considering a moment of heavy activity, when the controller's actions and his availability, at that moment, to control the traffic of the control sector are observed and timed.

2. DISCUSSION

2.1 Knowledge of the capacity of air traffic control sectors for ATC operating positions is necessary for three reasons.

- a. Firstly, for long-term planning, adequate knowledge and understanding is required of any future shortfall in capacity, as indicated by traffic forecasts.
- b. Secondly, if it is realized that there is already a shortage of capacity requiring the application of flow control measures, it is necessary to know what exactly is the ATC capacity is, to limit air traffic to a level, route or sector which does not overload the system or penalize the operators excessively.
- c. Thirdly, it is necessary to know the required number of staff to run all operational working positions to effectively apply the flow control measures.

2.2 The sector capacity project for the determination ATC capacity of Muscat ACC has been a starting point to determine the ATC capacity and effectively and safely manage traffic within Muscat FIR.

2.3 The project has proposed a capacity baseline for ACC sectors and paved the way forward for tasks of developing ATC capacity for other ATC units in future.

2.4 CAA Oman has planned to implement ATC capacity and apply flow control measures accordingly, and capacity review will be the next step for any technological or operational changes that influence the current capacity.

3. ATC CAPACITY ASSESSMENT METHODOLOGY

3.1 The term ATC capacity reflects the maximum number of aircraft which a single ATCO can handle in one operational position to provide the aircraft with the regular air traffic services within a specified duration of time in a specified ATC sector(s), taking into account, the ATC unit configuration, weather, available staff and equipment, and any other factor that may affect the workload of the ATC Officer.

3.2 In Oman, the capacity of ACCs is calculated by analyzing recorded data from the current Data Analysis Tool (DAT), along with data ascertained from real time live traffic compiled and studied done in 2021-2022.

3.3 Therefore, this project is a cornerstone in defining sector capacity, and it is necessary to fulfil ICAO requirements. Additionally, it represents the first step in establishing the efficient Air Traffic Flow Management (ATFM) system within Muscat Flight Information Region (FIR).

3.4 The ultimate goal of the project is to increase overall safety performance for Muscat Air Traffic Services (ATS) via developing an efficient ATFM system that can provide better operational planning and human resources allocation.

3.5 The project team selected the two appropriate sector capacity methodologies as stated below mainly by assessing the current capacity situation in the Muscat ACC.

3.6 FAA sector capacity methodology

3.6.1 Within this method, the sector capacity is determined using the average sector flight time in minutes during a week over 24 hours for any 15-minute time period. The formula used to determine sector capacity is

$$\text{Sector Capacity (optimal)} = \frac{\text{Average Sector Flight Time (seconds)}}{36 \text{ (seconds)}}$$

3.6.2 The calculation process is as follows:

- 1) Determine the average flying time across each sector within 15 minutes slots in seconds.
- 2) After that time is determined:
- 3) Multiply that value by 60 seconds to compute the average sector flight time in seconds;
- 4) Then divide by 36 seconds because each flight takes 36 seconds of an ATCO's work time; and
- 5) The result is the sector capacity value (optimum).

3.6.3 Adjustments: the optimum value for a sector is then adjusted for factors such as:

- 1) Airway structure;
- 2) Airspace volume (vertically and laterally);
- 3) Complexity;
- 4) Climbing and descending traffic;
- 5) Adjacent sectors;
- 6) Military operations and special-use airspace
- 7) Quality of the voice communications
- 8) Radar coverage

3.7 ATC SECTOR CAPACITY CALCULATION MODEL USED IN BRAZIL

3.7.1 In Brazil, the number of aircraft that can be controlled simultaneously by a single ATCO (N) in a given sector is estimated using the following formula:

$$N = \frac{\varphi \cdot \delta}{\eta \cdot \tau_m \nu_m}$$

where ATC capacity is a direct or inverse function of some factors to be considered:

Factors directly proportional to ATC capacity:	
φ	the ATCO availability factor, defined as the percentage of time available for planning aircraft separation procedures;
δ	average distance flown by aircraft in the sector, which is a function of the paths and en-route or terminal procedures established for each sector;
Factors inversely proportional to ATC capacity:	
η	number of communications for each aircraft in the sector. This number must be limited to the least possible required to understand the pilot and the ATCO. This number can be minimized by issuing a complete clearance sufficiently in advance for flight planning;
τ_m	mean duration of each message. This factor can be minimized by issuing messages objectively, without lengthy explanations that are detrimental for an understanding between the pilot and the ATCO; and
ν_m	mean speed of aircraft in the sector. <i>If δ and ν_m are replaced with the average flight time of the aircraft in the sector (T), this formula can be replaced with a simpler version</i>

4. ACTION BY THE MEETING

4.1 The meeting is invited to:

- a) note the information contained in this paper;
- b) request member States to share their experiences on the subject matter of this paper; and
- c) discuss any relevant matters as appropriate.