International Civil Aviation Organization

MIDANPIRG/21 and RASG-MID/11 Meetings

(Abu Dhabi, United Arab Emirates, 04-10 March 2024)

Agenda Item 5.3: ANS (AIM, PBN, AGA-AOP, ATM-SAR, CNS and MET

TRAFFIC COMPLEXITY AND DENSITY RELATIONSHIP IN THE DETERMINATION OF ATCO MINIMUM EXPERIENCE REQUIREMENTS (MER)

(Presented by United Arab Emirates)

SUMMARY

This working paper provides a summary on the United Arab Emirates Traffic Complexity and Density Relationship in The Determination of ATCO Minimum Experience Requirements (MER) study.

Suggested actions are presented in paragraph 3.

REFERENCES

- *ICAO Document 9868 - Manual on Air Traffic Controller Competency-Based Training and Assessment*
- *ICAO Document 4444 - Procedures for Air Navigation Services (PANS-ATM)*
- GCAA CAR Part VIII, Subpart 4 Air Traffic Service Organisations

1. INTRODUCTION

1.1 Current ATS regulations for calculation of ATCO minimum experience requirements (MER) is interdependent with traffic density in calculating training hours for ATCO's. This concept is deemed to be considered a rudimentary approach and the introduction of the traffic complexity calculations into these assessments is deemed a more rational method in calculating the MER. However there is limited guidance on managing these assessments.

1.2 The primary objective of this working paper is to analyse how variations in traffic complexity and density impact the determination of MER for ATCOs. Understanding this relationship is essential for adapting training programs, ensuring workforce competence, and maintaining a high level of safety in air traffic management.

2. DISCUSSION

THE UNITED ARAB EMIRATES TRAFFIC COMPLEXITY AND DENSITY RELATIONSHIP IN THE DETERMINATION OF ATCO MINIMUM EXPERIENCE REQUIREMENTS (MER)

2.1 Gathering comprehensive data on air traffic complexity and density across various airspace configurations and regions is crucial in the determination of the Traffic Density and Complexity relationship.

Collaborative efforts with member states, air navigation service providers, and industry stakeholders will be necessary to obtain accurate and representative data.

2.2 Statistical and analytical tools will need to be employed to examine the correlation between traffic complexity, density, and ATCO performance. This analysis will consider factors such as airspace design, technology integration, and traffic management procedures.

2.3 The key factors influencing ATCO MER include:

(i) Airspace Configuration

Different airspace configurations, including terminal airspace and en-route sectors, can significantly affect the workload and decision-making requirements for ATCOs. This working paper will investigate how the complexity of different airspace designs correlates with MER;

(ii) Technological Advances

Advancements in air traffic management technologies may influence the skills and experience needed by ATCOs. Evaluating the impact of technology on traffic complexity and density will be crucial in determining appropriate MER; and

(iii) Traffic Management Procedures

Variations in traffic management procedures, such as separation standards and coordination protocols, can contribute to differences in workload for ATCOs. This working paper will explore how these procedures affect the establishment of MER.

2.4 The task demands on controllers, including ATC complexity, equipment interface, and procedural requirements, shape subsequent controller activities. Workload is then influenced by performance shaping factors. To establish a connection between ATC complexity and a controller's subjective workload, the study will need to identify complexity factors and correlate them with workload indicators.

2.5 The concept of a Workload Matrix Calculator should be considered. it combines traffic density and complexity statements with a scoring system that will calculate a mean score that can align with low/medium and high traffic workload benchmarking. The Workload Matrix Calculator will determine the MER for each rating. ATC units shall determine and periodically review which Traffic Density/ Complexity Category is appropriate for the ATC Unit. This shall be acceptable to the relevant Authority.

2.6 A draft example of an ATCO Workload Matrix Calculator can be found in **Appendix A** which has been developed for the Aerodrome Control environment and in the Approach Control environment. The separation of the disciplines is important as there are varying influencing factors between the operational environments that need to be captured separately. There are some overlapping performance shaping factors that can be represented in both calculators (Sector Capacities, Weather, ATM Systems as some examples). These are represented on the Workload Matrix Calculators as a ‘Complexity and Density’ value.

2.7 With the assignment of a Complexity and density value on the Workload Matrix Calculator, it is then possible to assign a score that is defined in this example as (with respect to traffic density):

- Sporadic / Occasional / Infrequent (Classified as **LOW** and assigned a score of **1**)

- Often / Regular / Frequent (Classified as **Medium** and assigned a score of **2**)
- Steady / Constant / Continual (Classified as **High** and assigned a score of **3**)

Once the Matrix has been populated, a cumulative score will be displayed as a Unit Workload Score. This score can be aligned with a Complexity and Density Range which is assigned as follows:

- Score **< 34** which aligns with **LOW** Complexity **LOW** Density
- Score **34 – 55** which aligns with **Medium** Complexity **Medium** Density
- Score **> 55** which aligns with **High** Complexity **High** Density

2.8 With the defined Complexity and Density range outcome from the Workload Matrix Calculator application, it will be possible to directly align the outcome with published MER requirements (where applicable). To provide an example, based on the current UAE Civil Aviation Regulation Part VIII subpart 4, Air Traffic Services – Appendix 2 Minimum Experience Requirements criteria, the proposed Complexity and Density Grading generated from the ATCO Workload Matrix Calculator will have considerable relevance:

<table>
<tr><th>Training Days/Hours</th><th>HIGH</th><th>MEDIUM</th><th>LOW</th></tr>
<tr><td>Aerodrome Control</td><td rowspan="4">150/600</td><td rowspan="3">100/400</td><td rowspan="3">50/200</td></tr>
<tr><td>Approach Control (Procedural)</td></tr>
<tr><td>Approach Control (Surveillance)</td></tr>
<tr><td>Area Control (Surveillance)</td><td colspan="2">NOT APPLICABLE</td></tr>
</table>

*Training hours calculated as: Previously Rated Controller / Ab-Initio Trainee

2.9 In conclusion, this working paper aims to provide valuable insights into the relationship between traffic complexity, density, and the determination of ATCO MER. The findings will contribute to the ongoing efforts to enhance air traffic management training programs, adapt to evolving technologies, and ensure the continued safety of global aviation.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) Consider and note this working paper; and

b) Based on the results of this study, recommendations for adjusting MER criteria and developing targeted training programs will be proposed. These recommendations will be informed by a collaborative effort involving ICAO, member states, and industry stakeholders.

Appendix A

Sample ATCO Workload Matrix Calculator Template – Aerodrome Control

WORKLOAD MATRIX AERODROME CONTROL	Sporadic Occasional Infrequent	Often Regular Frequent	Steady Constant Continual
	LOW	MEDIUM	HIGH
COMPLEXITY & DENSITY VALUE	1	2	3
Aircraft Movements including Vehicle Movements	0		
Reaching (or Exceeding) Sector Capacity	0		
Separation Requirements, Arrivals and Departures	0		
Conflicting Traffic on Manoeuvring Area	0		
Aircraft Mix (Performance, Wake Turbulence Category)	0		
Runway Holding Point Delay	0		
Air Traffic Flow Management (ATFM)	0		
Conditional Clearances	0		
Coordination (Internal/External) Required	0		
Exercises/Special Missions	0		
VIP/VVIP Movements	0		
Training/Test Flights/UAVs (Drones)	0		
Special Events (Restricting Normal Operations)	0		
Weather Affecting Operations, e.g. Go-Around, Deviation	0		
Aircraft Diversion (due to Visibility, Fuel etc.)	0		
Closed Runway(s)	0		
Crossing of Active Runways	0		
Pushback Restrictions/Delays	0		
Taxiway Restrictions/Closure/WIP	0		
Interaction with ATM Systems	0		
Non-controlling Tasks	0		
Frequency Congestion, Repeating Instructions	0		
Pilot Non-compliance with ATC Instructions	0		
Pilot - Poor RTF or Unfamiliar	0		
Degraded Equipment	0		
Emergency and Unusual Operations	0		
COMPLEXITY & DENSITY RANGE	< 35	35 - 56	> 56
UNIT WORKLOAD SCORE	0		

Sample ATCO Workload Matrix Calculator Template – Approach Control

WORKLOAD MATRIX APPROACH CONTROL	Sporadic Occasional Infrequent	Often Regular Frequent	Steady Constant Continual
	LOW	MEDIUM	HIGH
COMPLEXITY & DENSITY VALUE	1	2	3
Aircraft Movements including Vehicle Movements	0		
Reaching (or Exceeding) Sector Capacity	0		
Separation Requirements, Arrivals and Departures	0		
Heading, Vectoring, Spacing, Re-routing Required	0		
Conflicting Traffic (Same Level, Crossing, Climb/Descend)	0		
Aircraft Mix (Performance, Wake Turbulence Category)	0		
Holding/Orbiting	0		
Air Traffic Flow Management (ATFM)	0		
Conditional Clearances	0		
Coordination (Internal/External) Required	0		
Limited Airspace, i.e. FUA, SUA etc.	0		
Exercises/Special Missions	0		
VIP/VVIP Movements	0		
Training/Test Flights/UAVs (Drones)	0		
Special Events (Restricting Normal Operations)	0		
Weather Affecting Operations, e.g. Go-Around, Deviation	0		
Aircraft Diversion (due to Visibility, Fuel etc.)	0		
Interaction with ATM Systems	0		
Non-controlling Tasks	0		
Frequency Congestion, Repeating Instructions	0		
Pilot Non-compliance with ATC Instructions	0		
Pilot - Poor RTF or Unfamiliar	0		
Degraded Equipment	0		
Short Term Conflict Alert (STCA) Activated	0		
Emergency and Unusual Operations	0		
COMPLEXITY & DENSITY RANGE	< 34	34 - 55	> 55
UNIT WORKLOAD SCORE	0		