



# WORKSHOP ON THE DETERMINATION AND ASSESSMENT OF ATC CAPACITY

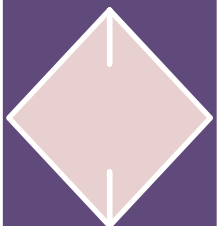
Abuja, 08 - 12 July 2024

ATC Sector capacity assessment  
and review

- ASECNA Dakar center -

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# Summary



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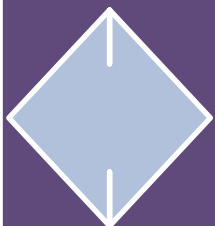
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# Background

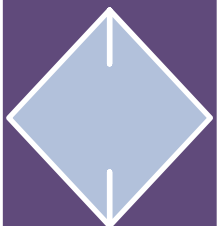


## # ICAO Protocol Question 7.081

**2018** : CAA (ANACIM) edit circular No00139/ANACIM/DG asking for Capacity determination to satisfy national regulations and ICAO SARPs.

## Objective of the Circular

To provide ANSP with indications and general information on the determination of ATC Sectors capacity



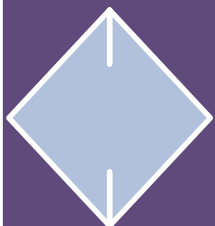


# Background



## Action required

ANSP to development of policies and procedures for determination of ATS sectors capacity including the number of personnel required to ensure the provision of adequate ATS services.





# Definition



## **ATC capacity :**

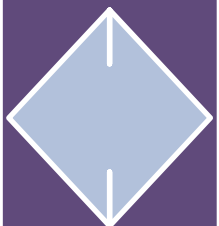
Sector capacity is a metric that shows how much traffic can be safely handled by an ATC unit in that sector in a given amount of time (practically per hour – Doc 4444 § 3.1.1.3).



# Capacity management principals

Regardless of the calculation method in use, the main principles of capacity management are:

- If the traffic forecast exceeds the capacity, then either another sector should be open or traffic restrictions need to be applied.
- If the traffic forecast shows that much more traffic can be handled, then excessive sectors need to be closed and restrictions need to be eased.



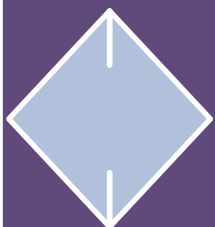


# Part 1

## Dakar ACC sector capacity assessment

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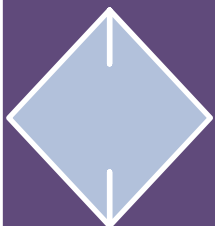
# Capacity assessment in ASECNA - Dakar ACC



## ASECNA adopted DORATASK model

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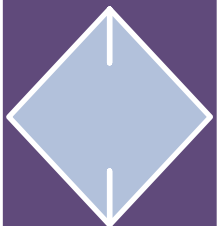
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## Overview of DORATASK method

# Centered on controller workload assessment

# The **workload assessment** is based on the time spent for :

1. **observable tasks** composed of routine and conflict resolution tasks - can be recorded and timed, and
2. **non-observable tasks** needed for planning - generally cannot be directly recorded or timed.





# Capacity assessment in ASECNA - Dakar ACC



## Overview of DORATASK method

### # Centered on controller workload assessment

A margin is needed by the controller to safely manage traffic in the sector :

**The Recuperation time (Third time)** which, in ASECNA case, is empirically determined based on historical data and represents **15 minutes** (1/4 of an hour).



# Capacity assessment in ASECNA - Dakar ACC



## Controller workload assessment

According to the model, controller workload is the summation of times spent on :

- observable and
- non-observable tasks.



# Capacity assessment in ASECNA - Dakar ACC



## Step 1 : Assessment of controller theoretical workload (Cmt)

This value integrates times spent for observable and non-observable tasks

How ?



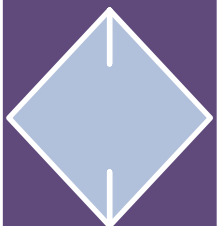
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## Step 1 : Assessment of controller theoretical workload (Cmt)

### Determination of parameters in the table

<b><math>T_p</math></b>	Average flight time in the sector
<b><math>T_{scp}</math></b>	Specific task time (Strip marking, A/G COM, etc.)
<b><math>T_o</math></b>	Total ATC occupancy time during $T_p$
<b><math>N_{scp}</math></b>	Total number of specific task (Strip marking, A/G COM, etc.) during $T_p$
<b><math>N_{atco}</math></b>	Number of ATCO in charge of the unit (EXE/PLN)





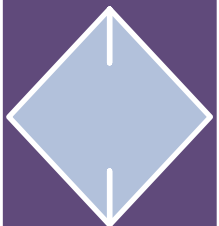
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Step 1 : Assessment of controller theoretical workload (Cmt)

$$\text{Cmt (in \%)} = T_o / (T_p * \text{Natco})$$

This value allow us to theoretically assess the average workload of the control position in charge of the flight taken into account the number of controllers that intervene simultaneously in the management of this flight (executive and/or planner controller).





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## Step 2 : Assessment of controller average workload ( $C_m$ )

Other parameters to consider for  $C_m$  determination are :

<b>Nft</b>	Total number of flights in the sector during $T_p$
<b>100 %</b>	Occupancy rate



# Capacity assessment in ASECNA - Dakar ACC



Step 2 : Assessment of controller average workload (C<sub>m</sub>)

$$C_m = (N_{ft} / C_{mt}) * 100\%$$





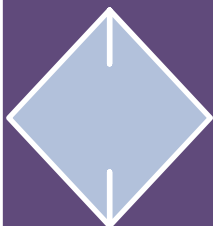
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## Step 2 : Assessment of controller average workload (Cm)

Use an excel file as follows :

AC ID	Tp	To	Nft	Natco	Cmt	Cm





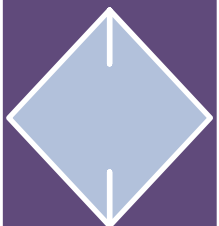
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## Step 3: Adjustment of $C_m$ to obtain the declared capacity ( $C_d$ )

The adjustment is needed to integrate the recuperation time ( $T_r$ )

$T_r = (T_p * Natco) / 4$	Adjusted recuperation time
$T_{oa} = T_o + T_r$	Adjusted total ATC occupancy time during $T_p$
$C_{ma} = T_{oa} / (T_p * Natco)$	Adjusted $C_m$
$C_a = (N_{ft} / C_{ma}) * 100\%$	Adjusted controller workload





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## Step 4 : Adjustment of $C_m$ to obtain the declared capacity ( $C_d$ )

Doc 4444 states that the most appropriate measure of capacity is likely to be the sustainable hourly traffic flow.

Hourly declared capacity  $C_d$  for a sector is :

$$C_d = (C_a * 60) / T_p$$

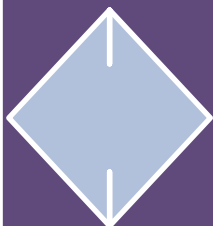


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## Step 4 : Assessment of controller average workload (Cm)

Use an excel file as follows :

AC ID	Tp	Toa	Nft	Natco	Cma	Ca

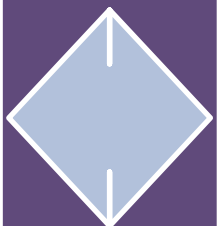




# Part 2

## Tower sector capacity assessment

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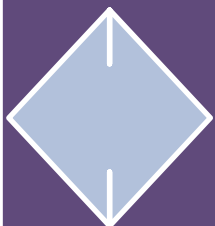
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# Capacity assessment – TOWER – # Dakar Diass airport

## Capacity determination method :

The empiric approach methodology was adopted to calculate the capacity for the tower position taking into account factors related to the airdrome and the sector in general.

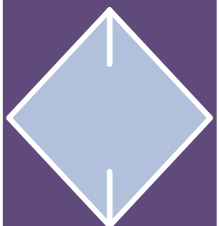




# Capacity assessment – TOWER – # Dakar Diass airport

## Factors considered :

- Runway occupancy time
- Airdrome layout (number of runways, taxiways, etc)
- Type of operations in the tower sector
  - IFR
  - VFR
  - Mixed mode
- Approach types
- separation, etc.



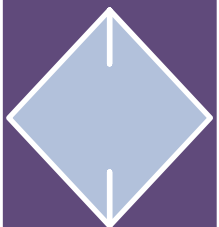


# Capacity assessment – TOWER – # Dakar Diass airport

## Considering :

- Airdrome layout (number of runways, taxiways, etc)
- Runway occupancy time (approximately 2 minutes)
- Approach types (IAF position)
- Aircraft categories operating the airdrome
- Historical data

**Landing interval 6 minutes** (allow integration of departures) :







# Capacity assessment – TOWER – # Dakar Diass airport

## Landing interval of 6 minutes

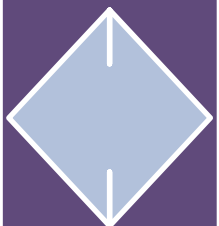
# Hourly approach capacity = 60 minutes  $\div$  Landing interval

▶  $60 \div 6 = 10$  aircraft per hour

# Integration of 1 take off for each landing aircraft

**Hourly capacity = 20 aircraft per hour**

(10 arrivals + 10 take offs)





# Capacity assessment – TOWER – # Dakar Diass airport

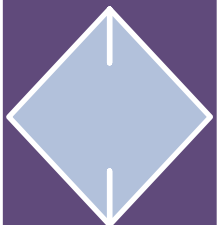
## Mixed mode operations in the tower sector

VFR / SVFR flights permitted

Statistics give average time for 1 VFR/SVFR flight in controlled airspace of 20 minutes.

$$60 \div 20 = 3 \text{ VFR/SVFR flight per hour}$$

**Declared capacity for tower sector = 23 aircraft per hour**





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