Airspace Volumes & Sectorisation

Module 13 – Activity 9

European Airspace Concept Workshops for PBN Implementation
OBJECTIVE

This module will provide a good understanding of Airspace volumes and Sectorisation supporting ATM.
Three GOLDEN RULES

Airspace Volumes protect the IFR Flight paths. They are Designed AFTER the routes have been designed.

Routes should not be designed so as to fit into pre-existing Airspace Volumes.

Only delineate as much airspace volume as needed.
Context & Iterations

Activity 6
Agree CNS/ATM Assumptions

Activity 7
Airspace Design Route & Holds

Activity 8
Initial Procedure Design

Activity 9
Airspace Design Volumes & Sectors

Activity 12
Finalisation of Procedure Design
TMA

Terminal control area

A control area normally established at the confluence of ATS routes in the vicinity of one or more major aerodromes. [Doc. 4444]
Terminal Airspace

*Terminal Airspace (TA)* – is a generic term describing airspace which is part of the airspace continuum. Terminal airspace surrounds an airport, and it is an airspace within which air traffic services are provided. It encompasses all the various terminologies currently used throughout the ECAC region. Such airspace predominantly contains traffic operating along Terminal Routes or, to a lesser extent, ATS Routes of the ARN.

[Explanatory note: The above description is aimed at including TMA, CTA, CTR, ATZ airspace classification or any other nomenclature used to describe the airspace around an airport].

[The 2015 Airspace Concept & Strategy for the ECAC Area & Key Enablers]
Competing Interests

**STRUCTURES & SECTORS: Objectives**

**ATC REQUIREMENTS**

- SAFETY, CAPACITY & EFFICIENCY
- SUFFICIENT AIRSPACE TO ACCOMMODATE:
  - ROUTES (TACTICAL AND PUBLISHED)
  - HOLDING PATTERNS
  - TRAFFIC SEQUENCING TECHNIQUES

**USER REQUIREMENTS**

- Unhindered airspace access

**ENVIRONMENTAL REQUIREMENTS**

- Airspace 'Prohibitions' over cities, natural parks, residential areas
Airspace Volumes

Controlled Airspace

- DEP 3%
- DEP 7%
- DEP 10%
- ARR MAX
- ARR 3°

ARRIVALS
DEPARTURES
Airspace Volumes

Protect IFR Flight Paths
Airspace Volumes

Take the airspace required – not more.
Terminal Airspace Systems

1. 1 Terminal Airspace
   (As per Chapter 6)

2. 2 Terminal Airspaces
   N Sectorised
   New northern Holds
   More IFR Traffic

3. 2 Terminal Airspaces
   Parallel RWY added at N
   New southern Hold
   More Traffic to Y

4. 2 larger Terminal Airspaces
   Two-Phase holding system
   More Traffic

5. 1 Terminal Airspace system
   with Entry Gates; Revised
   Sectorisation
Terminal Airspace System (TAS) – A system that combines two or more terminal airspace Volumes, aimed at improving the design and management of terminal routes and ATC sectorisation, servicing several airports in close proximity.

[The 2015 Airspace Concept & Strategy for the ECAC Area & Key Enablers]
Evolution of functions

Ref. Figure 7-1 (above): Evolution of Terminal Airspaces X in the vertical dimension and associated sample ATC functions

Terminal Airspace System - Sectorisation & ATC function

- Terminal Airspace
- Approach Control
- Area Control
- Hybrid ACC-APP Control
Sectorisation

- Functional
- Geographical
ATC Sectorisation
## Geographical Sectorisation

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
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<tbody>
<tr>
<td>➤ Controller can fully exploit the space available in sector to manipulate best levels for inbounds/outbounds and expedite climb and descent without need for co-ordination.</td>
<td>➤ Controller handles mixed traffic i.e. arrival, departure and transit traffic.</td>
</tr>
<tr>
<td>➤ Easier to balance workload between sectors.</td>
<td>➤ In instances where the sector division runs along the runway centre-line, departing aircraft departing in different directions may be controlled by different controllers after take-off. (Effective mitigation can be provided by putting appropriate procedures in place).</td>
</tr>
<tr>
<td>➤ Can be less demanding in terms of the Radar Display and ATC system</td>
<td>➤ In cases where an aircraft is required to transit more than one geographic sector in the Terminal Airspace, this can add to complexity by requiring additional co-ordination.</td>
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<tr>
<td>➤ Relatively easily to describe operational instructions for ATC areas of responsibility.</td>
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## Functional Sectorisation

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>➔ Controller handles one traffic type i.e. either departures or arrivals because sector defined as a function of task.</td>
<td>➔ Vertical/Lateral limits of sector can prove overly restrictive as one (vertical) band is unlikely to cater for all aircraft performance types.</td>
</tr>
<tr>
<td>➔ Usually, all Departing aircraft are on the same frequency after take-off.</td>
<td>➔ Difficult to balance workload between sectors especially where departure and arrival peaks do not coincide.</td>
</tr>
<tr>
<td>➔ In some configurations, can prove more flexible to operate.</td>
<td>➔ Can be demanding in terms of the Radar Display and ATC System</td>
</tr>
<tr>
<td></td>
<td>➔ Operating instructions for ATC can be difficult to formulate with respect to areas of responsibility;</td>
</tr>
</tbody>
</table>
Sectorisation

Avoid Sector designs that cause stepped climbs or descents.
**Sectorisation**

**ATC Sectorisation**

- Maintain holding area in same sector
- Avoid crossing too close to sector boundary
- Sector boundaries should not coincide with route centre lines
- Preferably, keep sectors the same when runway changes
Sectorisation

**SE4.2:** The vertical limits of a geographically defined sector need not be uniform i.e. fixed at one upper level or one lower level, nor need these vertical limits coincide with the vertical limits of (horizontally) adjoining sectors.

*Figure 6-15: Vertical Sector boundaries and crossing routes*
Terminal Airspace Systems

1 Terminal Airspace (As per Chapter 6)

2 Terminal Airspaces
N Sectorised
New northern Holds
More IFR Traffic

3 Terminal Airspaces
Parallel RWY added at N
New southern Hold
More Traffic to Y

4 2 larger Terminal Airspaces
Two-Phase holding system
More Traffic

5 1 Terminal Airspace system
with Entry Gates; Revised
Sectorisation

VFR Airport

ENTRY GATE

ENTRY GATE

ENTRY GATE

ENTRY GATE

2 larger Terminal Airspaces
Two-Phase holding system
More Traffic

1 Terminal Airspace system
with Entry Gates; Revised
Sectorisation

1 Terminal Airspace

2 Terminal Airspaces

Parallel RWY added at N

New southern Hold

More Traffic to Y
Iterations

Activity 6
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Design Options (1)

- **No separate APP ATSU is established.**
- **All sectorisation is associated with the ACC.**
- **Traffic density is sufficiently low to be handled by a single ACC en-route sector.**

As traffic density increases, it may be necessary to establish a dedicated ACC Sector, combining the functions of en-route and arrival/departure.
Design Options (2)

- ACC En-route and Arrival/Departure Sector
  - APP Arrival/Departure Sector
  - Tower

- ACC En-route and Arrival/Departure Sector
  - ACC Arrival/Departure Sector
  - APP Arrival/Departure Sector
  - Tower

- ACC En-route Sector
  - ACC Arrival/Departure Sector
  - APP Arrival/Departure Sector
  - Tower

The ACC Sector handles both the En-route function and some of the Arrival/Departure traffic. Traffic closer to the airport is handled by a separate APP Arrival/Departure Sector.

As traffic density increases further, there may be a need for additional sectors within the ACC's area of responsibility. This example shows two ACC Sectors, each with some En-route and Arrival/Departure responsibilities.

Alternatively, the ACC tasks may be sectioned to provide a dedicated ACC En-route Sector and one or more ACC Arrival/Departure Sectors.
Design Options (3)

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**ACC EN-ROUTE SECTOR**

**APP ARRIVAL/DEPARTURE SECTOR**

**TOWER**

The ACC is solely responsible for the en-route traffic, while the APP unit controls the Arrival/Departure traffic in a single extended sector, which may be large in both horizontal and vertical dimensions.

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**ACC EN-ROUTE SECTOR**

**APP DEPARTURE SECTOR**

**APP ARRIVAL SECTOR**

**TOWER**

As traffic density increases, it may be necessary to establish functional Arrival and Departure Sectors within the APP area of responsibility.

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**ACC EN-ROUTE SECTOR**

**APP DEPARTURE SECTOR**

**APP ARRIVAL SECTOR**

**APP FINAL DIRECTOR**

**TOWER**

As traffic density increases even further, the Arrival task itself could be sectorised into an (Initial) Arrival Sector and a Final Director (Sector).
Design Options (4)

1. ACC EN-ROUTE AND ARRIVAL/DEPARTURE SECTOR
   - whilst traffic density is low, the ACC handles most of the traffic in a combined En-route + Arrival/Departure Sector. APP is responsible only for the final vectoring of arrival traffic.

2. ACC EN-ROUTE SECTOR
   - As traffic density increases, it may be necessary to divide the ACC function into two sectors (En-route and Departure).

3. ACC EN-ROUTE SECTOR
   - At high traffic density an ACC Arrival Sector is introduced to separate the arrival function from the on-route function.
Design Options (5)

1. ACC EN-ROUTE and Arrival/Departure Sector
   - APP Arrival Sector
   - At low traffic density, the APP unit has responsibility for arriving traffic in the APP Arrival Sector.

2. ACC EN-ROUTE Sector
   - ACC Departure Sector
   - APP Arrival Sector
   - As traffic density increases, it may be necessary to establish a functional Departure Sector within the ACC area of responsibility.

3. ACC EN-ROUTE Sector
   - ACC Departure Sector
   - APP Arrival Sector
   - APP Final Director
   - As traffic density increases even further, the Arrival task itself could be sectorised into an APP (Initial) Arrival Sector and an APP Final Director (Sector).
THANK YOU