

Volume 2

**EUROCONTROL MANUAL  
FOR  
AIRSPACE PLANNING**

**- COMMON GUIDELINES -**

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Abstract		
<p>This document contains planning elements and methods of application for a common airspace design and change process in the ECAC area. This Planning Manual would then serve as a model for States to update and harmonise their own national airspace planning and allocation process with their neighbours.</p> <p>The material in this document is intended to supplement the provisions specified in ICAO documents and in the EUROCONTROL Handbook for Airspace Management and it should therefore be used in conjunction with these documents.</p>		
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Jean Paul LEMAIRE	93381	AFN BD

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**EATMP Infocentre**  
 EUROCONTROL Headquarters  
 96 Rue de la Fusée  
 B-1130 BRUSSELS

Tel: +32 (0)2 729 51 51

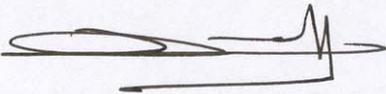
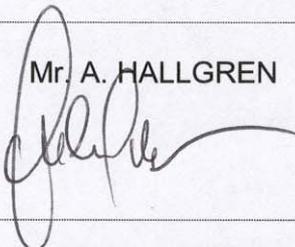
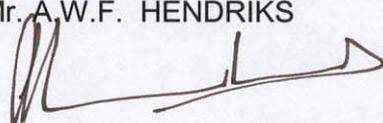
Fax: +32 (0)2 729 99 84

E-mail: [eatmp.infocentre@eurocontrol.int](mailto:eatmp.infocentre@eurocontrol.int)

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### DOCUMENT APPROVAL

The following table identifies all management authorities who have successively approved the present issue of this document.

AUTHORITY	NAME AND SIGNATURE	DATE
Airspace Management Sub-Group Chairman	Mr. J. DOS SANTOS 	01/12/03
Route Network Development Sub-Group Chairman	Mr. A. DUCHENE 	01/12/03
ATM Procedures Development Sub-Group Chairman	Mr. A. HALLGREN 	01/12/03
Airspace and Navigation Team Chairman	Mr. A.W.F. HENDRIKS 	01/12/03
Senior Director EATM	Mr. W. PHILIPP 	10.12.03

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# FOREWORD

## 1 PRESENTATION OF THE MANUAL

### 1.1 About the Document

- 1.1.1 This document constitutes Volume 2 of the EUROCONTROL Manual for Airspace Planning which contains detailed planning elements and methods of application for a common airspace design and change process in the ECAC area.
- 1.1.2 The guidelines contained in this document have been developed by ECAC Member States, with a view of supporting the ECAC airspace planning and design process so as to ensure that Safety is improved or at least maintained by the design or changes to airspace structures<sup>1</sup>.
- 1.1.3 The manual will be reviewed periodically to ensure that the planning criteria remain valid in the light of the progress made and experience gained, and to reflect the actual changes which take place in aviation.
- 1.1.4 The EUROCONTROL MANUAL FOR AIRSPACE PLANNING is intended to serve as a model for States to update and harmonise their own national airspace planning and allocation process with their neighbours. Therefore, the material contained in the present Volume 2 is mainly focused on guidance for airspace planners.

### 1.2 Responsible Body and Acknowledgement

- 1.2.1 This document has been developed by the EUROCONTROL Airspace and Navigation Team (ANT). It is expected that the EUROCONTROL Manual for Airspace Planning and its future amendments will be endorsed in accordance with the EUROCONTROL EATM procedures.
- 1.2.2 The EUROCONTROL Agency wishes to acknowledge the valuable assistance received from Member States and the International Council of Aircraft Owner and Pilot Associations (IAOPA) in preparing this Planning Manual.

### 1.3 Structure of the Manual

- 1.3.1 The EUROCONTROL Manual for Airspace Planning comprises two volumes. Volume 1 describes the institutional framework and applicability of the document, whereas Volume 2 (this document) contains detailed guidelines and planning criteria.

Section 1 - **General Guidelines for the Establishment of Airspace Structures** - identifies general principles for the establishment and use of airspace structures.

Section 2 - **ATS Airspace Classification** - provides guidance for the harmonisation and simplification of ECAC Airspace Classification.

Section 3 - **Airspace Restriction/ Reservation Design** – deals with planning consideration for the design of Airspace Restrictions and Reservations and for re-shaping the airspace to accommodate user-preferred trajectories.

Section 4 - **ATS Route/Sector Design** -describes the general criteria used for the development of the European ATS Route Network (ARN) and associated airspace sectorisation, as well as planning consideration for the establishment of Conditional Routes.

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<sup>1</sup> In the context of this manual, "**Airspace Structure**" includes Control Area (CTA), Terminal Control Area (TMA), Control Zone (CTR), ATS Route, ATC Sector, Conditional Route (CDR), Danger Area (D), Restricted Area (R), Prohibited Area (P), Temporary Segregated Area (TSA), Temporary Reserved Area (TRA), Cross-Border Area (CBA), Reduced Co-ordination Airspace (RCA), Prior Co-ordination Airspace (PCA), ...

- Section 5 - **Terminal Airspace Design** - provides a methodology and identifies principles associated with Terminal Airspace design.
- Section 6 - **Delegation of the Responsibility for ATS Provision** - provides guidance for the Delegation of the Responsibility for Air Traffic Services Provision.
- Section 7 - **Free Route Airspace Design** - provides initial guidance material for the design of Free Route Airspace over a group of States.
- Section 8 - **Terms and References** - provides a list of acronyms and abbreviations, as well as an explanation of terms and a list of references and source documents used to develop the manual.

## 2 PURPOSE

### 2.1 Need for an EUROCONTROL Manual for Airspace Planning

- 2.1.1 In order to reconcile competing requirements in airspace utilisation between Commercial Aviation (*highest possible protection from other airspace users*), General Aviation & Aerial Work (*maximum freedom in all airspace*) and Military Aviation (*highest possible flexibility, freedom of access to all airspace, protection for special activity and low altitude flying*), airspace design and allocation is often a compromise between all expressed requirements and lead usually to lengthy discussions between the parties concerned. Therefore, in order to ensure more transparency and predictability of airspace management measures, it is necessary to establish within each State objective criteria for the design of airspace.
- 2.1.2 As identified in the EUROCONTROL Airspace Strategy for the ECAC States, there is now a strong need to evolve to a more collaborative airspace management at international level to ensure harmonisation of airspace organisations between all ECAC States. To that end, it is necessary to first establish an "EUROCONTROL MANUAL FOR AIRSPACE PLANNING", which would provide guidelines and criteria for a uniform airspace design and change process for ECAC States to be mirrored in their own national Airspace Guidance Material.

### 2.2 Relationship between ICAO and EUROCONTROL Documents

- 2.2.1 The material contained in this document should be used in conjunction with the provisions specified in ICAO and other EUROCONTROL documents.
- 2.2.2 The EUROCONTROL Manual for Airspace Planning should not be considered as the substitute for official national regulations in individual ECAC States nor for the ASM Part of the ICAO European Region Air Navigation Plan.
- 2.2.3 Specifically, States are reminded that by virtue of Article 38 of the "*Convention on International Civil Aviation*", Contracting States are required to notify ICAO of any differences between their national regulations and practices, and International Standards contained in Annexes to the Convention, and any amendments thereto. ICAO has invited Contracting States to extend such notification to any differences from Recommended Practices contained in the Annexes, when the notification of such differences is important for the safety of air navigation.
- 2.2.4 Additionally, Annex 15, Chapter 4, 4.1.2 c) and d) specify that national Aeronautical Information Publications shall include a list of significant differences between the national regulations and practices of the State and the related ICAO Standards, Recommended Practices and Procedures given in a form that would enable a user to differentiate readily between the requirements of the State and the related ICAO provisions, and the choice made by a State in each significant case where an alternative course of action is provided for in ICAO Standards, Recommended Practices and Procedures.

- 2.2.5 Furthermore, attention is drawn to the ICAO publication “*Procedures for Air Navigation Services – Air Traffic Management*” (PANS-ATM), Doc 4444 ATM/501, Chapter 2, Section 2.6, which specifies that the relevant authority designated by the State responsible for providing air traffic services in the airspace concerned shall ensure that a safety assessment is carried out in respect of proposals for :
- a. significant airspace reorganisations;
  - b. significant changes in the provision of ATS procedures applicable to an airspace or an aerodrome; and
  - c. the introduction of new equipment, systems or facilities.

### **2.3 Management of the Document**

- 2.3.1 It is anticipated that the Airspace & Navigation Team (ANT) will be responsible for the maintenance of the Planning Manual and for monitoring the progress of its adaptation into national Guidance Material.
- 2.3.2 As it is intended that this Planning Manual should also reflect, in consolidated form, best practices and collective experience gathered in the field of airspace design, ECAC States, International Users Organisations and ATS Providers, all are encouraged to provide EUROCONTROL with their comments and suggestions for modification and/or extension to cover new aspects of airspace planning.

## **3 SCOPE**

### **3.1 General**

- 3.1.1 The scope of the EUROCONTROL Manual for Airspace Planning is that which was defined by the EUROCONTROL Airspace Strategy for the ECAC States. It is concerned with the needs of all airspace user groups on a basis of equity. Consequently, an important goal of the common guidelines for airspace design in the ECAC area described in this Planning Manual is to enable equal access to the airspace providing maximum freedom for all users consistent with the required level of safety in the provision of ATM services, while making due allowance for the security and defence needs of individual States.
- 3.1.2 The evolution of the ECAC airspace structure will follow closely the strategic principles and objectives of the ATM 2000+ Strategy. Due account will be taken of the increasing need for the provision of a seamless ATM service and the associated requirements for the interoperability between civil and military systems.

### **3.2 Applicability**

- 3.2.1 Material contained in the present Volume 2 should be used as guidance by States in the continued development of their own national airspace planning process and also serve as a basis for bilateral or multilateral discussion with neighbouring States aiming at the harmonisation of their planning activities.

## **4 SPECIFIC REMARKS RELEVANT TO THE SECOND EDITION**

### **4.1 Complete Edition**

- 4.1.1 This document takes into account existing material and best practices related to ATS Route/Sector Design (Section 4), Terminal Airspace Design (Section 5) and the Delegation of the Responsibility for ATS Provision (Section 6).
- 4.1.2 It also provides general guidelines for the Establishment of Airspace Structures (Section 1) and details the specific guidelines for Airspace Restriction/Reservation Design (Section 3), as well as the update of guidelines for ATS Airspace Classification (Section 2).

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# SECTION 1

## GENERAL GUIDELINES FOR THE ESTABLISHMENT OF AIRSPACE STRUCTURES

### 1.1 INTRODUCTION

#### 1.1.1 Planning Considerations

1.1.1.1 The "General Guidelines for the Establishment of Airspace Structures" have been developed by ECAC Member States on the basis of best practices in use in some States, agreed Flexible Use of Airspace (FUA) principles as stated in the FUA Reference Documents and in accordance with the directions for change identified in the "EUROCONTROL Airspace Strategy for the ECAC States".

1.1.1.2 Airspace organisation and management should evolve to a more collaborative function at an international level in order to support the ECAC's collective responsibility for all aspects of planning, design, update, civil/military co-ordination, regulation and airspace legislation.

1.1.1.3 The main objective of airspace management is to maximise the efficient use of airspace whilst maintaining the level of safety applicable to air traffic operations within such airspace. In order to achieve this objective, the airspace structures<sup>2</sup> throughout the ECAC airspace should be based on common criteria with regards to airspace design, lateral and vertical delineation, and designation.

1.1.1.4 Within the context of airspace planning and design, the attention of airspace planners and designers is drawn to the following ICAO and EUROCONTROL safety requirements which are not limited to :

- ATS safety management as per ICAO Annex 11, para 2.26;
- Safety assessments as per ICAO Doc 4444, Chapter 2;
- Guidance to ATM Safety Regulators contained in ESARR 3;
- Risk Assessment and Mitigation in ATM contained in ESARR 4.

#### 1.1.2 Common Guidelines for the Establishment of Airspace Structures

3.3.2.1 As stated in the "EUROCONTROL Airspace Strategy for the ECAC States" Document, Volume 2 of this Manual provides States with common guidelines for the establishment of airspace structures including general criteria for the design, lateral and vertical delineation and designation of each type of airspace structure.

3.3.2.2 Harmonised application of ICAO provisions for the delineation and classification of ATS airspace and as regards to safety measures relating to military activities including the need for airspace reservation and/or restriction provides the foundation of general guidelines for the establishment of airspace structures within ECAC area.

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<sup>2</sup> In the context of this manual, "**Airspace Structure**" includes Control Area (CTA), Terminal Control Area (TMA), Control Zone (CTR), ATS Route, ATC Sector, Conditional Route (CDR), Danger Area (D), Restricted Area (R), Prohibited Area (P), Temporary Segregated Area (TSA), Temporary Reserved Area (TRA), Cross-Border Area (CBA), Reduced Co-ordination Airspace (RCA), Prior Co-ordination Airspace (PCA), ...

3.3.2.3 A number of essential principles have been developed to provide an integrated approach to the delineation, establishment and use of specific portions of airspace by civil and military users, including sharing of common boundaries between them. Relevant ICAO references are :

- delineation of CTR/CTA and ATS routes : Annexes 4 & 11, PANS-OPS (Doc 8168) Vol. II, Doc 9426 ;
- definition of protected airspace : Annexes 2 & 11, PANS-ATM (Doc 4444);
- establishment of separation minima : PANS-ATM (Doc 4444), Doc 9689 ;
- determination of spacing between ATS routes : Annex 11, Doc 9426 and EUR 001/RNAV/5;
- military activities as regards civil traffic: Principle of '*Due regard for the safety of navigation of civil aircraft*' as per the Chicago Convention (Doc 7300) Art. 3 (d).

3.3.2.4 General Guidelines for the establishment of Controlled Airspace form also part of the present Section 1, whereas specific and detailed guidelines and planning criteria are provided in:

- Section 2 for the harmonisation and simplification of ATS airspace classification;
- Section 3 for the design of airspace restrictions and reservations;
- Section 4 for the design of the ATS Route and Sectorisation; and
- Section 5 for the design of Terminal Airspace.

## 1.2 PROVISIONS FOR AIRSPACE ORGANISATION

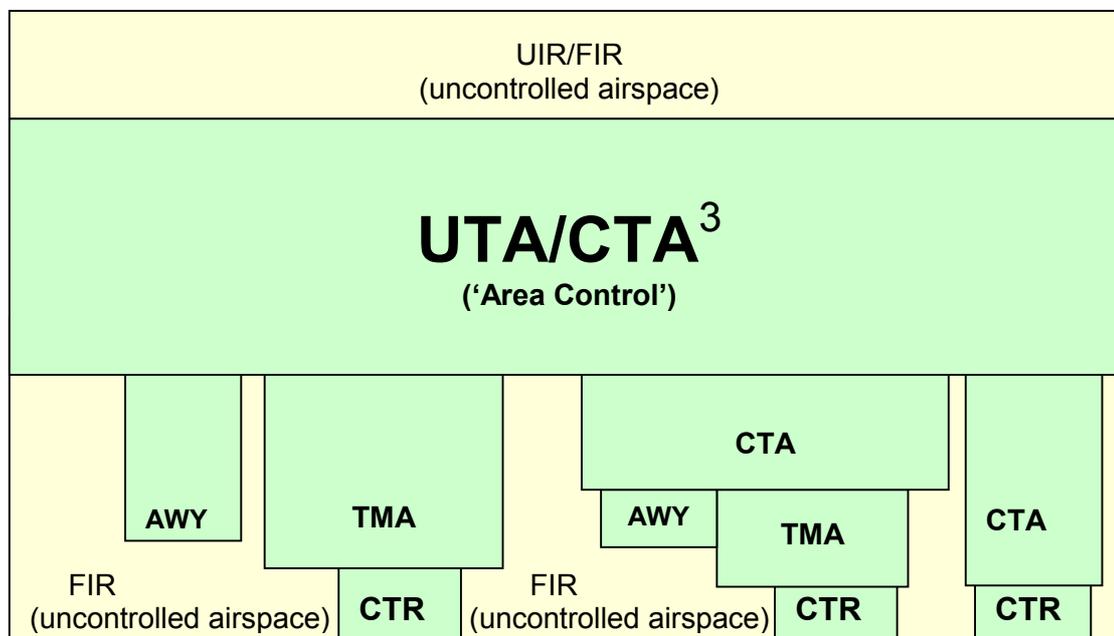
### 1.2.1 Airspace Organisation for ATS Provision

1.2.1.1 As stated in ICAO Annex 11, when it has been determined that air traffic services will be provided in particular portions of the airspace, then those portions of the airspace shall be designated in relation to the air traffic services that are to be provided, as follows:

- **Flight Information Regions (FIRs)** for those portions of the airspace where it is determined that flight information service and alerting service will be provided - *FIRs shall be delineated to cover the whole of the air route structure to be served by such regions. Such delineation shall be related to the nature of the route and the need for efficient service rather than to national boundaries.*
- **Control Areas (CTAs) and Control Zones (CTRs)** for those portions of the airspace where it is determined that ATC service will be provided to IFR flights - *CTAs including inter alia, **Airways (AWYs)** and **Terminal Control Areas (TMAs)** shall be delineated so as to encompass sufficient airspace to contain the flight paths of those IFR flights or portions thereof to which it is desired to provide the applicable parts of ATC service, taking into account the capabilities of the navigation aids normally used in that area.*
- **Upper Flight Information Regions (UIRs) and Upper Control Areas (UTAs)** for those portions of the upper airspace where it is desirable to limit the number of FIRs or CTAs through which high flying aircraft would otherwise have to operate - *UIRs or UTAs, as appropriate, shall be delineated to include the upper airspace within the lateral limits of a number of lower FIRs or CTAs.*

1.2.1.2 FIR/UIR boundaries in the ECAC area are determined on the basis of European Regional (EUR) Air Navigation Agreements approved by the Council of ICAO to provide for the least number of such regions compatible with efficiency of service and with economy (see Doc 7754 – EUR Basic ANP – Part VII).

- 1.2.1.3 Lateral and vertical limits of those portions of the airspace (UTA, CTA<sup>3</sup>, AWY, TMA, CTR), where ATC service will be provided are determined by individual States for the territories over which they have jurisdiction. However, ECAC States should establish Controlled Airspace in consistency with the FUA Concept to ensure that unnecessary restrictions are not imposed.



**ECAC Airspace Vertical Organisation**

## 1.2.2 Safety Measures relating to Military Activities - Civil/Military Co-ordination

- 1.2.2.1 ICAO Annex 11, paragraphs 2.15 and 2.16, and more particularly Doc 9554 contain provisions for the co-ordination between the military authorities planning activities potentially hazardous to civil aircraft and the responsible ATS authorities.
- 1.2.2.2 Within ECAC States, the objective of such civil/military co-ordination is to de-conflict military and civil operations<sup>4</sup> to the effect that they do not constitute a danger for each other.
- 1.2.2.3 Through the application of the Flexible Use of Airspace (FUA) Concept, the best arrangements will be reached to ensure that military operations are conducted so as to minimise interference with the normal operations of civil aircraft. Ideally, this means the selection of locations outside promulgated ATS routes for the conduct of the potentially hazardous activities.
- 1.2.2.4 If the temporary closure of certain ATS routes is unavoidable, agreement should be sought by ATS authorities with the State(s) concerned on the temporary use of promulgated alternative routes bypassing the area of activity or, if no convenient promulgated alternative routes exist, on the establishment of temporary routes. Such type of agreement is covered for the ECAC States under the Conditional Route (CDR) Concept (see [Section 4](#)).

<sup>3</sup> In the context of this manual, the term CTA is not used as a generic term, but only to designate a control area established in the form of an entire block of airspace with area control arrangements.

<sup>4</sup> This includes Test Flights or any other aerial operations such as gliding, UAV, ballooning, ...

- 1.2.2.5 At present in the ECAC area, compatibility of civil and military operations is mainly governed by national rules which are in accordance with the level of civil/military ATS system inter-operability in place within each State. Regardless of the organisation adopted by the individual States, it has always been necessary to implement co-ordination procedures between civil and military ATS to ensure safe compatibility between Operational Air Traffic (OAT) and General Air Traffic (GAT) operating in the same airspace. Essentially, for the ECAC States, civil and military activities are reconciled either by the means of separating flights through tactical avoidance actions or by temporary segregation of airspace using the Temporary Airspace Allocation (TAA) process (see [Section 3](#)).
- 1.2.2.6 More generally the ICAO Convention states in Article 3(d), that "*the contracting States undertake, when issuing regulations for their state aircraft, that they will have **due regard** for the safety of navigation of civil aircraft*". The effect of the non-applicability of the ICAO Convention to military aviation, as stipulated in Article 3(a), has been, amongst other things, the setting aside of airspace temporarily reserved for the exclusive use of military aircraft within which the Convention has no application.
- 1.2.2.7 However, the ECAC States have developed and implemented the Flexible Use of Airspace (FUA) Concept within which, when a joint share use of airspace is no longer possible, ECAC States should endeavour to establish either a Temporary Reserved Area (TRA), Temporary Segregated Area (TSA) or an AMC-Manageable Danger or Restricted Area with associated Conditional Routes (CDRs).
- 1.2.2.8 This situation should occur whenever military aircraft manoeuvres are unpredictable, sensitive to external interference or difficult to alter without adversely affecting the mission and/or when due to the nature of their activities, some military flights need to be temporarily segregated to protect them as well as non-participating aircraft.

### 1.2.3 Airspace Restriction and Reservation

- 1.2.3.1 Because of the potential risk to GAT generated by some aerial activities and of the need for the protection of sensitive areas on the ground from possible disturbance by overflight, ECAC States have usually established **Airspace Restrictions** of varying degrees of severity in accordance with the following ICAO definitions:
- **Danger Area (D)** is an airspace of defined dimensions within which activities **dangerous** to the flight of aircraft may exist at specified times;
  - **Restricted Area (R)** is an airspace of defined dimensions, above the land area or territorial waters of a State, within which the flight of aircraft is **restricted** in accordance with specific conditions;
  - **Prohibited Area (P)** is an airspace of defined dimensions, above the land area or territorial waters of a State, within which the flight of aircraft is **prohibited**.
- 1.2.3.2 In addition, because of some aerial activities by specific airspace users require the reservation of portions of the airspace for their exclusive use for specific periods of time, several ECAC States had established reserved-type airspace using sometimes quite different procedures.
- 1.2.3.3 However, ICAO Annex 11, paragraph 2.17.5, recommends that "*in order to provide added airspace capacity and to improve efficiency and flexibility of aircraft operations, States should establish procedures providing for a flexible use of airspace reserved for military or other special activities. The procedures should permit all airspace users to have safe access to such reserved airspace*".

1.2.3.4 As ICAO Doc 9426 provides only a generic definition for **Airspace Reservation** as “a defined volume of airspace normally under the jurisdiction of one aviation authority and temporarily reserved, by common agreement, for exclusive use by another aviation authority”, the FUA Concept provides, for a common understanding, clear definitions of the two following different types of temporary airspace reservations taking into consideration the activity that would take place associated with the transit possibility (see [Section 3](#)):

- **Temporary Reserved Area (TRA)** is a defined volume of airspace normally under the jurisdiction of one aviation authority and **temporarily reserved**, by common agreement, for the specific use by another aviation authority and through which other traffic may be allowed to transit, under ATC clearance.
- **Temporary Segregated Area (TSA)** is a defined volume of airspace normally under the jurisdiction of one aviation authority and **temporarily segregated**, by common agreement, for the exclusive use by another aviation authority and through which other traffic will not be allowed to transit.

**Note:** Pending results from consultation with ICAO on above definitions, the current TSA definition is maintained i.e.:

*“**Temporary Segregated Area (TSA)** is an airspace of defined dimensions within which activities require the reservation of airspace for the exclusive use of specific users during a determined period of time”.*

1.2.3.5 Restrictions and reservations constitute a limitation to access such airspace by non-participating aircraft, with the associated restrictive effects on flight operations.

1.2.3.6 For the ECAC States, in accordance with Flexible Use of Airspace (FUA) principles, airspace restrictions and reservations should only be applied for limited periods of time and should be terminated as soon as the relevant activity ceases. [see EUROCONTROL Handbook for Airspace Management].

## 1.3 TERMS ASSOCIATED WITH AIRSPACE DELINEATION

### 1.3.1 Controlled Airspace

1.3.1.1 ICAO Annex 11, Chapter 2, contains Standards and Recommended Practices (SARPs) regarding the delineation of controlled airspace, including Recommended Practices which address the establishment of lower and upper limits for a control area whilst taking into account both IFR and VFR flights.

### 1.3.2 Airspace subject to Reservation/Restriction

1.3.2.1 If specific guidelines for the delineation of reserved/restricted airspace do not exist in State publications or legislation, it is recommended that relevant guidelines as contained in this manual be taken into account.

1.3.2.2 When establishing TRAs/TSAs, D or R areas, the boundaries should encompass airspace to contain the activity and ensure that VFR aircraft which are operating on the vertical and/or horizontal limits of the reserved/restricted area are not endangered by the activity within.

1.3.2.3 In addition to establishing ATS Airspace Class C above FL 195, accommodation of various types of ‘special’ GAT VFR flights above FL 195 will be made in airspace reserved for that purpose (TRAs/TSAs) or in accordance with specific arrangements agreed by the appropriate ATS authority (see [Section 2](#)).

### 1.3.3 Published Limits and Protected Airspace

1.3.3.1 Being three dimensional, airspace structures have to be described in terms of horizontal and vertical dimensions and the limits thereof published in national AIPs will be called “**Published Limits**” (see para. 1.4.7).

1.3.3.2 In order to provide protection between activities in adjacent airspace, a “**Protected Airspace**” should be developed to contain each activity safely within its horizontal and vertical *published limits*.

1.3.3.3 It is recommended to clearly specify assumptions applied when establishing the published limits of any airspace structures. Any such assumptions, particularly with regards to contingencies, should also form part of safety assessment.

Note: *Amongst several criteria in establishing airspace structures, consideration should be given to the availability of radar monitoring. Particular attention should be given when designing cross-border structures.*

## 1.4 PRINCIPLES FOR THE DESIGN OF AIRSPACE STRUCTURES

### 1.4.1 General

1.4.1.1 A number of essential principles regarding the delineation of airspace boundaries and conditions of use of any airspace structures are defined below to ensure common understanding and full awareness of all airspace users and ATM providers concerned, whilst avoiding waste of airspace and ensuring safe sharing use of airspace between civil and military operations.

1.4.1.2 These principles should be seen as an integrated approach to the delineation of airspace by adopting a common development process. This approach allows implementation according to the means (procedures and/or system) set in place.

1.4.1.3 As indicated in ICAO Doc 9554, paragraph 6.1, in order that due regard will be given to the safe and efficient operation of civil aircraft, States should ensure that military authorities responsible for the planning and conducting activities potentially hazardous to such aircraft are fully familiar with the area of activity in terms of:

- type(s) of civil aircraft operations;
- ATS airspace organisation and responsible controlling/monitoring unit(s);
- ATS routes and their dimensions, as appropriate; and
- relevant regulations and special rules in force, including airspace restrictions.

1.4.1.4 In these circumstances, it should be stressed that for the delineation of any airspace structures, only the strict application of the essential principles below and in particular the Third Principle will ensure that activity in any airspace volume will not endanger non-participating aircraft flying at or near its published limits.

1.4.1.5 ECAC States should therefore endeavour to reconsider all their airspace organisation using the following essential principles for a common interpretation of rules related to the delineation, establishment and use of specific portions of airspace by civil and military users (see [Annex 1A](#)).

### 1.4.2 Essential Principles

#### 1.4.2.1 First Principle - Responsible Authorities

***A responsible authority will be determined by each State in regard to:***

- ◆ ***airspace design;***
- ◆ ***type of Air Traffic Service provision; and/or***
- ◆ ***any other activity carried out in specified airspace structures.***

- The responsible authority for airspace design should be the permanent high-level policy body in charge of Strategic ASM Level 1 activities (see *Section 3 of the EUROCONTROL Handbook for Airspace Management*).

#### 1.4.2.2 Second Principle – Design Efficiency

***The dimensions of airspace structures should be established to encompass the absolute minimum airspace necessary to contain operations.***

#### 1.4.2.3 Third Principle – Containment of Operations

***The published limits should contain enough airspace to ensure that activity in that airspace structure will not endanger non-participating aircraft operating at or near its published limits.***

#### 1.4.2.4 Fourth Principle – Protected Airspace

***Airspace structures should be established in such a way that associated protected airspaces do not overlap.***

#### 1.4.2.5 Fifth Principle - Boundaries

***Distinct/individual boundaries should preferably be defined for activities in adjacent airspace. However, where it is necessary to define a common boundary, appropriate measures governing operations in the proximity of the common boundary should be established.***

- ❑ Letters of Agreement (LoA) are the way in which standard co-ordination procedures between the two parties should be formalised.
- ❑ Letters of Agreement should contain normal practices for standard co-ordination and contingency plans for instances when communication between two units is not possible.

#### 1.4.2.6 Sixth Principle - Published Limits

***The published limits of any airspace structure will be described in accordance with ICAO provisions stated in Annexes 4 & 15 and Doc 8126.***

- ❑ The published limits refer to the horizontal and vertical dimensions of a defined airspace structure.
- ❑ Application of the above for the publication of ATS routes will include:
  - Upper/Lower Limits, as appropriate;
  - Lateral Limits or RNP Type, as appropriate;
  - Significant points; and
  - Magnetic track of the ATS route (*not applicable for RNAV routes*).

#### 1.4.2.7 Seventh Principle – Rules of Use

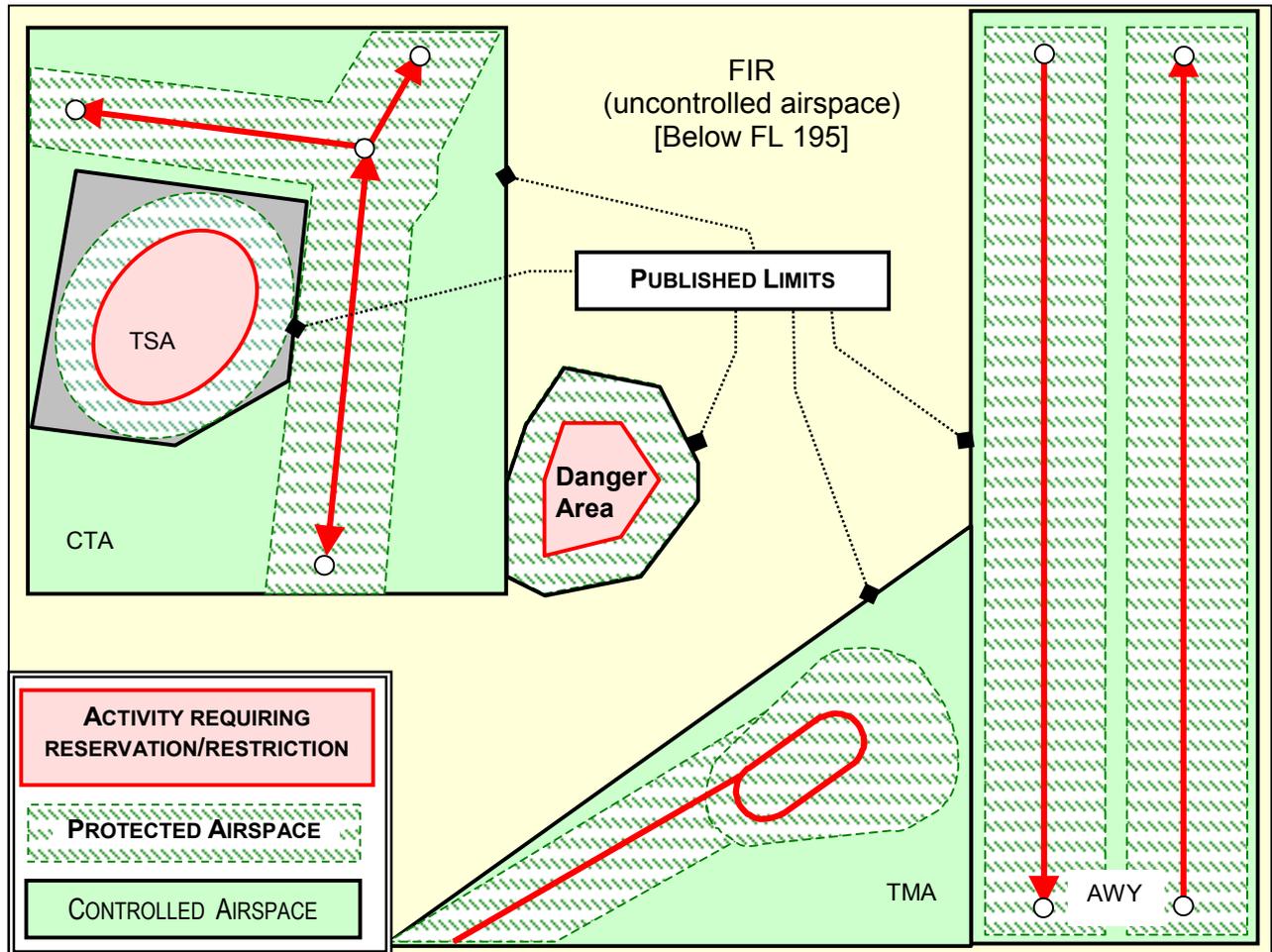
***The Responsible Authority bears the obligation for ensuring that rules of use are established, published and complied with for the airspace structure within its area of responsibility.***

- ❑ Agreement should be established between parties involved to minimise any limitations imposed by rules of operations and/or ATS Procedures for the use of adjacent airspace structures through tactical co-ordination on a flight-by-flight basis, while ensuring the application of required separation minima.

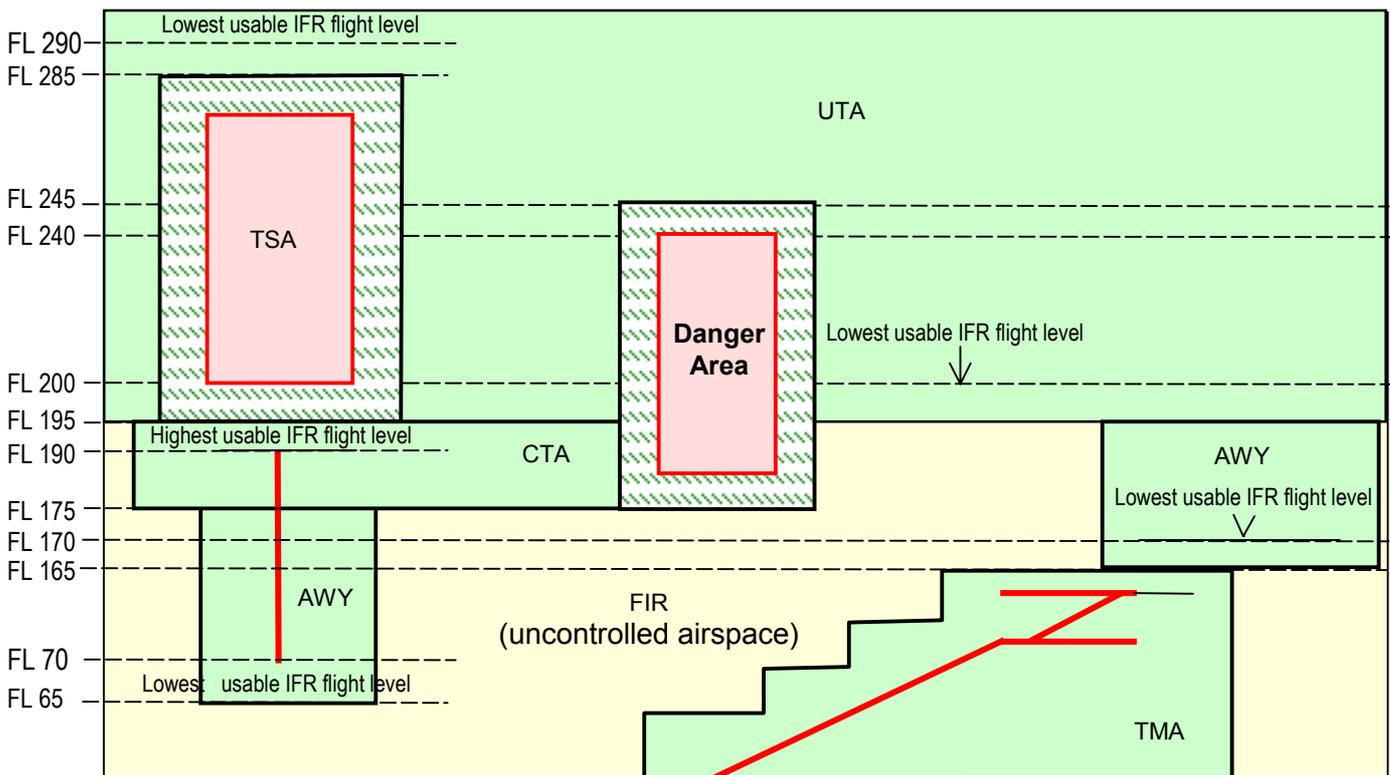
### 1.4.3 Illustrations of Delineation of Airspace Boundaries

1.4.3.1 The principles (specified in paragraph 1.4.2) to be considered when delineating airspace are illustrated in the following horizontal and vertical diagrams:

**Illustration of Horizontal Delineation of Airspace**



**Illustration of Vertical Delineation of Airspace**



## 1.5 COMMON BOUNDARIES

### 1.5.1 General

1.5.1.1 The essential principles specified in paragraph 1.4.2 and the rules for the establishment of ATS routes, airspace reservations (TAA Concept) and airspace restrictions (P, R, D) need to be combined in such a manner to ensure no waste of airspace. In this regard, common boundaries can be used as the published limits of any adjoining airspace reservations and/or restrictions and controlled airspace, without either infringing safety or requiring additional buffer in between.

### 1.5.2 Application of Protected Airspace

1.5.2.1 On one hand, airspace structures for potentially dangerous aerial activities need to be established in such a way that State 'Due Regard' obligation is strategically observed. On the other hand, sufficient controlled airspace should be established to encompass the flight paths of the traffic to which it is necessary to provide ATC.

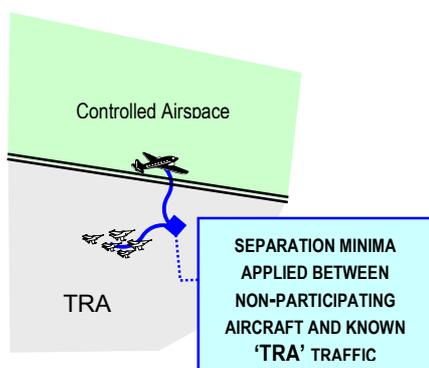
1.5.2.2 ECAC States should endeavour to use the highest level of containment to define the protected airspace around the activities or for an ATS route, for the strategic delineation of airspace reservations or restrictions in close proximity of a RNAV or non-RNAV ATS route.

### 1.5.3 Definition of Tactical Rules

1.5.3.1 The establishment of a common boundary should always be complemented by tactical rules. These can be part of the national air law and/or take the form of LoAs between units involved. Such rules should be as flexible as possible taking into account the following :

- Efficient airspace design and operation ensuring no waste of airspace;
- Radar vectoring in achieving efficient use of airspace.

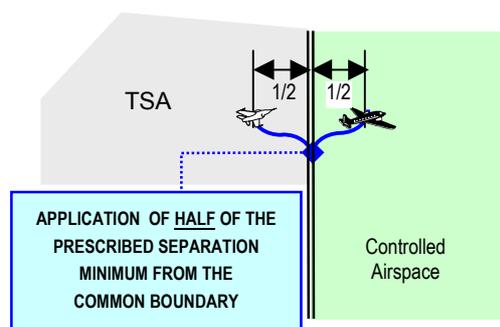
### 1.5.4 Illustrations of Tactical Rules (see [Figures A, B and C](#))



**Fig. A**

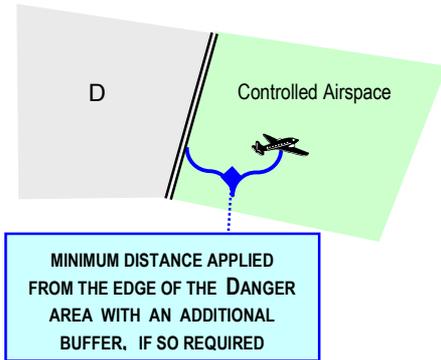
**Fig. A** applies when a direct controller-to-controller co-ordination is maintained between ATS units involved and a full knowledge of radar-controlled aircraft operating inside the area provided to both controllers.

Procedures should be established providing for the application of prescribed separation minima from known 'area' traffic. This permits non-participating aircraft to safely operate closer to the published limits of a reserved/restricted airspace.



**Fig. B**

In some instances, when a direct controller-to-controller co-ordination cannot be maintained and/or information on radar-controlled aircraft operating inside the 'TSA' cannot be provided to both controllers, some States have prescribed that separation provision should be distributed equally on both sides of the common boundary as illustrated in **Fig. B**.



As illustrated in **Fig. C**, when the half of prescribed separation rule specified for Figure B cannot be used, a minimum distance should be applied from the published limits of an active area, including any additional buffer, where applicable.

**Fig. C**

### 1.5.5 Safety Assessment

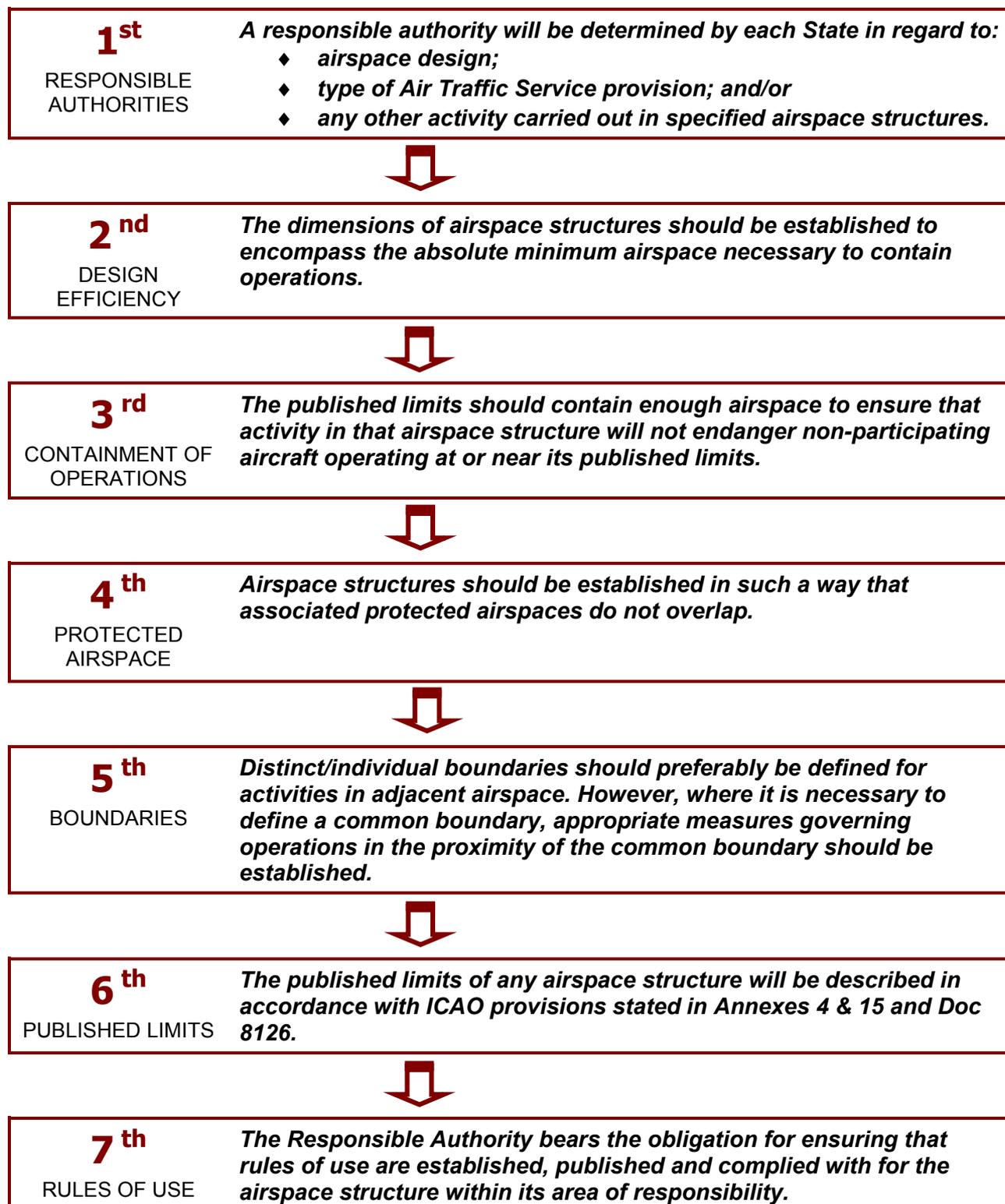
1.5.5.1 When considering such tactical rules, Responsible Authorities should ensure that safety is assured in all circumstances through:

- the conduct of appropriate safety assessments;
- the definition, if required, of specific separation minima depending on the activities conducted in reserved/restricted airspace, with the addition of an adequate buffer;
- the implementation of robust LoAs between civil and military units involved; and
- the promulgation of the first usable IFR levels above/below an area in the definition of associated ATS routes, as appropriate.

1.5.5.2 ICAO Annex 11, paragraph 2.16.3, recommends that "*Arrangements shall be made to permit information relevant to the safe and expeditious conduct of flights of civil aircraft to be promptly exchanged between air traffic services units and appropriate military units*".

Annex 1A

## PRINCIPLES FOR THE DESIGN OF AIRSPACE STRUCTURES



## **SECTION 1**

# **GENERAL GUIDELINES FOR THE ESTABLISHMENT OF AIRSPACE STRUCTURES**

## **FINAL PAGE**

### **SUGGESTION - COMMENTS**

To report any errors, or to propose a modification to the present Section 1 "General Guidelines for the Establishment of Airspace structures", please contact:

Mr Jean-Paul Lemaire  
EUROCONTROL  
Airspace & Flow Management and Navigation Business Division (AFN)  
Rue de la Fusée, 96  
B-1130 BRUSSELS  
(E-mail: [jean-paul.lemaire@eurocontrol.int](mailto:jean-paul.lemaire@eurocontrol.int))

### **SECTION 1 - SPONSOR: AIRSPACE MANAGEMENT SUB-GROUP**

Whenever material received, in accordance with the above procedure, makes it apparent that an amendment of the present Section 1 is required, such amendment will be first discussed within the Airspace Management Sub-Group (ASM-SG) and then circulated for consideration by the Route Network Development Sub-Group (RNDSG) and the ATM Procedures Development Sub-Group (APDSG) before its adoption by the Airspace & Navigation Team (ANT).

### **PUBLICATION OF AMENDMENT**

The agreed amendment will then be issued by EUROCONTROL in the form most convenient for its insertion in the Planning Manual.

## **SECTION 2**

# **GUIDELINES FOR ATS AIRSPACE CLASSIFICATION**

## **2.1 INTRODUCTION**

### **2.1.1 Backdrop**

2.1.1.1 The initial goal of ICAO in implementing, in 1992, a new ATS Airspace Classification<sup>(1)</sup> was to simplify the designation of airspace and to standardise equipment and pilot requirements for IFR and VFR operations. The purpose was to eliminate the confusion between the characteristics of CTA, CTR, TMA and ATZ airspaces and to clarify the services provided to IFR and VFR flights in each class of airspace.

### **2.1.2 Current ICAO Requirements for Classification of ATS Airspace**

2.1.2.1 According to ICAO Annex 11 - 2.5, when it has been determined that air traffic services are to be provided in a particular portion of airspace or in airspace associated with particular aerodromes, then those portions of the airspace shall be designated in relation to the air traffic services that are to be provided.

2.1.2.2 Airspace shall be classified and designated in accordance with the seven classes - A to G, defined in ICAO Annex 11 - 2.6. The requirements for flights within each class of airspace are defined in ICAO Annex 11 - Appendix 4, in terms of the type of flight allowed, the separation provided, the services provided, meteorological conditions, speed limitations, radio communication requirements and the ATC clearance required.

2.1.2.3 States shall select those airspace classes appropriate to their needs from the least restrictive Class G to the most restrictive Class A.

### **2.1.3 Differences Notified to ICAO**

2.1.3.1 These ICAO provisions were interpreted in different ways by the ECAC States to best meet their own national requirements. Some States have therefore notified differences between their national regulations and practices and the corresponding International SARPS to ICAO. Other States have not yet introduced ICAO Airspace Classes.

2.1.3.2 Some ECAC States authorise VFR flights above FL 195, either by establishing Class B or C airspace, or by allowing VFR flights in Class A in accordance with specific conditions and/or with special ATC instructions. Some States relieve IFR flights from mandatory requirements for continuous two-way radio communication in Classes F & G. Other States do not permit IFR flights in Class G. Another State requires ATC clearances for IFR flights to operate in Class F airspace.

2.1.3.3 Most of the States have adapted VMC minima to their national conditions. Some States provide an ATC service to VFR flights or at least separation from IFR traffic.

---

<sup>(1)</sup> Reference: Third Meeting of the Visual Flight Rules Operations Panel [VFOP] (1986)

### **2.1.4 Need for a Simplified and Harmonised Airspace Organisation**

- 2.1.4.1 The EUROCONTROL Airspace Strategy for the ECAC States has, accordingly, identified a lack of harmonisation in the current application of ICAO ATS Airspace Classes by the ECAC States.
- 2.1.4.2 Therefore, the Airspace Strategy calls for a uniform application of these Classes appropriate for the traffic operating in the airspace in order to avoid over and under classification. In addition, classifications should be as simple as possible and should also permit unambiguous rules and safe flight operations.
- 2.1.4.3 Direction for Change A of the Airspace Strategy identifies the strategic steps towards a simplified airspace organisation based on the proposed Traffic Environment Models N, K, and U. The first of 5 steps - Operational Improvement 1A (OI-1A), refers to the harmonisation of the existing ICAO airspace classifications in ECAC airspace starting with the common classification of the airspace above a common agreed level. The second step - OI-2A, refers to the simplification and harmonisation of the remainder of ECAC airspace to the surface.

## **2.2 AIR TRAFFIC SERVICES REQUIREMENTS**

### **2.2.1 Requirements for Civil ATS Provision**

- 2.2.1.1 To cope with the continuing increase in IFR traffic, ECAC States have progressively reduced the use of non-radar procedures by the introduction of appropriate radar and communications systems with a sufficient level of automation so as to improve ATC capacity and efficiency whilst at the same time enhancing safety.
- 2.2.1.2 Functional compatibility of the data exchanged between the airborne and the ground elements is essential to ensure the efficiency of the overall ATM system. An air traffic control unit should, therefore, be provided with information on the intended movement of the aircraft, or variations therefrom, and with current information on actual progress of the aircraft, so as to determine from the information received, the relative position of known aircraft to each other.
- 2.2.1.3 In order to meet the aspirations of the users of the airspace in the context of enhancing the flexibility of operations, whilst maintaining a safe and orderly flow of air traffic, the organisation of the airspace will need to evolve to an airspace structure based on the knowledge of traffic. The level of control will then be determined by the complexity of the traffic situation rather than on the current system of airspace classifications.

### **2.2.2 Requirements for Military ATS Provision**

- 2.2.2.1 Military flying operations constitute a significant and important proportion of total airspace use. Therefore, the military authorities of some ECAC States have established their own "Operational Air Traffic" (OAT) Services in parallel with the "General Air Traffic" (GAT) Services in order to provide for their specialised operations such as air combat training, low-level missions, in-flight refuelling and high-energy flying activities which are incompatible with the normal application of the ICAO Rules of the air and air traffic services procedures.
- 2.2.2.2 As the co-existence of civil and military ATS systems has, in many cases, resulted in competition and an inefficient use of airspace, some States have decided to create an integrated ATS system to provide for both the civil and military needs. Experience gained by these States indicates that this solution offers promising results regarding the equitable and efficient sharing of airspace.

## 2.3 COMMERCIAL AIR TRANSPORT REQUIREMENTS

### 2.3.1 General Requirements

2.3.1.1 In respect of airspace organisation, the airline community seeks:

- Seamless services within airspace considered as a continuum;
- Simple and unambiguous rules, easy to implement and to follow;
- Freedom of movement to follow preferred and flexible flight profiles with minimum constraints;
- Pan-European harmonisation of airspace structure and legislation;
- Upper/Lower Airspace classification should be harmonised as soon as possible in order to enable the traffic to be operated within the airspace of a European network.

### 2.3.2 Requirement for a Clear Notification of Separation Responsibility

2.3.2.1 One of the critical issues identified with the lack of a harmonised application of ICAO ATS Airspace Classes is the limited awareness of aircrews regarding airspace classification. This results in confusion about the services offered and a lack of knowledge of the responsibility for separation, particularly at the lower levels, where the airspace classification is most varied throughout ECAC airspace.

2.3.2.2 For example, with radar services provided for the greater part of a flight throughout Europe, the flight crews operating on an IFR flight plan tend to assume that separation from all other traffic is always provided by ATC regardless of the class of airspace in which they are operating.

2.3.2.3 Because the safety of commercial air transport is of paramount importance, active control with separation of aircraft assured by ATC should be the rule for normal IFR operations.

## 2.4 MILITARY OPERATIONS REQUIREMENTS

### 2.4.1 General Requirements

2.4.1.1 Security in Europe may necessitate military operations undertaken by international organisations: UN, NATO or WEU, and for military aircraft to take precedence over civil aviation in some circumstances. It is, therefore, a fundamental principle that each ECAC State is able to train and operate its military air, sea and ground forces to enable them to discharge their responsibilities for security and defence. In order to carry out its operational tasks, military aviation seeks:

- freedom to operate in IMC/VMC at any time in all areas of ECAC airspace;
- special handling - in particular for priority flights and for time-critical missions, but also for military aircraft not fully equipped to the civil standard;
- to retain the possibility of operating uncontrolled VFR flights, including in "Controlled" airspace;
- temporary airspace reservations (TSAs), to contain activities which are incompatible with the normal application of the Rules of the Air;
- airspace restrictions for non flight-related activities such as protection of areas of national interest, gunnery, missile firing, etc....

## **2.5 GENERAL AVIATION & AERIAL WORK OPERATIONS REQUIREMENTS**

### **2.5.1 General Requirements**

2.5.1.1 General Aviation (GA) requires access to controlled airspace and airports at reasonable commercial cost. Where this activity increases it is likely to be largely centred on less congested airports. Aerial Work (AW) aviation needs to reserve airspace for particular operations, while recreation and sports aviation operating under VFR require a legitimate right of access to European airspace, although it may not be possible to fit to such aircraft the equipment required for flight in Controlled Airspace.

2.5.1.2 Although the majority of GA/AW flights operate in "Lower" Airspace under VFR rules, a sizeable amount (more than 10%) is IFR traffic. Therefore, the General Aviation & Aerial Work community seeks:

- to achieve maximum freedom of movement in all categories/classes of airspace;
- sufficient "Uncontrolled" airspace for its operations and VFR access to "Controlled" airspace, in particular for some gliders in the "Upper" Airspace;
- to maintain the right to change flight rules from IFR to VFR and vice-versa in the air, as well as before take-off or, at least, to receive special handling;
- to have the possibility of operating under VFR as long as weather conditions permit the application of the "see and avoid" rule.

## **2.6 TEST FLIGHTS & UAV OPERATIONS REQUIREMENTS**

### **2.6.1 General Requirements**

2.6.1.1 Test and Acceptance Flights for both civil and military purposes require special handling, but represent a relatively small airspace user community. The use of Uninhabited Aerial Vehicles (UAVs), formerly developed for military operations and recreation (model flying), has recently been extended to various civil aerial applications as a more cost effective solution than the use of conventional aircraft or helicopters.

2.6.1.2 No uniform regulatory framework for UAVs exists today, but it could be assumed that the Test Flights & UAVs community seeks mainly:

- accommodation of their operations, based on shared use of airspace, with sometimes a need for special handling, rather than on strict segregation;
- possibility of operating in the "Upper" Airspace;
- definition of standards for additional equipment capabilities so that UAVs can be designed to achieve compatibility with the airspace they are expected to operate in.

## **2.7 LIST OF POTENTIAL CRITERIA TO ESTABLISH CLASSIFICATION**

### **2.7.1 General**

2.7.1.1 In the course of the evolution of ECAC airspace towards a simplified organisation, as identified in Direction for Change A of the EUROCONTROL Airspace Strategy for the ECAC States, the different ATS Classes available for airspace classification will be limited to those defined in the harmonisation process in force at the time of publication of the present Edition/Amendment of the Planning Manual.

2.7.1.2 Until the harmonisation process is completed, where a choice of airspace classification still exists and as a result of the number of elements involved, it has not been possible to develop specific criteria to determine how to classify the airspace in a given area or at a given location. However, taking into account best practices in use in some ECAC States, the following decision-making criteria could be considered :

- Level of Air Traffic Services to be provided;
- Air safety-relevant incidents;
- IFR traffic volume;
- Mixed environment (IFR/VFR flights, different speeds and/or types of aircraft,...);
- Traffic concentration - Environmental Constraints;
- Particular operations (Military, GA, Test Flights, Aerial Work, Gliders, UAV,...);
- Meteorological conditions - Daylight/Night Operations;
- Flight Planning Issues;
- Cost-Benefit Analysis (Staff training, mandatory equipment, user charges,..)
- Principles or criteria already established for harmonised airspace.

## **2.7.2 Level of Air Traffic Services To Be Provided**

2.7.2.1 Essentially, when the number and frequency of IFR flights have reached a level where the responsibility for the arrangements to maintain a safe and expeditious flow of traffic can no longer be left to the discretion of individual pilots, the provision of Air Traffic Control (ATC) will be required. This should apply in particular when IFR operations of a commercial nature are conducted.

2.7.2.2 The planning for, and the execution of, ATC is essentially a national responsibility. However situations may arise where States will be required to improve their services, not because there is an urgent national requirement to do so, but in order to ensure that the efforts of adjacent States to improve their ATS are not compromised.

2.7.2.3 It is, therefore, of prime importance that both the planning and execution of ATC is conducted in a manner that ensures that optimum uniformity is maintained to the greatest degree possible. Thus, the delineation of airspace, wherein ATC is to be provided, should be related to the nature of the route structure and/or the containment of IFR flight paths and the need for an efficient service rather than observing national boundaries (see [Section 1](#)).

## **2.7.3 Air Safety-Relevant Incidents**

2.7.3.1 Even though the airspace classification should be established mainly as an enabling measure to facilitate the separation of aircraft by ATC, a local concentration of Air Safety-Relevant Incidents will require an immediate overall situational analysis which might lead to a change of classification of the airspace concerned.

## **2.7.4 IFR Traffic Volume**

2.7.4.1 Categorisation of airspace surrounding aerodromes is mainly influenced by the volume of IFR traffic to be handled. As the number of IFR movements at an aerodrome increases, the necessity to protect IFR operations from other traffic by the implementation of a more restrictive ATS Class may be appropriate.

2.7.4.2 Change in airspace classification would therefore be considered primarily on the basis of the IFR traffic figures and trends registered over previous years and forecast increases or decreases at a given aerodrome. To that end, in order to simplify airspace organisation, modular airspace structures with a limited number of ATS Classes, in accordance with the Airspace Strategy, would be assigned to different categories of aerodromes in accordance with their annual IFR traffic volume.

## **2.7.5 Mixed Environment**

2.7.5.1 A mixture of different types of air traffic (IFR/VFR) with aircraft of various speeds (light, conventional, jet, etc...) necessitates the provision of more advanced air traffic services and the establishment of a more restrictive class of airspace than, for example, the handling of a relatively greater density of traffic where only one type of operation is concerned.

2.7.5.2 Therefore, qualitative data on issues related to the handling of a mixture of traffic should be gathered to assess the best classification for a given block of airspace. The following parameters should be considered:

- the proportion of jet and/or heavy aircraft
- the amount and type of VFR operations
- training activities

## **2.7.6 Traffic Concentration - Environmental Constraints**

2.7.6.1 Areas of intense activity, flight paths of both IFR and VFR traffic, traffic flows (*uni-, bi- or multi-directional*), the relative situation of aerodromes in the vicinity, the proximity of big cities, etc... are other qualitative criteria which may influence the choice of an ATS Class in order to ensure the degree of control required to manage the situation.

## **2.7.7 Particular Operations**

2.7.7.1 In determining an ATS Class appropriate to the main user of a block of airspace, care should be taken that unnecessary restrictions are not imposed on other traffic such as Military, General Aviation, Test Flights, Aerial Work, Gliders and/or UAV that wish to operate in this airspace.

## **2.7.8 Meteorological Conditions - Daylight/Night Operations**

2.7.8.1 Meteorological conditions and/or Daylight/Night operations might have a substantial effect on the airspace classification of areas where there is a regular flow of IFR traffic, whereas similar or worse conditions might be less important for the classification of an area where such conditions would suspend the normal VFR traffic.

2.7.8.2 Most of the ECAC States have therefore adapted VMC minima to their prevailing national weather conditions. However, in view of the simplification and harmonisation of ATS Classification in Europe, adoption of common VMC minima for the entire ECAC region should be sought.

## **2.7.9 Flight Planning Issues**

2.7.9.1 The flight plan is currently the only way by which the pilots/operators inform ATS of their intended operations and formally request air traffic services. From the flight plan ATS derives all the information of operational significance regarding the intended flight, such as equipment carried, route to be flown, requested flight level(s), departure/destination aerodrome, etc...

2.7.9.2 When it becomes necessary for ATC to have available all of this information on each individual aircraft operating within a given volume of airspace, a change in airspace classification may be required in order that the mandatory filing of flight plans is established.

## **2.7.10 Cost-Benefit Analysis**

2.7.10.1 Change in airspace classification may have an impact on the numbers and training of qualified personnel (pilots & controllers), such factors require advance planning and therefore consideration during the decision-making process.

2.7.10.2 Change in airspace classification may also require the provision of additional facilities, especially for communication, navigation and surveillance.

2.7.10.3 Changes in airspace classification may, therefore, require a comprehensive Cost-Benefit Analysis.

## 2.8 GUIDANCE FOR ORGANISING THE "UPPER" PART OF ECAC AIRSPACE

### 2.8.1 Common Classification Above a Common Agreed Level

2.8.1.1 Within ECAC Airspace, the types and density of traffic above FL 195 require the provision of common procedures by ATC.

2.8.1.2 An ATS Route Network (ARN) has thus been established in ECAC Airspace, under the auspices of the EUROCONTROL Airspace & Navigation Team (ANT), for the purpose of flight planning and which facilitates the organisation of an orderly traffic flow by the Central Flow Management Unit (CFMU) (see [Section 4](#)).

2.8.1.3 Area control arrangements in place in most of ECAC States have the advantage that whenever traffic conditions and military activities permit, ATC may authorise specific flights under its control to deviate from the established route structure and to follow a more direct flight path or to fly in parallel with other flights without aircraft leaving controlled airspace and thus losing the benefit of ATC (see [Section 1](#)).

2.8.1.4 ECAC States have commonly agreed to provide, as from **27 November 2003**, an area control service in the entire ECAC airspace **above FL 195 in ATS Class C**.

### 2.8.2 Common Process for ATS Airspace Classification above FL 195

2.8.2.1 ECAC States should designate the authority responsible for providing ATC services within the corresponding block of airspace under their sovereignty and for the territories over which they have jurisdiction.

2.8.2.2 In order to ensure a common ATS airspace classification within ECAC Airspace above FL 195 in accordance with the Airspace Strategy, ECAC States are required to ensure that the airspace above FL 195 and its associated traffic handling comply with the general agreements set out in paragraph 2.8.1.4. To that end, ECAC States will:

- enact this international agreement in corresponding national Regulations and/or Decrees;
- update accordingly their national AIP.

### 2.8.3 Common Conditions for VFR Access to Class C Airspace above FL 195

2.8.3.1 In addition to establishing Class C airspace as the ATS Airspace Class to be applied throughout ECAC airspace above FL 195, it will be necessary to introduce harmonised rules for access to this airspace by GAT traffic that may seek to fly en-route under VFR. Safety and airspace capacity considerations, and the understanding that there is almost no requirement for en-route GAT VFR flight above FL 195, require a general rule to be formulated:

- En-route GAT VFR flights above FL 195 will not be permitted.

However, there are various types of "special" GAT flight that will have to be accommodated, accordingly the general rule is amplified thus:

- GAT VFR flights above FL 195 and up to and including FL 285 will only be authorised in:
  - An airspace reservation [Temporary Segregated Airspace (TSA) or its equivalent] or
  - In accordance with specific arrangements agreed by the appropriate ATS authority
- GAT VFR flights above FL 285, within RVSM airspace, must be contained within:
  - An airspace reservation (TSA or its equivalent)

## **2.9 GUIDANCE FOR ORGANISING THE "MIDDLE" PART OF ECAC AIRSPACE**

### **2.9.1 Need for a Known Traffic Environment above a common division level**

2.9.1.1 TBD

### **2.9.2 Classification of a System of ATS Routes**

2.9.2.1 TBD

### **2.9.3 Classification of a Control Area (CTA/TMA)**

2.9.3.1 TBD

### **2.9.4 Special Handling of Particular Operations**

2.9.4.1 TBD

### **2.9.5 Common Process for ATS Airspace Classification in "Middle" Airspace**

2.9.5.1 TBD

## **2.10 GUIDANCE FOR ORGANISING THE "LOWER" PART OF ECAC AIRSPACE**

### **2.10.1 Categorisation of Airspace Surrounding Aerodromes**

2.10.1.1 TBD

### **2.10.2 Evaluation of VFR/IFR Traffic Mix and Concentration**

2.10.2.1 TBD

### **2.10.3 Impact of Daylight/Night Operations and/or Weather Conditions**

2.10.3.1 TBD

### **2.10.4 Classification of Terminal Airspace**

2.10.4.1 TBD

### **2.10.5 Special Handling of Particular Operations**

2.10.5.1 TBD

### **2.10.6 Common Process for ATS Airspace Classification in "Lower" Airspace**

2.10.6.1 TBD

**2.11 RATIONALISATION OF ATS AIRSPACE CLASSIFICATION TOWARDS TRAFFIC ENVIRONMENT MODEL - (see ANNEX 2A) -****2.11.1 Concept of iNtended Traffic Environment (Category N)**

2.11.1.1 TBD

**2.11.2 Concept of Known Traffic Environment (Category K)**

2.11.2.1 TBD

**2.11.3 Concept of Unknown Traffic Environment (Category U)**

2.11.3.1 TBD

**2.11.4 Separation Responsibility (ATC or Visual)**

2.11.4.1 TBD

**2.11.5 ATS Provision**

2.11.5.1 TBD

**2.11.6 Common Differences Notified to ICAO**

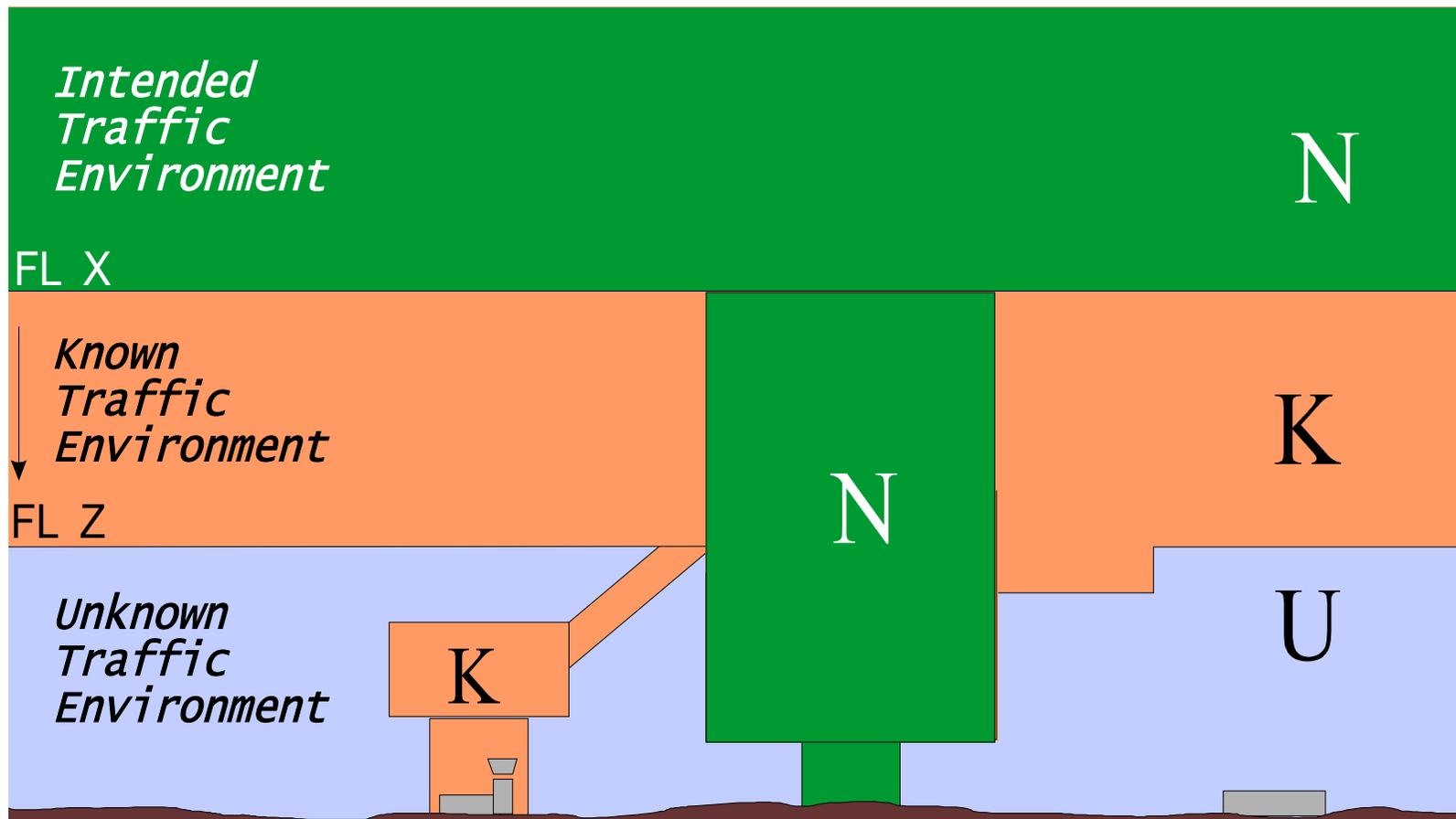
2.11.6.1 TBD

**2.11.7 Common Process for Airspace Categorisation in N, K, U**

2.11.7.1 TBD

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### RATIONALISATION OF ATS AIRSPACE CLASSIFICATION



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## **SECTION 2**

<h1><b>GUIDELINES FOR ATS AIRSPACE CLASSIFICATION</b></h1>
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## **FINAL PAGE**

### **SUGGESTION - COMMENTS**

To report any errors, or to propose a modification to the present Section 2 "Guidelines for ATS Airspace Classification", please contact:

Mr Bill Armit  
EUROCONTROL  
Airspace & Flow Management and Navigation Business Division (AFN)  
Rue de la Fusée, 96  
B-1130 BRUSSELS  
(E-mail: [bill.armit@eurocontrol.int](mailto:bill.armit@eurocontrol.int))

### **SECTION 2 - SPONSOR: AIRSPACE MANAGEMENT SUB-GROUP**

Whenever material received, in accordance with the above procedure, makes it apparent that an amendment of the present Section 2 is required, such amendment will be first discussed within the Airspace Management Sub-Group (ASM-SG) before its adoption by the Airspace & Navigation Team (ANT).

### **PUBLICATION OF AMENDMENT**

The agreed amendment will then be issued by EUROCONTROL in the form most convenient for its insertion in the Planning Manual.

## **SECTION 3**

# **AIRSPACE RESTRICTIONS & RESERVATIONS DESIGN**

### **3.1 INTRODUCTION**

#### **3.1.1 Flexible Use of Airspace Concept**

- 3.1.1.1 The Concept of the Flexible Use of Airspace (FUA) endorsed at MATSE/4 in June 1994 and supported by the European Parliament on 27 September 1994 has been gradually implemented in the ECAC States as from the **28<sup>th</sup> March 1996**.
- 3.1.1.2 The basis for the FUA Concept is that airspace should no longer be designated as either military or civil airspace, but should be considered as one continuum and used flexibly on a day-to-day basis. Consequently, any necessary airspace reservation or segregation should be only of a temporary nature.
- 3.1.1.3 A more effective sharing of ECAC airspace and efficient use of airspace by civil and military users stemming from the application of the FUA Concept is realised through joint civil/military strategic planning and pre-tactical airspace allocation.
- 3.1.1.4 Airspace Management (ASM) procedures at the three levels; Strategic ASM Level 1, Pre-Tactical ASM Level 2 and Tactical ASM Level 3 are described in the EUROCONTROL Handbook for Airspace Management, whereas general guidelines for the establishment of airspace structures can be found in the Section 1 and planning considerations for ATS routes design including Conditional Routes (CDRs) in the Section 4 and for airspace restrictions and reservations design in the present Section 3.

#### **3.1.2 Flexible Airspace Structures**

- 3.1.2.1 The FUA Concept uses airspace structures that are particularly suited for temporary allocation and/or utilisation.
- 3.1.2.2 The different airspace structures; Conditional Routes (CDRs), Temporary Segregated Areas, (TSAs), Temporary Reserved Areas (TRAs), Cross-Border Areas (CBAs) or those Danger or Restricted Areas (D, R) subject to pre-tactical or tactical allocation under the Temporary Airspace Allocation (TAA) process, as well as Reduced Co-ordination Airspace (RCA) or Prior Co-ordination Airspace (PCA) procedures used for flexible airspace management are detailed hereafter.
- 3.1.2.3 In addition the present Section 3 provides elements for the information on any other activities of particular nature or for re-shaping the airspace to accommodate user-preferred trajectories for vectoring and in the future, free routing and/or autonomous operations.

#### **3.1.3 National High-Level Policy Body Functions**

- 3.1.3.1 In accordance with FUA principles, Strategic ASM at Level 1 consists of a joint civil and military process, within the high-level civil/military national body which formulates the national ASM policy and carries out the necessary strategic planning work, taking into account national and international airspace users requirements.
- 3.1.3.2 The permanent "National High-Level Policy Body" is required to establish a joint civil and military process to perform the following minimum functions:

- a) formulate the national policy for airspace management;
- b) reassess periodically the national airspace structures including ATS routes (see [Section 4](#)) and Terminal Airspace (see [Section 5](#)) with the aim of planning, as far as possible, for flexible airspace structures and procedures;
- c) validate activities requiring airspace segregation and assess the level of risk for other airspace users;
- d) plan the establishment of flexible airspace arrangements (CDRs, TSAs, CBAs, RCAs, PCAs, .. ) and conduct, if required, associated safety assessment;
- e) change or modify, if required and if practicable, Danger and Restricted Areas into temporary allocated airspace;
- f) establish controlled airspace and ATS airspace classifications (see [Section 2](#)) taking into account the FUA concept;
- g) publish in national AIP the airspace structures including ATS routes and ATS airspace under its jurisdiction;
- h) co-ordinate major events planned long before the day of operation, such as large scale military exercises, which require additional segregated or reserved airspace, and notify these activities by AIS-publication;
- i) periodically review the national airspace needs and, where applicable, cross-border airspace utilisation.

### **3.1.4 Need for National Airspace Planning Arrangements for Change Process**

- 3.1.4.1 In order to ensure that airspace is utilised in a safe and efficient manner and that in the near future, a co-ordination process for airspace planning between neighbouring States will be properly set-up, there is a need first that all ECAC States establish formerly National Airspace Planning Arrangements.
- 3.1.4.2 Such National Airspace Planning Arrangements should clearly establish policies for the effective allocation and use of airspace and its supporting infrastructure and should define the process and responsibilities to ensure that proposed changes to airspace are initiated, considered, refined, approved and finally implemented in a safe and effective manner.
- 3.1.4.3 To that end, an outline of such airspace change process will be provided in the EUROCONTROL Handbok for Airspace Management to assist ECAC States in developing their National Airspace Planning Arrangements through which subsequent changes to the national airspace organisation could be made taking into account the needs of all stakeholders.

## **3.2 TEMPORARY AIRSPACE ALLOCATION (TAA) PROCESS**

### **3.2.1 General Presentation of the TAA Process**

- 3.2.1.1 Since the demands on the use of airspace are manifold, some of which are not compatible with civil aviation (e.g. rocket firing) and because there exist sensitive areas on the ground that need protection from possible disturbance by over-flying aircraft, it is recognised that there is a need for States to establish airspace restrictions of varying degrees of severity. In addition, there are aerial activities by specific users or user groups, which may require the reservation of portions of the airspace for their exclusive use for determined periods of time.
- 3.2.1.2 Whenever such restrictions and/or reservations have to be imposed, they invariably constitute a limitation to the free and unhampered use of that airspace with the associated effects on flight operations. It is therefore evident that the scope and duration of reservation/restriction established should be subject to very stringent scrutiny in order to keep undesirable effects to the minimum consistent with the reason causing their creation.

3.2.1.3 To achieve this and in order to improve efficiency and flexibility of aircraft operations, States will endeavour to use the “Temporary Airspace Allocation” (TAA) process summarised in a diagram at Annex 3A.

3.2.1.4 Definition of the TAA Process :

*The **Temporary Airspace Allocation (TAA) Process** consists in the allocation process of an airspace of defined dimensions assigned for the temporary reservation (TRA/TSA) or restriction (D/R) and identified more generally as an “AMC-manageable” area.*

3.2.1.5 The TAA Process involves all AMC-manageable areas that are subject to allocation at ASM Level 2 & 3. These manageable areas are either formal structures established for the temporary reservation of airspace (see paragraph 3.2.3) or the temporary restriction of airspace (see paragraph 3.2.4) that are allocated at Level 2 & 3.

## **3.2.2 Validation of Activities Requiring Airspace Reservation/Restriction**

3.2.2.1 General

3.2.2.1.1 In general airspace should only be reserved or restricted for specific periods of time which should stop as soon as the associated activity ceases. In practise, the TAA process includes all the AMC-manageable structures whenever their use can be linked to a daily allocation for the duration of a planned activity. Thus, when designating airspace volumes, States should establish, as far as possible, AMC-manageable structures.

3.2.2.2 Criteria governing the evaluation of national airspace needs and validation of activities

3.2.2.2.1 When States initiate their evaluation of short-term national airspace needs, or have to deal with a new airspace request, they should :

- ensure that the activities relating to the request for temporary reservation or restriction are valid and justify such action;
- consider the feasibility of avoiding any potential hazard and/or disruption to other airspace users, through appropriate civil/military co-ordination procedures, so that a joint use of airspace will be possible;
- if the joint use of airspace is not possible, determine the needs in terms of space, time and the conditions of use, that are required to confine the activities, to minimise the potential hazard and to minimise disruption to other airspace users;
- assess the level of risk for other airspace users and determine how a request can best be met with the least interference to other users.

3.2.2.3 Criteria governing the choice between Airspace Reservation and Restriction

3.2.2.3.1 Having assessed the need for an AMC-manageable area, where the activities are suitable for daily management and allocation at Level 2, States should :

- whenever possible, establish an airspace reservation using guidelines defined in Chapter 3.2.3;
- if not, - where either because of difficulty in the notification of airspace status to interested airspace users or because of national legal requirements - establish an airspace restriction (R or D) in accordance with guidelines defined in Chapter 3.2.4.

3.2.2.3.2 Finally, States should keep established airspace reservations and airspace restrictions under regular review so as to determine whether they are still required or whether modification may be necessary in the light of changed requirements.

### 3.2.3 Guidelines for the Establishment of Airspace Reservation

#### 3.2.3.1 Activities Requiring Temporary Airspace Reservation

3.2.3.1.1 States should establish, whenever possible, an airspace reservation over their land and/or territorial waters :

- in response to an operational need to accommodate civil, military, R&D, training or test-flights which, due to the nature of their activities, must be temporarily “protected” from non-participating traffic;
- for military training activities conducted under positive control, when aircraft manoeuvres are unpredictable, sensitive to external interference, or difficult to alter without adversely affecting the mission;
- for civil and military activities where the level of risk is not permanently present and where a temporary airspace reservation or segregation for a period is manageable at Level 2.

3.2.3.1.2 States should clearly identify the activities for which the reservation/segregation of airspace is required from other activities and assess if they can be conducted simultaneously with traffic transiting together with their location in relation to the major traffic flows, in order to define the type of airspace reservation to be applied.

#### 3.2.3.2 Different Types of Temporary Airspace Reservation (TRA, TSA)

3.2.3.2.1 While it is recognised that there exist legitimate reasons for establishment of airspace reservations, experience also indicates that depending on the activities, some “reserved” airspace may be transited by another airspace user under specific conditions and/or based on appropriate co-ordination procedures. For this reason, different areas can be established taking into consideration the activity that would take place associated with the transit possibility.

3.2.3.2.2 **Temporary Reserved Area (TRA)** is a defined volume of airspace normally under the jurisdiction of one aviation authority and **temporarily reserved**, by common agreement, for the specific use by another aviation authority and through which other traffic may be allowed to transit, under ATC clearance.

3.2.3.2.3 Any ATC clearance for crossing an active TRA will be subject to prior co-ordination requirements in accordance with appropriate co-ordination procedures established between civil and military ATS units concerned.

3.2.3.2.4 **Temporary Segregated Area (TSA)** is a defined volume of airspace normally under the jurisdiction of one aviation authority and **temporarily segregated**, by common agreement, for the exclusive use by another aviation authority and through which other traffic will not be allowed to transit.

3.2.3.2.5 In order to permit all airspace users and ATS providers to be fully aware of areas subject to temporary reservation/segregation, Temporary Reserved Areas (TRAs) and Temporary Segregated Areas (TSAs) will be published in the national AIPs.

**Note:** Pending results from consultation with ICAO on above definitions, the current TSA definition is maintained i.e. :

***“Temporary Segregated Area (TSA) is an airspace of defined dimensions within which activities require the reservation of airspace for the exclusive use of specific users during a determined period of time”.***

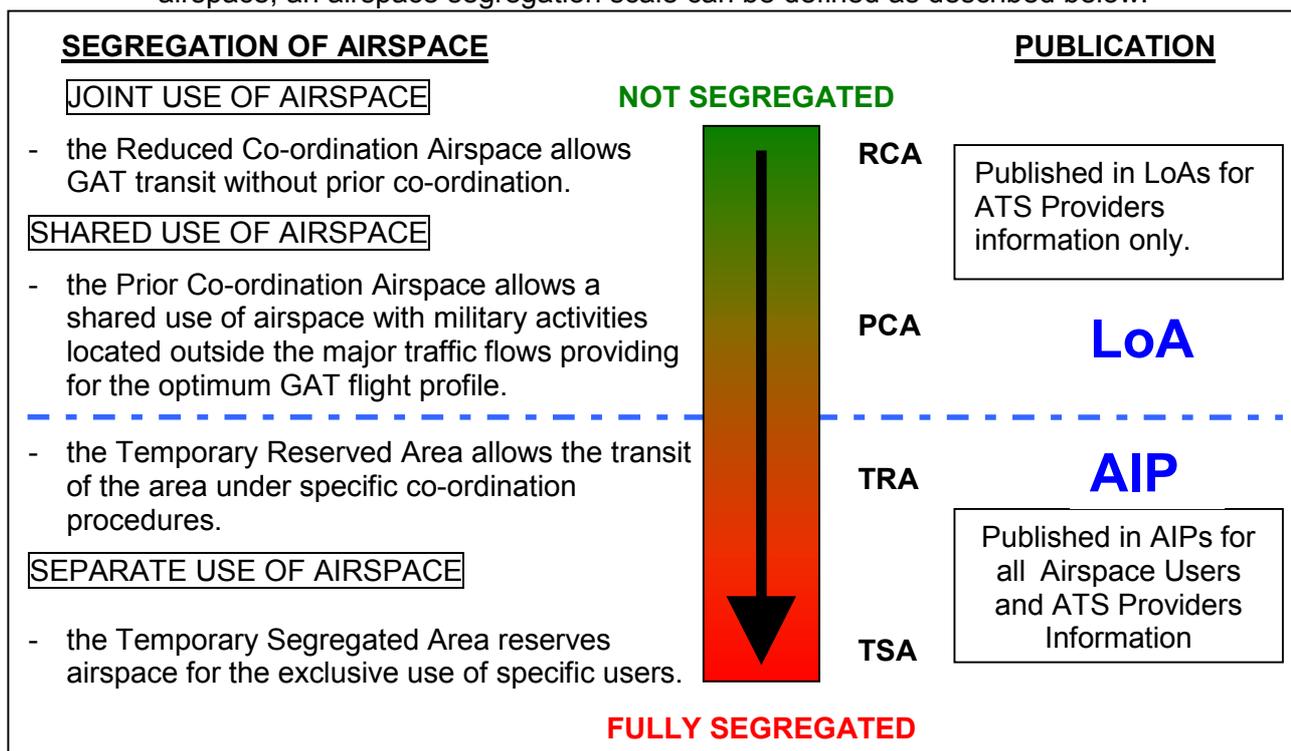
#### 3.2.3.3 Procedures for a Joint/Shared Use of Airspace

3.2.3.3.1 In applying FUA principles, States should, before establishing any AMC-manageable areas, validate activities requiring airspace restriction/segregation and consider the feasibility of a joint or shared use of airspace, whenever possible, between General Air Traffic (GAT) and Operational Air traffic (OAT).

- 3.2.3.3.2 To that end, two procedures can be established in Letters of Agreement between the appropriate civil and military control units. These LoAs would need to specify the criteria required by the military authorities to permit or not GAT to fly “off-route” (e.g. radar performance, controller’s workload, amount of OAT traffic expected).
- 3.2.3.3.3 The **Reduced Co-ordination Airspace (RCA)** procedure is used to allow GAT to fly “off-route” without requiring civil controllers to initiate co-ordination with the military controllers.
- 3.2.3.3.4 The RCA procedure is usually applied for a very large area such as the entire FIR/UIR, but also for critical ACC sectors which have different capacity figures according to the existence of military activity or not.
- 3.2.3.3.5 The **Prior Co-ordination Airspace (PCA)** procedure, as another way of booking airspace, involves a given block of controlled airspace within which military activities can take place on an ad-hoc basis with individual GAT transit allowed under rules specified in LoAs between civil and military units concerned.
- 3.2.3.3.6 So as to minimise the need for individual off-route co-ordination, the PCA procedure will mainly be applied for airspace established outside the major traffic flows providing for the optimum GAT flight profile.
- 3.2.3.3.7 The airspace booking through the PCA procedure will be co-ordinated primarily between the ATS Providers concerned because they will be in the best position to put the reservation into effect. Therefore, Prior Co-ordination Airspace (PCA) will not be published in AIPs, but only in Letters of Agreement between the appropriate civil and military control units.
- 3.2.3.3.8 When the RCA procedure is in force, these Letters of Agreement should define the criteria required for the application of the PCA procedure with specific notice periods to allow the safe return of GAT flights to the ATS route network. Conversely, when military activities within a Prior Co-ordination Airspace (PCA) cease or decrease, the RCA procedure will be initiated.

3.2.3.4 Degree of Airspace Segregation - Choice between RCA, PCA, TRA and TSA

3.2.3.4.1 From the joint/shared use of airspace to the temporary reservation/segregation of airspace, an airspace segregation scale can be defined as described below.



3.2.3.4.2 AOs will normally use the permanent ATS routes established outside TSAs, TRAs and/or PCAs. However, if available, they will be allowed to file a CDR or even a direct track (not in case of a TSA) and will therefore be re-routed around an active PCA or TRA. When an area (TRA, TSA) is not active, the traffic may expect “short track” through it on the initiative of the ATS Provider.

3.2.3.5 Guidelines for the Establishment of Prior Co-ordination Airspace (PCA)

3.2.3.5.1 The RCA procedure (see Chapter 2.3.5 of the EUROCONTROL Handbook for Airspace Management) and PCA procedure will be implemented exclusively within controlled airspace in known traffic environment, and their use will be complementary according to co-ordination procedures laid down in associated LoAs to ensure a maximum joint use of airspace.

3.2.3.5.2 The purpose of PCA is to temporarily book an airspace, for the use of specific users, that is located outside the major GAT traffic flows. A PCA should be established within a controlled airspace in a known traffic environment, where en-route GAT VFR flights are not permitted (e.g. Class C above FL 195 - see Section 2) to guarantee that information on the airspace status will be provided to the required audience.

3.2.3.5.3 A PCA will mainly be used to separate general and commercial aviation operating in controlled airspace in a known traffic environment from high-speed military operations such as air combat training and formation flying.

3.2.3.6 Guidelines for the Establishment of Temporary Reserved Area (TRA) or Temporary Segregated Area (TSA)

3.2.3.6.1 When there is a need to inform in advance airspace users of any potential activity requiring to temporarily reserve/segregate an area and/or when such activity is located within a busy GAT environment, a TRA/TSA will be created and published in AIPs.

3.2.3.6.2 For cross-border activities, the same guidelines will be used for the establishment of a Cross-Border Area (CBA) either in a form of a TRA or a TSA. Specific elements which require to be taken into consideration for the establishment of such TRA or TSA across international boundaries are listed in the EUROCONTROL Handbook for Airspace Management – Section 3.

3.2.3.7 Criteria for pre-defining airspace reservation volumes (TRA/TSA)

3.2.3.7.1 TRA and TSA will be airspace of pre-defined dimensions but, if several activities are foreseen to take place in the area, they may be subdivided at Level 1 and published as such in AIPs. AMCs may then be able to allocate them fully or partially in accordance with national policy.

3.2.3.7.2 TRA and TSA are established as pre-defined volumes of airspace so as to safely encompass either pre-planned military-type missions within a specific area (e.g. combat manoeuvres, practice air intercepts,...) or activities in movement (e.g. aerial refuelling, en-route mass formations,...). TRA and TSA could also be required for civil activities such as special test-flights or even for radar vectoring within pre-defined areas of potentially very high density of traffic.

3.2.3.7.3 For the delineation of any reserved airspace volumes (TRA or TSA), the State 'Due Regard' obligation should be strategically observed so that activity in that airspace structure will not endanger non-participating aircraft operating at or near its published limits. Distinct/individual boundaries should preferably be defined for activities in adjacent airspace. However, where it is necessary to define a common boundary, appropriate measures governing operations in the proximity of the common boundary should be established (see Section 1).

3.2.3.7.4 The establishment of a common boundary should always be complemented by tactical rules. These can be part of the national air law and/or take the form of LoAs between units involved. Such rules should be as flexible as possible taking into account the following :

- Efficient airspace design and operation ensuring no waste of airspace;
- Radar vectoring in achieving efficient use of airspace.

3.2.3.7.5 In defining these tactical separation rules, States should ensure that safety is assured in all circumstances through:

- the definition, if so required, of specific separation minima depending on the activities conducted in reserved airspace, with the addition of an adequate buffer;
- the application of appropriate LoAs between civil and military units involved;
- the promulgation of the first usable IFR flight levels above/below an area in the definition of associated ATS routes.

### 3.2.3.8 Co-ordination of airspace reservation - TRA/TSA utilisation

3.2.3.8.1 For an efficient Temporary Airspace Allocation (TAA) process, ASM Level 2 requires the designation of an Approved Agency (AA) for the co-ordination of TRA/TSA utilisation and for the daily submission of corresponding airspace requests to the AMC the day before operations.

## 3.2.4 Guidelines for the Establishment of Airspace Restriction

### 3.2.4.1 Requirements for Airspace Restriction (Danger, Restricted or Prohibited Areas)

3.2.4.1.1 The FUA Concept recommends that where possible, D and R Areas are replaced by an airspace reservation (see [Chapter 3.2.3](#) above) or modified by applying the TAA process when the airspace restriction is manageable at Level 2. However, States may have a continuing requirement to retain D and R Areas; e.g. Danger Areas over the High Seas (see [Chapter 3.2.5](#)).

3.2.4.1.2 Other D and R areas in some ATS classes of airspace may also not be suitable for replacement by an airspace reservation (TRA, TSA), either because of difficulty in the notification of airspace status to interested airspace users, or because of national and international legal requirements. For example a TSA, though managed as closely as possible to real-time requirements, may be more restrictive than existing D and R areas which can be penetrated by non-participating aircraft under specific and published conditions. Should the changing of some D and R Areas into TRA or TSA impose unreasonable constraints to users, States should retain these D and R Areas.

### 3.2.4.2 Criteria for pre-defining airspace restriction volumes (P/R/D)

3.2.4.2.1 For the delineation of any restricted airspace volumes (P, R or D), the State 'Due Regard' obligation should be strategically observed so that participating activity will not endanger non-participating aircraft operating at or near its published limits. Distinct/individual boundaries should preferably be defined for activities in adjacent airspace. However, where it is necessary to define a common boundary, appropriate measures governing operations in the proximity of the common boundary should be established (see [Section 1](#)).

3.2.4.2.2 The establishment of a common boundary should always be complemented by tactical rules. These can be part of the national air law and/or take the form of LoAs between units involved. Such rules should be as flexible as possible taking into account the following :

- Efficient airspace design and operation ensuring no waste of airspace;
  - Radar vectoring in achieving efficient use of airspace.
- 3.2.4.2.3 In defining these tactical separation rules, States should ensure that safety is assured in all circumstances through:
- the definition, if so required, of specific separation minima depending on the activities conducted in restricted airspace, with the addition of an adequate buffer;
  - the application of appropriate LoAs between civil and military units involved;
  - the promulgation of the first usable IFR flight levels above/below an area in the definition of associated ATS routes.
- 3.2.4.2.4 The AIP would identify those D and R areas managed and allocated at Level 2. To that end, some States may add suitable qualifiers to these D and R designators to indicate the Level 2 management of these areas. The period and conditions of use of these AMC-manageable areas will be published in AUPs in the list “CHARLIE” of Temporary Airspace Allocation (TAA).
- 3.2.4.2.5 Other D and R areas, not suitable for Level 2 management, would be identified as such and completely defined in the national AIPs. Within these published times the activity will take place without any allocation by AMCs unless users and/or managers of these airspace restrictions are able to notify their activities for the following day.

### **3.2.5 Guidelines for the Establishment of Airspace Restriction/Reservation over the High Seas**

#### **3.2.5.1 Establishment of Danger Areas over the High Seas**

- 3.2.5.1.1 The FUA Concept recommends that where possible, D and R Areas are replaced by an airspace reservation (see [Chapter 3.2.3](#) above) or modified by applying the TAA process when the airspace restriction is manageable at Level 2.
- 3.2.5.1.2 However, over the High Seas, regardless of the risk involved, only Danger Areas can be established.

#### **3.2.5.2 Activities over the High Seas manageable at ASM Level 2**

- 3.2.5.2.1 In general airspace should only be reserved or restricted for specific periods of time which should stop as soon as the associated activity ceases. In practise, the TAA process includes all the AMC-manageable structures whenever their use can be linked to a daily allocation for the duration of a planned activity.
- 3.2.5.2.2 Thus, when designating airspace volumes over the High Seas wherein an ECAC State has accepted the responsibility for providing ATS, that State should establish, as far as possible, “AMC-manageable Danger Areas” and allocate them in the same way as over land and/or territorial waters (see [Chapters 3.3.2 & 4.10](#) of the EUROCONTROL Handbook for Airspace Management related to ASM over the High Seas).

#### **3.2.5.3 Requirements for Danger Area Restriction over the High Seas**

- 3.2.5.3.1 In all other cases, according to ICAO recommendations, those who initiate danger area restrictions over the High Seas are under an increased moral obligation to judge whether establishment of the Danger Area is unavoidable and if it is, to give full details on the intended activities therein (see [Chapter 4.10](#) of the EUROCONTROL Handbook for Airspace Management related to ASM over the High Seas).

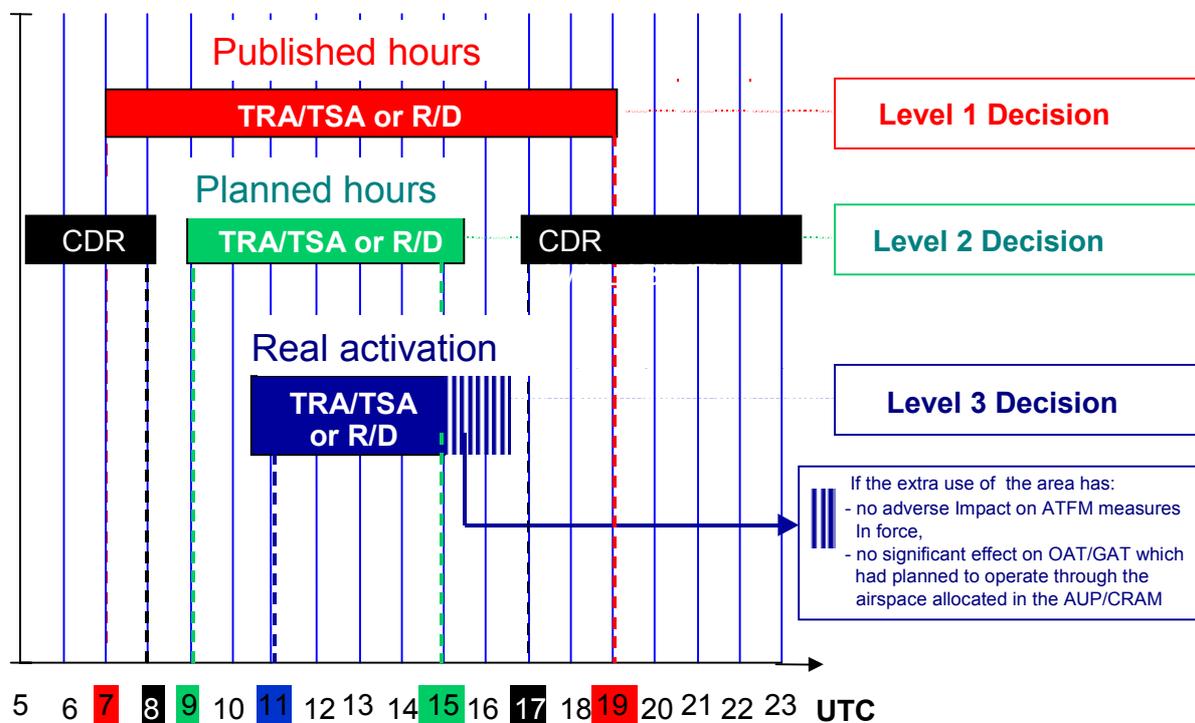
### 3.2.6 Activation Times Parameters

#### 3.2.6.1 General

3.2.6.1.1 Activation times should be clearly stated in accordance with the following parameters :

- the "Published Hours" which would be the period of activation decided at Level 1 and published in AIP/NOTAM in a new column dealing with "Activation Hours". The Published Hours would cover the maximum possible activation time;
- the "Planned Hours" which would always take place within the Published Hours and would be decided at Level 2 by AMC's and published as such in AUP's;
- the "Real Activation Time" which would normally take place within the Planned Hours and would be the actual period of use of the area notified at Level 3 by appropriate means.

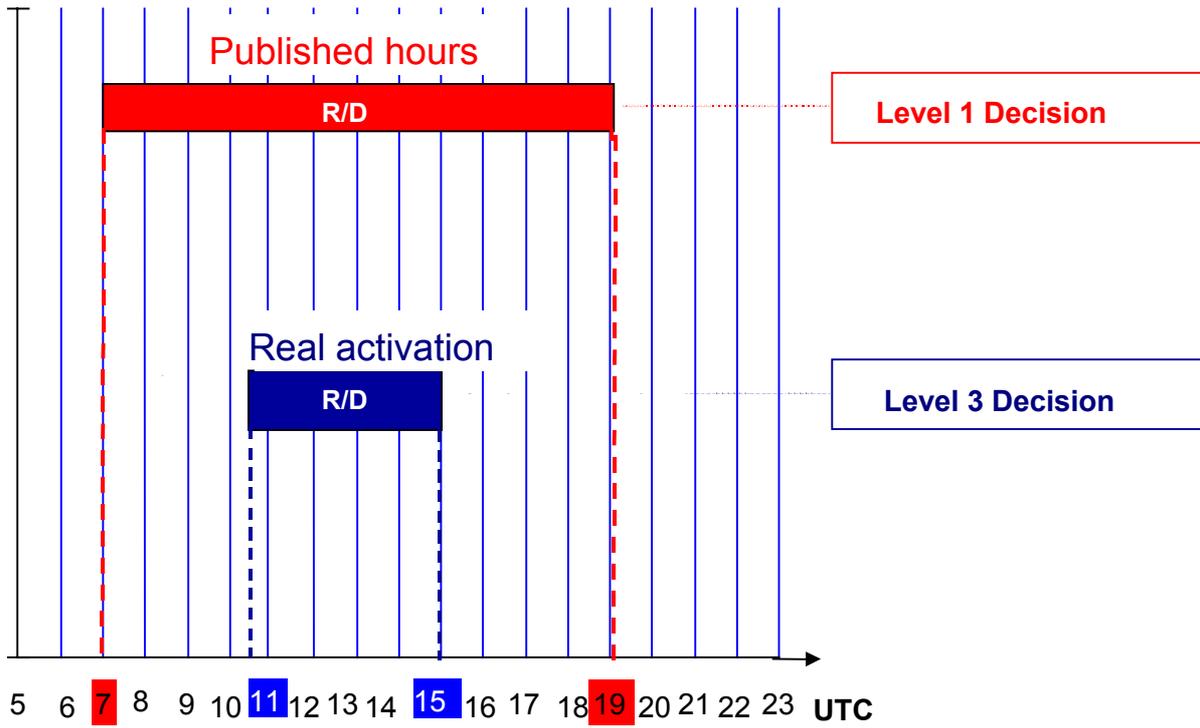
#### 3.2.6.2 Activation times associated with the TAA Process – AMC-Manageable Areas



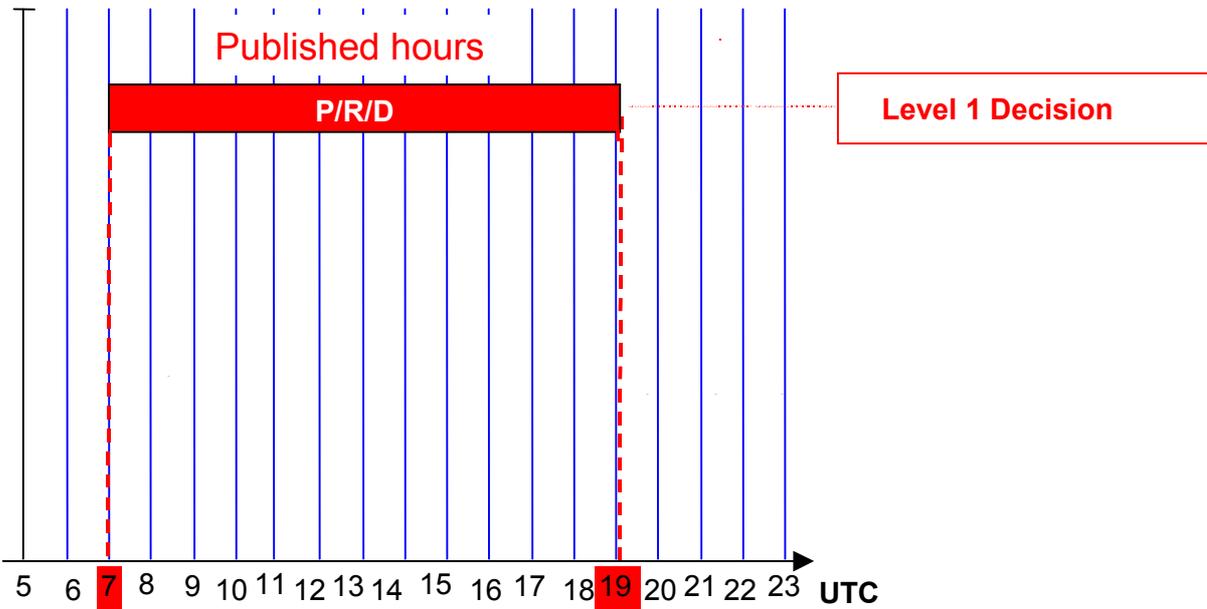
3.2.6.2.1 There is the possibility, after adequate Level 3 co-ordination, for the "Real Activation Time" of an area to be outside the "Planned Hours". This would require consideration of various issues, including :

- the control of access into the airspace in which the area is situated;
- any adverse impact on the ATFM measures in force;
- any significant effect on GAT/OAT which had planned to fly or operate through the airspace on the basis of related information in the CRAM/AUP.

3.2.6.3 Activation times associated with Airspace Restrictions Manageable at Level 3



3.2.6.4 Activation times associated with Airspace Restrictions NOT Manageable at all



### 3.2.7 Harmonised Publication of Airspace Restriction/Reservation

#### 3.2.7.1 Publication of Restriction (P, R, D)

3.2.7.1.1 The ICAO AIS Manual (Doc. 8126) recommends that AIP RAC 5 lists all areas through which the flight of aircraft is subject to certain specified conditions and which have some permanency, including those which are activated from time to time. Doc. 8126 also requires that any such area should be designated a Prohibited Area (P), a Restricted Area (R) or a Danger Area (D).

3.2.7.1.2 A fictitious example of the harmonised publication in AIPs of Temporary Allocated Airspace (TAA) in the form of AMC-manageable R and D Areas is given in Annex 3B together with an explanatory note to be published in front of ENR 5.

#### 3.2.7.2 Publication of Temporary Airspace Reservation (TRA, TSA)

3.2.7.2.1 Article 3 d) of the ICAO Convention requires Contracting States to have due regard for the safety of navigation of civil aircraft when issuing regulations for military aircraft. ICAO Annex 11 prescribes that any activity potentially hazardous to civil aircraft shall be co-ordinated with the appropriate air traffic services authorities. The co-ordination shall be effected early enough to permit timely promulgation of information regarding the activities in accordance with the provisions of ICAO Annex 15.

3.2.7.2.2 Under these circumstances, if an airspace reservation is formally established within controlled airspace, ECAC States, according to their own legislation, should publish the area as a TRA or a TSA in AIP ENR 5-2 (see Annex 3B). Nevertheless in all cases, States are required to establish LoAs, if needed, with direct communication between civil and military controlling/monitoring units concerned in order to allow an efficient co-ordination process.

3.2.7.2.3 As specified in the Doc. 8126, the description and graphic portrayal of TRA or TSA should include, as appropriate:

- 1) identification and name (if any) - lateral limits with geographical co-ordinates;
- 2) upper and lower limits;
- 3) type of restriction or nature of hazard;
- 4) remarks including the period of activity if the area is only “active” during certain periods.

The “risk of interception in the event of penetration” should also be noted in the remarks column defined in sub para 4) above.

3.2.7.2.4 As stated in para. 3.2.6.2, TAA activation time parameters encompass “Published Hours”, “Planned Hours” and “Real Activation Time”. The Published Hours would cover the maximum possible activation and should be published in the AIP in a new column or as a specific part of the “Remarks” column. In some cases, it could also be useful to publish in the “Remarks” column the “Operating Authority” and the “Penetration Conditions”, if any.

3.2.7.2.5 Information concerning Cross-Border Activities within a TRA or TSA established over international boundaries should be published in a similar way as a national TRA or TSA. However, such a “Cross-Border Area” must be given specific designators for publication in the AIPs of the States concerned, and the lateral limits of the area in each State.

**3.2.8 Depiction on the ASM Planning Chart**

3.2.8.1 General

3.2.8.1.1 Areas not suitable for allocation at Level 2 (Not AMC Manageable) and therefore not covered by the TAA Concept, can be split into two categories according to their handling at Level 3 (see paragraph 3.2.5.3 & 3.2.5.4 above).

3.2.8.1.2 Therefore, areas depicted on the ASM Planning Chart are subdivided into three categories according to their management possibilities as follows:

- in **plain light yellow** with orange outline, for the AMC-manageable areas subject to pre-tactical management on a daily basis (TAA Concept);
- in **medium pink border** with pink outline, for areas subject to tactical management, and for which real-time activity is known through appropriate means, and
- in **plain light pink** with pink outline, for areas not manageable at all (strategic definition only) or permanently prohibited (P) and for which no information on their actual activity can be retrieved.

3.2.8.2 Relationship between Airspace Reservation/Restriction and the FUA Concept

3.2.8.2.1 The table below summarises the relationship between the Airspace Reservation (TRA, TSA), Airspace Restriction (P, R, D) and the FUA Concept.

		AIRSPACE RESERVATION	AIRSPACE RESTRICTION	Depiction on the ASM Planning Chart
AMC manageable, allocated at ASM Level 2	TAA Concept	TRA TSA	Restricted Area Danger Area	Plain light yellow 
Not AMC manageable, but real-time activity notified at ASM Level 3			Restricted Area Danger Area	Medium pink border 
Not suitable for Level 2 allocation nor for Level 3 notification			Prohibited Area Restricted Area Danger Area	Plain light pink 

**Relationship between Airspace Reservation/Restriction and the FUA Concept**

**3.3 RE-SHAPING AIRSPACE TO ACCOMMODATE EN-ROUTE USER-PREFERRED TRAJECTORIES**

**3.3.1 General**

3.3.1.1 The general guidelines for the establishment and delineation of airspace structures, as defined in Section 1 and in previous Chapters, aim at finding a strategic compromise between conflicting demands made on the use of airspace by its many different users.

3.3.1.2 Once published, those airspace volumes need then to be used with full knowledge of the assumptions made for their establishment (Seventh Principle). However, tactical procedures should be established for the real-time use of those airspace in such a way that there is no waste of airspace (Fifth Principle) and a better utilisation of available airspace capacity.

3.3.1.3 In particular, control area initially established for structured routes can be used with new or adapted ATS airspace use procedures based on the provision of radar services to accommodate en-route user-preferred trajectories in different ways from less to full freedom of movement (*i.e. Bound to Fixed Route procedure up to Autonomous Operations*).

### **3.3.2 Introduction of New/Adapted ATS Airspace Use Procedures**

#### **3.3.2.1 Bound to Fixed Route (BFR) Procedure**

- mandatory routing on centre lines of promulgated ATS routes;
- No direct routing offered;
- track-keeping responsibility to the air, with possibilities of radar monitoring or vectoring;
- separation responsibility to the ground.

#### **3.3.2.2 Prior Co-ordination Airspace (PCA) Procedure - (see paragraph 3.2.3.5)**

- mandatory routing on centre lines of promulgated ATS routes;
- direct routing offered after prior co-ordination with military controlling/monitoring unit concerned;
- track-keeping responsibility to the air, with possibilities of radar monitoring or vectoring;
- separation responsibility to the ground.

#### **3.3.2.3 Reduced Co-ordination Airspace (RCA) Procedure - (see paragraph 3.2.3.3)**

- mandatory routing on centre lines of promulgated ATS routes;
- direct routing offered without the need for prior co-ordination;
- track-keeping responsibility to the air, with possibilities of radar monitoring or vectoring;
- separation responsibility to the ground.

#### **3.3.2.4 Parallel Tracks Application (PTA) Procedure**

- mandatory off-set routing from centre lines of promulgated ATS routes;
- track-keeping always under radar monitoring or vectoring;
- separation responsibility to the ground.

### 3.3.2.5 Radar Vectoring Area (RVA)<sup>5</sup> Procedure

- mandatory routing on controller instructions;
- track-keeping always under radar vectoring;
- separation responsibility to the ground.

### 3.3.2.6 Random RNAV Area - Free Route Airspace (FRA)<sup>6</sup> Procedure - (see Section 7)

- free/random RNAV routing may be flight planned within specified areas (FRAs);
- track-keeping responsibility to the air, with possibilities of radar monitoring;
- separation responsibility to the ground.

### 3.3.2.7 Free Flight Airspace (FFA)<sup>7</sup> Procedure

- autonomous operations within specified areas (FFAs);
- track-keeping responsibility to the air, with possibility of radar monitoring;
- separation responsibility to the air.

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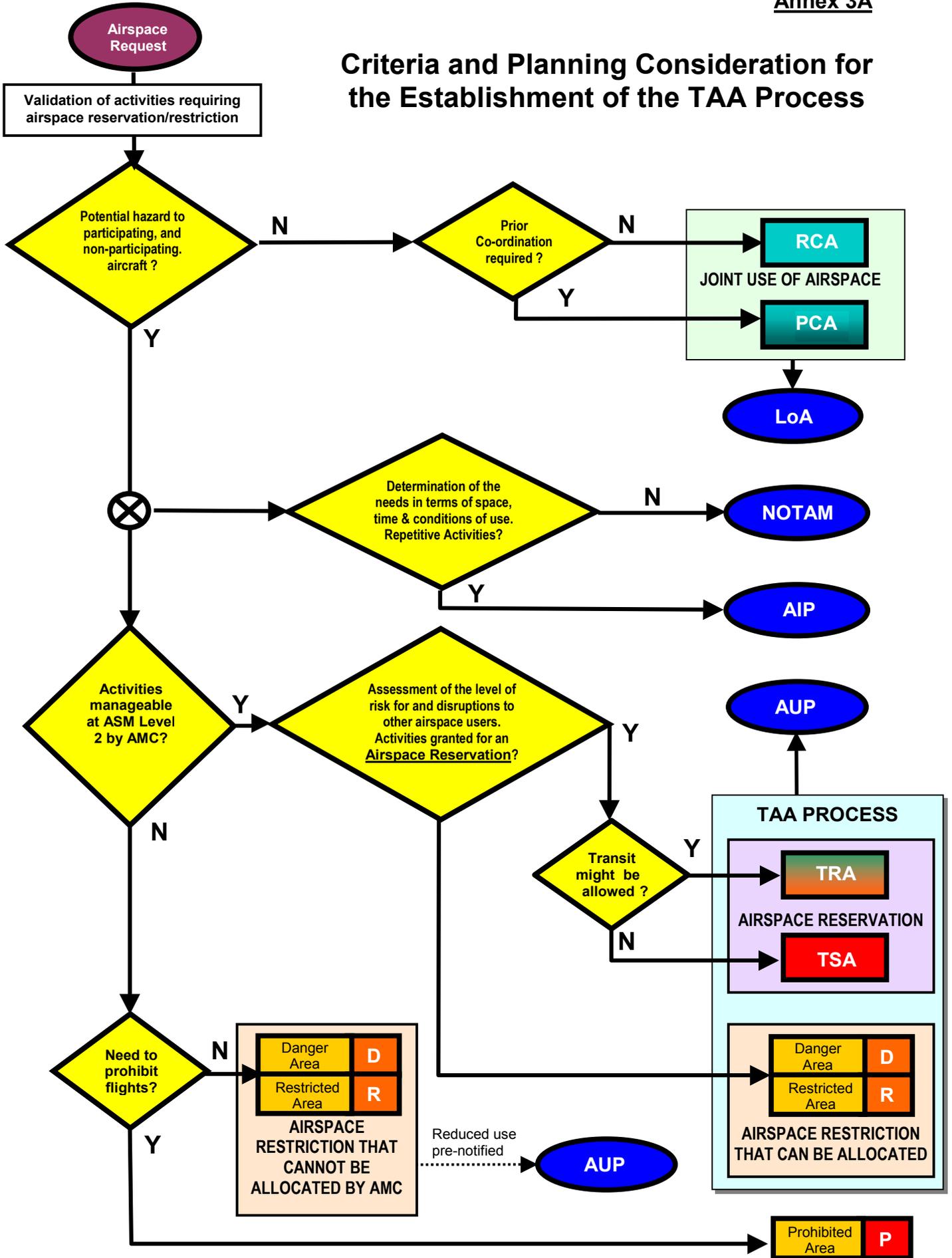
<sup>5</sup> A "Radar Vectoring Area" (RVA) would be seen as a kind of "civil TSA" to be strategically or dynamically (ad-hoc) established, after appropriate civil/military co-ordination, in area and during time of potential very high density of traffic to offer more flexibility to the controller than the use of fixed ATS routes, while ensuring temporary segregation of IFR flights from both OAT and VFR traffic.

<sup>6</sup> A "Free Route Airspace" (FRA) is a specific airspace within which users shall freely plan their routes between an entry point and an exit point without reference to the ATS route network. In this airspace, flights will remain subject to air traffic control.

<sup>7</sup> A "Free Flight Airspace" (FFA) is a specified volume of airspace within which autonomous operations will be allowed and the separation assurance responsibility will be fully transferred to the air.

**Annex 3A**

**Criteria and Planning Consideration for the Establishment of the TAA Process**



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**Annex 3B**

**FICTITIOUS EXAMPLES OF PUBLICATION OF D & R  
(Manageable or not) IN AIP ENR 5.1**

AIP  
XXXXXX

ENR 5-1-x  
From 02 APR 98

IDENTIFICATION NAME <i>Lateral Limits Coordinates</i>	<u>Upper Limit</u> <u>Lower Limit</u>	Activation Time Penetration Conditions	Remarks Type of Activity Operating Authority
1	2	3	
<b>(EXAMPLE OF RESTRICTED AMC-MANAGEABLE AREA)</b>			
<b>XX-R 101 South</b>  543045N 0131502E - 542830N 0111000E - ..... - to point of origin	<u>FL 310</u> FL 110	MON TO FRI 0830-1700  Planned hours specified in daily xxx AUP  Real-time activity information and/or crossing clearance from:	<b>AMC-manageable area</b>  Air-to-air firing  ZZZZ Control  FREQ: .... MHz
<b>(EXAMPLE OF DANGER AMC-MANAGEABLE AREA OVER THE HIGH SEAS)</b>			
<b>XX-D 120 North Sea</b>  534045N 0101502E - 532830N 0123005E - ..... - to point of origin	<u>FL 660</u> FL 195	MON TO FRI 0700-1600  Planned hours specified in daily xxx AUP  Real-time activity information and/or crossing clearance from:	<b>AMC-manageable area</b>  Air Combat Training  YYYY Control  FREQ: .... MHz
<b>(EXAMPLE OF RESTRICTED AREA not suitable for AMC Management)</b>			
<b>XX-R 20 East</b>  Sector of an arc, 25 NM radius centred at 503045N 0031502E, from 270° GEO clockwise to 137° GEO.	<u>FL 95</u> GND	MON TO FRI 0730-1700 (0630-1600)  Real-time activity information and/or crossing clearance from:	Gunfiring  XXXX TWR  FREQ: .... MHz
<b>(EXAMPLE OF DANGER AREA not suitable for AMC Management)</b>			
<b>XX-D 10 West</b>  A Circle, 20 KM radius centred at 504305N 0120002E.	<u>FL 360</u> GND	MON TO FRI 1030-1700 (0930-1600)	Bombing exercise

## FICTITIOUS EXAMPLES OF TRA/TSA PUBLICATION IN AIP ENR 5.2

AIP  
xxxxxx

ENR 5-2-x  
From 02 APR 98

IDENTIFICATION NAME <i>Lateral Limits Coordinates</i>	Systems/means of activation promulgation	Activation Time Upper/Lower Limits	Remarks Type of Activity Penetration Conditions
1	2	3	
<b><u>(EXAMPLE OF TEMPORARY SEGREGATED AREA)</u></b>			
<b>XX-TSA 01 A</b> NORTH EAST I  543045N 0131502E - 542830N 0111000E - ..... - to point of origin  <b>XX-TSA 01 B</b> NORTH EAST II  543145N 0121502E - 542830N 0111000E - ..... - to point of origin	Planned hours specified in daily xxx AUP  Real-time activity information from: ZZZZ Control  FREQ: .... MHZ	MON TO FRI 0830- 1700  FL 360-FL 230	<b>AMC-manageable area</b>  Air Combat Training  Penetration prohibited during Activation
<b><u>(EXAMPLE OF TEMPORARY RESERVED AREA)</u></b>			
<b>XX-TRA 10</b> NORTH WEST ALPHA  Sector of an arc, 25 NM radius centred at 503045N 0031502E, from 270° GEO clockwise to 137° GEO.	Planned hours specified in daily xxx AUP  Real-time activity information from: XXXX TWR FREQ: .... MHZ	MON TO FRI 0730- 1700 (0630-1600)  FL 245 - 700 M MSL	<b>AMC-manageable area</b> <b>Flying School Training</b>  Rules of the air not always complied with Crossing clearance from : XXXX TWR

## FICTITIOUS EXAMPLES OF PUBLICATION OF “Forewarning Areas” IN AIP ENR 5.3

AIP  
xxxxxx

ENR 5-3-x  
From 02 APR 98

IDENTIFICATION NAME <i>Lateral Limits Coordinates</i>	Systems/means of activation promulgation	Activation Time Upper/Lower Limits	Remarks Type of Activity Penetration Conditions
1	2	3	
<b><u>(Example of Intense Aerial Activity outside Controlled Airspace)</u></b>			
<b>XX-F 250</b> BLUE ANGEL SOUTH  534052N 0151502E - 533830N 0150305E - ..... -to point of origin	Information on activation and contact authority provided by NOTAM	Date, times and Upper/Lower Limits promulgated by NOTAM ten days in advance	SAR operations in VMC only

## EXAMPLE OF EXPLANATORY NOTE ON AIRSPACE RESERVATION (TRA/TSA) IN FRONT OF AIP ENR 5

AIP  
XXXXXX

ENR 5-0-x  
From 02 APR 98

### Purpose of Airspace Reservation (TRA or TSA)

The purpose of **airspace reservation** is to *temporarily reserve, by common agreement, a defined volume of airspace normally under the jurisdiction of one aviation authority for exclusive use by another aviation authority*. As some “reserved” airspace may be transited by another airspace user under specific conditions and/or based on appropriate co-ordination procedures, two different types of airspace reservation have been defined taking into consideration the activity that would take place associated with the transit possibility:

**Temporary Reserved Area (TRA)** is a defined volume of airspace normally under the jurisdiction of one aviation authority and **temporarily reserved**, by common agreement, for the specific use by another aviation authority and through which other traffic may be allowed to transit, under ATC clearance

**Temporary Segregated Area (TSA)** is a defined volume of airspace normally under the jurisdiction of one aviation authority and **temporarily segregated**, by common agreement, for the exclusive use by another aviation authority and through which other traffic will not be allowed to transit.

### The Temporary Airspace Allocation (TAA) Process

The **Temporary Airspace Allocation (TAA) Process** consists in the allocation process of an airspace of defined dimensions assigned for the temporary reservation (TRA/TSA) or restriction (D/R) and identified more generally as an “**AMC-manageable area**” in AIP ENR 5.

The TAA process permits activities requiring temporary reservation to be allocated on the day before operations so as to allow the Airspace Management Cell (AMC) to make available, if required, Conditional Routes (CDRs) established through them outside their planned hours.

Any remaining D, R and P areas that are not suitable for AMC management, remain unaltered in the AIP. The planned activity and conditions for the use of TRA/TSA and AMC-manageable D or R areas will be published daily in the national “Airspace Use Plan” (AUP).

### TRA/TSA Activation Times Parameters

TRA or TSA activation times are defined in accordance with the following parameters:

#### 1. Published Hours

- “Published Hours” cover(s) the maximum possible activation time.
- “Published Hours” are published in AIPs in the Activation Time Column.

#### 2. Planned Hours

- “Planned Hours” will be specified daily by AMCs and published in the national AUP.
- “Planned Hours” will always take place within the “Published Hours”.

#### 3. Real Activation Time

- “Real Activation Time” is the actual period of use of the area known from the Operating Authority.
- “Real Activation Time” will normally take place within the “Planned Hours”.

## **SECTION 3**

# **AIRSPACE RESTRICTIONS & RESERVATIONS DESIGN**

## **FINAL PAGE**

### **SUGGESTION - COMMENTS**

To report any errors, or to propose a modification to the present Section 3 "Airspace Restrictions & Reservations Design", please contact:

Mr Jean-Paul Lemaire  
EUROCONTROL  
Airspace & Flow Management and Navigation Business Division (AFN)  
Rue de la Fusée, 96  
B-1130 BRUSSELS  
(E-mail: [jean-paul.lemaire@eurocontrol.int](mailto:jean-paul.lemaire@eurocontrol.int))

### **SECTION 3 - SPONSOR: AIRSPACE MANAGEMENT SUB-GROUP**

Whenever material received, in accordance with the above procedure, makes it apparent that an amendment of the present Section 3 is required, such amendment will be first discussed within the Airspace Management Sub-Group (ASM-SG) before its adoption by the Airspace & Navigation Team (ANT).

### **PUBLICATION OF AMENDMENT**

The agreed amendment will then be issued by EUROCONTROL in the form most convenient for its insertion in the Planning Manual.

## **SECTION 4**

# **ATS ROUTE AND SECTOR DESIGN**

## **4.1 ESTABLISHMENT OF ATS ROUTES**

### **4.1.1 General Considerations**

- 4.1.1.1 Ideally, aircraft want to fly on the most direct route between their points of departure and their destination except when severe weather phenomena are encountered. However, because of conflicting demands from many different users, it is usually not possible to establish the most direct route and therefore it is necessary to find a compromise between the demands and the offers.
- 4.1.1.2 As a result, air traffic control services are required to manage effectively the demand with the aim of satisfying the requirement in the best possible way. It is therefore essential that the various individual intentions of those flights making up the traffic demand are presented to the controller in such a manner that they can be related to one another and possibly conflicting intentions.
- 4.1.1.3 Pre-defined routes of flight constitute one of the major elements used today to channel controlled air traffic mainly for the en-route part of the flight using an en-route network of ATS routes, but when necessary, in particular at the busier aerodromes, standard departures (SID) and standard arrivals (STAR) may also be established in accordance with guidelines provided in [Section 5](#).

### **4.1.2 ATS Route Network Development**

- 4.1.2.1 Today in Europe, the manner to handle large amounts of en-route traffic is through a pre-established ATS route network (ARN). For developing a new version of ARN, ICAO SARPS as per the Chicago Convention and Annexes thereto are complemented for ECAC States by agreed planning principles and criteria as defined in Chapters 4.2 & 4.3.

### **4.1.3 Free Route Airspace Development**

- 4.1.3.1 The number of flights in European Airspace is still growing, whereas exploiting more airspace capacity by constantly adapting the route structures and ATC sectors has limitations. EUROCONTROL together with some ECAC States are looking for new techniques to expand capacity and increase flight efficiency. This drive for further improvements has led to a concept that makes more effective use of aircraft flight management and navigation capabilities (e.g. possibilities of Random RNAV routings), in combination with more sophisticated automation to support the controller, fewer airborne conflicts, increased airspace capacity and more direct aircraft routings which can be flight planned by operators. This new approach which exploits these improvements is termed the “Free Route Airspace Concept” and will be further described in [Section 7](#).

#### 4.1.4 RNAV Routes and Non-RNAV ATS Routes

- 4.1.4.1 With effect from **23 April 1998**, the carriage and use of B-RNAV equipment became mandatory for aircraft operating within specified parts of the Regional ATS Route Network<sup>8</sup> of ECAC airspace. B-RNAV is specified as a navigation performance requiring a track-keeping accuracy of +/- 5NM for 95% of the flight time. Operators of aircraft must hold operational approval from their appropriate State regulatory authority and obtain airworthiness approval in accordance with JAA Temporary Guidance Leaflet TGL-2 (or acceptable alternative).
- 4.1.4.2 In order to contribute to safety and capacity gains, B-RNAV routes should be established in such a manner that their vertical delineation is harmonised throughout the ECAC area so as to enable a continuum of RNAV environment.
- 4.1.4.3 In most ECAC States, the minimum useable flight level for RNAV Routes is set at FL100 (i.e. B-RNAV equipment required above FL95), but this is not yet standard across all ECAC States. However, so as to enable RNAV operations in Terminal Airspace, RNAV environment will continue to/from the lowest safe and feasible level.

#### 4.1.5 Regional Routes and Non-Regional Routes

- 4.1.5.1 Where international operations constitute the majority of the traffic, the development of the ATS route network requires a cohesive and co-ordinated behaviour of all States concerned. Where national operations constitute the bulk of the traffic to be handled, there is still a need for a concerted approach with adjacent States.
- 4.1.5.2 Isolated actions by States in developing a national ATS route network are only possible with respect to ATS routes serving strictly national purposes. Such action will, in most cases, have direct and noticeable effects on the traffic beyond the area of responsibility of the States concerned.
- 4.1.5.3 In this context, following the ICAO European Region initiative and the ECAC en-route Strategy for the 1990's, a Route Network Development Sub-Group (RNDSG) under the auspices of the EUROCONTROL Airspace & Navigation Team (ANT) was created in May 1993 to act as the organiser and co-ordinator of planning and implementation activities aimed at improving and upgrading the ATS Route Network in the ECAC area of the European Region as mandated by ICAO (EANPG Conclusions 35/2 & 36/2).
- 4.1.5.4 All ECAC States are required to actively participate to this international work as the detailed establishment or review of individual ATS routes, forming the ATS route network, should now definitely proceed through the RNDSG from a "Top Down" approach taking an ECAC-wide view, based upon the need for enhancement of overall ECAC ATM capacity along the following lines :
- First identify the foreseen major traffic flows within the ECAC area as well as those extending beyond and review the weak links in the current route and sector organisation;
  - Establish and review the Regional En-route Network and supporting sectorisation to accommodate the expected major traffic flows reducing the airspace structures complexity and balancing the ATC workload;
  - Integrate those routes required to provide access to the Regional En-route Network from and to locations not directly served by them, as well as those routes not permanently available required to alleviate the traffic load on the main ATS routes (e.g. Conditional Routes);

---

<sup>8</sup> States may still designate Non-RNAV routes outside the Regional ATS Route Network as available for aircraft not fitted with RNAV equipment

- d) Ensure connectivity between the en-route network and routes to/from Terminal Airspace;
- e) Establish an overall phased implementation programme to ensure consistency in individual State implementation.

4.1.5.5 States may still designate Non-Regional routes to satisfy those activities of a more local nature or of a specific user group (e.g. VFR routes, military low-level routes, night flying,...) and should determine if these local routes need to be integrated in the overall route network.

#### **4.1.6 Lower ATS Routes and Upper ATS Routes**

4.1.6.1 In the ICAO EUR Air Navigation Plan (Doc. 7754, Vol.I, Basic ANP – Table ATS-1), the description of the ATS route network is subdivided, for planning purposes, into Lower and Upper ATS Routes with a uniform plane of division established at FL 245 disregarding existing limits of the FIRS/UIRs in the EUR region.

4.1.6.2 In the present environment, however, the division between Upper and Lower airspace has no relevance for most of the ECAC Region. But, national publication of ATS routes in AIPs are still distinguishing Lower and Upper ATS routes from a national perspective adopting their own FIR/UIR division without considering adjacent vertical division.

4.1.6.3 Thus those States, still considering a need for making a distinction between Lower and Upper ATS routes which do not coincide, are required to take into consideration from an ECAC-wide perspective a common division level based only on the use of “area control” arrangements versus a system of airways.

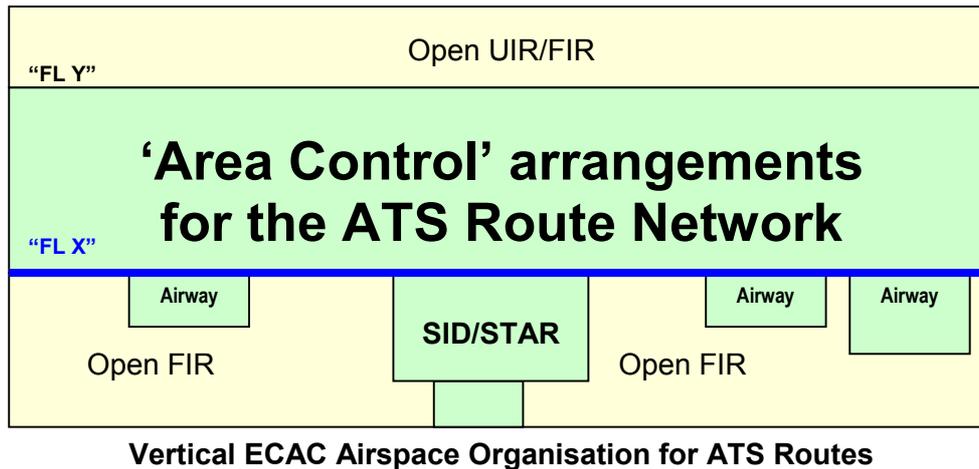
#### **4.1.7 ‘Area Control’ Arrangements and Airways**

4.1.7.1 “Area Control” arrangements have the advantage that, whenever traffic conditions permit, a controller may authorise specific flights under his/her control to deviate from the established ATS route or route structure without aircraft leaving controlled airspace and thus losing the benefit of ATC.

4.1.7.2 However, within a Control Area (CTA), the protected airspace provided along ATS routes is not visibly published as all airspace around the routes is by definition a controlled airspace, which does not facilitate the delineation of adjoining airspace restrictions or reservations (see [Section 3](#)). Conversely, controlled ATS routes established in the form of corridors (Airways) have by definition a clear description of associated protected airspace within which controlled flights should remain.

4.1.7.3 Nevertheless, following the agreement for a common ATS airspace classification above a commonly agreed base level, ECAC States have agreed to progress towards an ‘area control’ service above such a common level and that a system of airways will only be used below it (i.e. FL “X” see [Section 2](#)).

4.1.7.4 In order to give more freedom to VFR flights operations outside airways and Terminal Airspace, the lower limit of the controlled airspace should be established so that flights not requiring air traffic control services are not unnecessarily restricted while IFR traffic requiring ATC services can remain within controlled airspace during departure, en-route and approach phases of flight. For instance, Standard Instrument Departures (SIDs) and Standard Instrument Arrivals (STARs) should be contained in associated Terminal Airspace and Control Area established above. In the vicinity of aerodromes, the establishment of the lower limit of controlled airspace should also take into account those portions of airspace which may be required by ATC to vector aircraft by radar (see [Section 5](#)).



#### 4.1.8 ATS Routes Permanently Available and Conditional Routes

4.1.8.1 The majority of the ATS routes established will be permanently available, however there will be cases when or where non-permanent routes, defined for the ECAC area as Conditional Routes (CDRs) (see [Chapter 4.4](#)), should be established:

- a) when routes are required for specific periods only or can be made available only during weekends or at night because they cross areas (e.g. TSAs) which, during the week or daylight, are usually reserved for other activities (i.e. CDR 1);
- b) where routes whose use depends on pre-tactical co-ordination procedures (i.e. CDR 2) or can only be effected on an *ad hoc* basis for specific flights involved and depending on the circumstances as they prevail at that time (i.e. CDR 3).

4.1.8.2 Such Conditional Routes should also be included in the ATS route network, however with a clear indication of the limitations imposed on their use. Being non-permanent structures, CDRs should be reviewed at frequent intervals with a view to reconsidering their categorisation whenever the use made of them requires so. Such periodical review process will be made in accordance with ASM Level 1 functions defined in the EUROCONTROL Handbook for Airspace Management.

#### 4.1.9 Route Width and Route Spacing

4.1.9.1 According to ICAO Annex 11 - 2.11, where ATS routes are established, a protected airspace along each ATS route and a safe spacing between adjacent ATS routes shall be provided. The spacing between parallel ATS route centre lines for which a Required Navigation Performance (RNP) is applied for en-route operation will be dependent upon the relevant RNP type specified by individual States and when applicable, on the basis of regional agreements. In Europe, the foreseen applications of each RNP type are indicated in the Guidance Material relating to the Implementation of Area Navigation in the ICAO EUR Region (EUR Document 001-RNAV/5) currently under review.

4.1.9.2 From this guidance material, reductions of the B-RNAV<sup>9</sup> Route spacing minimum, to somewhere in the order of 10-15 NM, are expected to be possible for the ATS Route Network by placing higher reliance on ATC Radar Monitoring and intervention capabilities.

4.1.9.3 The circumstances in which such a reduction of route spacing is applied, will need to be assessed on case by case basis in accordance with ICAO Doc. 9689, taking into consideration procedural or radar environments and associated controller workload. An example study will be outlined in the ICAO EUR Guidance Material.

<sup>9</sup> B-RNAV is specified as a navigation performance requiring a track-keeping accuracy of +/- 5NM for 95% of the flight time (see [Chapter 4.1.4](#) above)

#### 4.1.10 Amendment to ICAO EUR ANP and Phased Implementation Plan

- 4.1.10.1 The ICAO European Region Air Navigation Plan (Doc. 7754 - EUR ANP) presents in general terms the ICAO plan for the provision of facilities and services for international air navigation in the ICAO European region. The Vol.1 - EUR Basic ANP describes in particular the basic ATS route network in the lower and upper airspace of the EUR region in the form of tables and charts artificially split at FL 245.
- 4.1.10.2 In order to be consistent with current and foreseen requirements of international civil aviation, the table and charts ATS-1 "*Basic ATS route network in the Lower and Upper Airspace*" of the ICAO Doc. 7754 are regularly updated to reflect ECAC States agreement to implement a new ARN version established by the RNDSG.
- 4.1.10.3 However, due to the time constraints of the ICAO EUR ANP amendment process and in order to have a more accurate view of the status of implementation of a new agreed ARN version, the RNDSG is required to establish a common programme for a phased implementation of the new version of the ATS Route Network and associated sectorisation indicating intermediate evolutionary stages and appropriate target dates.

#### 4.1.11 Harmonised Publication of ATS Routes

- 4.1.11.1 The ICAO AIS Manual (Doc. 8126) recommends that AIP - Part ENR 3 contains a list of all ATS routes established within the territory covered by the AIP, whether they form part of ICAO regional air navigation agreements or are for use by domestic traffic only.
- 4.1.11.2 As specified in Doc. 8126 – Appendix H (ENR 3. ATS Routes), a description should be included, where applicable, of the route(s), or portion(s) thereof, where special procedures are required. Additionally, an indication of the special procedures concerned should be given. Information relating to upper ATS routes should normally be listed separately in ENR 3.2.
- 4.1.11.3 In these circumstances, Permanent ATS routes and Conditional Routes (CDRs) should be listed together in so far as a single ATS route could contain both a permanent route portion and one or more segments of different categories of CDRs. Thus, there is no need to have additional designators for CDRs (see [Chapter 4.4](#)).

## 4.2 ATS ROUTE NETWORK DEVELOPMENT

### 4.2.1 General Approach

- 4.2.1.1 Since 1993 under the auspices of the Airspace & Navigation Team (ANT), the Route Network Development Sub-Group (RNDSG) has developed a planning process for versions of the ATS Route Network (ARN) which is "Top Down" and utilises a number of facilitating concepts and planning techniques which are described in the following sections.

### 4.2.2 A "Top Down" Approach

- 4.2.2.1 In developing versions of the ARN, the RNDSG has, as already mentioned, adopted a "Top Down" Approach which takes an ECAC wide view and is based upon the need for enhancement of overall ECAC ATM capacity. The process includes progression from broad proposals towards specific solutions.

Step 1 - Starting from in-depth analysis to identify current and foreseen problems, the planning work should highlight the actual causes of the weak links in the airspace structure.

Step 2 - Based on agreed general principles and criteria, the planning work should build overall route proposals to accommodate major traffic flows reducing the airspace structure complexity and balancing the ATC workload.

Step 3 - Within this defined framework, detailed proposals of airspace structure should be elaborated, consolidated and validated through appropriate regional expert groups.

The result of local studies must feed back into the initial proposals in a dialectical and iterative process.

Step 4 - A phased implementation programme must be agreed before coming into force.

A schematic diagram of the Top Down Approach is given in [Annex 4C](#).

### 4.2.3 Planning Principles (PP)

Versions of the ARN are developed on a number of agreed planning principles. They are:

#### 4.2.3.1 PP 1 - Planning should take into account the needs of both civil and military airspace users.

#### 4.2.3.2 PP 2 - Planning should normally expand from the core to the periphery.

It is well recognised that the question of ATM en-route capacity in ECAC airspace is essentially a problem of airspace capacity in the core area. Therefore, the architecture of the network should normally be developed from the core area toward the periphery by building the structure upon the most heavily loaded intra-European routes linking the top origin/destination areas. However, in applying this principle the specific problems of the periphery, such as ATM capacity, transition tasks etc, should be taken into account.

#### 4.2.3.3 PP 3 - Planning should integrate route network and supporting sectorisation at an early stage.

Although the start of airspace development process is network-oriented, there is a close two-way interrelationship between the network's structure and sectorisation definition. Consequently, from the initial planning phase onwards, it is necessary to ensure that a proper sectorisation scheme, including ATS delegation is feasible and viable in relation to the planned network.

#### 4.2.3.4 PP 4 - Planning should integrate into the en-route network, transition routes to/from TMAs in the initial planning phase.

The traffic in the ECAC area is predominantly short haul traffic with nearly half of the flight distance spent in climb or descent phases. Interfacing segments are usually heavily loaded. From the first stage of the network planning, it is therefore necessary to consistently integrate transition routes into the overall route structure and to ensure TMA-Network interface compatibility.

4.2.3.5 **PP 5 - Planning of ATS routes should aim at enabling a majority of flights to operate along or as near as possible to the direct route from origin to destination.**

Network development should be processed in such a way that major traffic flows can be carried out in as straight as possible channels in so far as this does not adversely affect ATM capacity.

4.2.3.6 **PP 6 - Planning of ATS routes should be in accordance with relevant ICAO Standards and Recommended Practices (SARPS).**

## 4.2.4 Facilitating Concepts (FC)

### 4.2.4.1 FC 1 - RNAV as the primary concept of navigation

Airspace planning should be based on a RNAV navigation system (not constrained by the location of station referenced nav aids).

*Note:*

*With effect from 1998, the EATCHIP Programme proposed that the carriage of B-RNAV equipment, approved for RNP-5 operations, would become mandatory for non-State aircraft on the entire ATS route network in the ECAC area, including designated feeder (transition\*) routes (SIDs & STARs) in/out of notified TMAs. States may designate domestic routes within the lower airspace as available for aircraft not fitted with RNAV.*

### 4.2.4.2 FC 2 - Full application of the FUA concept and extension to civil/civil flexibility through additional optional routings.

In application of the Flexible Use of Airspace concept, conditional routes should be planned to reinforce the permanent ATS route network based on pre-defined utilisation scenarios compatible with operationally efficient sector configuration.

The establishment of CDRs should as far as possible be supported by the generalisation of area type controlled airspace.

### 4.2.4.3 FC 3 - Route network planning in ECAC airspace should take place in a seamless way, disregarding FIR boundaries.

Delegation of ATS should be utilised where necessary to enhance the capacity and efficiency of the ATM system. FIR boundaries and ATS limits of responsibility should not constrain such delegation. The following examples indicate where such ATS delegation should take place:

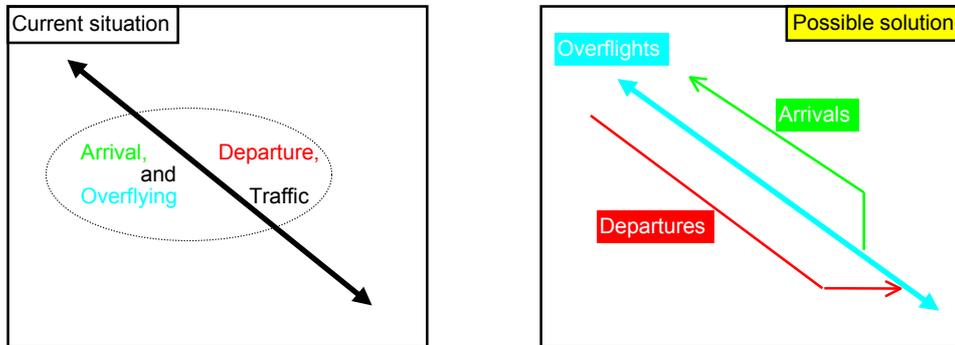
- when alignments of routes drawn independently of FIR boundaries determine the location of crossing points close to existing FIR/sector boundaries, in order to provide the controller with sufficient anticipation with respect to entering traffic;
- when alignments of routes affect an FIR airspace for a short distance, in order to avoid the hand-over of aircraft and additional co-ordination workload;
- for terminal sectors (vertical and/or geographically) in order to enable the controller to anticipate the regulation/vectoring of inbound traffic flow.

### 4.2.4.4 FC 4 - As from Version 4, maximise the capacity enhancement potential of RVSM implementation on 24<sup>th</sup> January 2002.

### 4.2.5 Planning Techniques (PT)

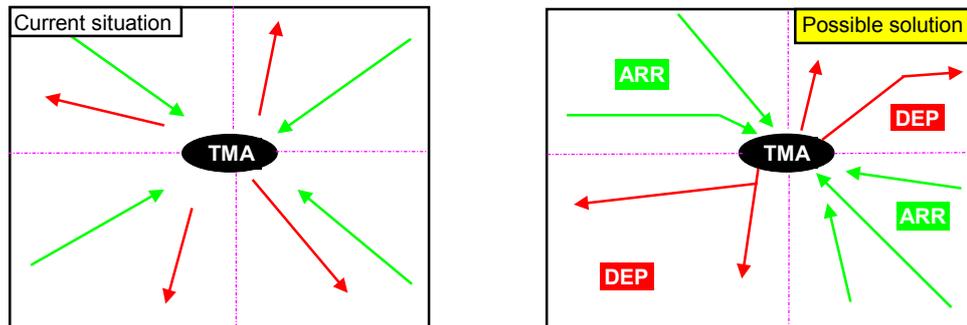
#### 4.2.5.1 PT 1 - Establish specialised routes.

In dense areas, additional capacity can be gained by the segregation and deconfliction of arrival/departure routes and their separation from overflight routes. This structure should be applied for climbing and descending phases.



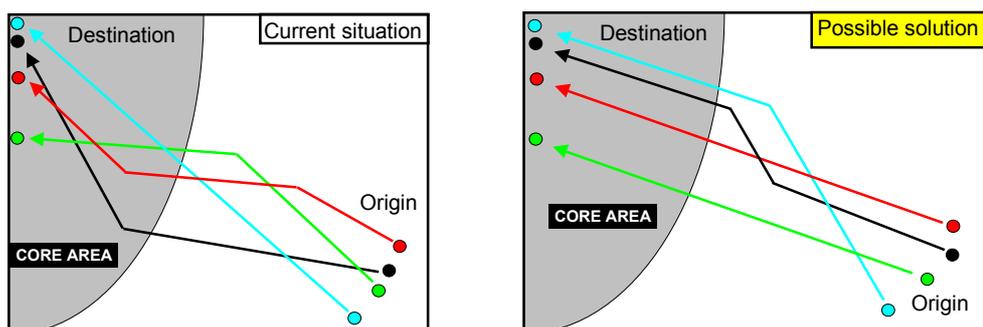
#### 4.2.5.2 PT 2 - Establish specialised sectors.

Based on the structure described above, specialised sectors should be established, grouping sets of routes of similar nature (arrival/departure; see illustration below), direction, and/or flight level series (odd level specialised sector, even level specialised sector). Where practicable, sectors should be specialised to solve one main specific problem.



#### 4.2.5.3 PT 3 - Organise any essential crossing of ATS routes carrying major traffic flows as close as practical to their origin.

Network development should be done in such a way that any essential crossing of ATS routes carrying major traffic flows can be carried out as close as possible to their origin. However, taking into consideration the network complexity in the vicinity of the origin area, it may be more appropriate to transfer the crossing into areas where the network/traffic density is lower.



## 4.3 DEVELOPING A NEW VERSION OF THE ARN

### 4.3.1 General

4.3.1.1 In developing Version 3 of the ARN, the RNDSG produced a comprehensive list of criteria applicable to both route network and sector development. These were included in a separate document as a deliverable in the EATCHIP programme: Doc ASM.ET1.ST02.Del01. This deliverable was endorsed by the ANT in October 1997. As this work is still applicable in general terms to the development of routes and sectors, and as the time available to the RNDSG, did not allow a review of this work before the commencement of the development process for Version 4, it was agreed that the Version 3 criteria would continue to be the basis for Version 4, supplemented by specific criteria applicable in the context of RVSM Implementation.

### 4.3.2 Overview of Criteria used for Route Network and Sectorisation Development

4.3.2.1 The general criteria used for route network and sectorisation development, as drawn up for Version 3, are included as Annex A and Annex B. These general criteria are now complemented by the Guidelines developed as a result of the simulations and evaluations carried out to assess the impact of RVSM in an Airspace context. These EUR RVSM Implementation guidelines are summarised in Chapter 4.3.3.

### 4.3.3 Summary of Specific RVSM Criteria for Version 4

4.3.3.1 The implementation of RVSM will alter the vertical distribution of traffic as extra flight levels become available for use and the density of traffic on each flight level reduces. This should enable more aircraft to fly at, or close to, their optimum FL and permit a relaxation of the level capping restrictions on short haul city pairs. In order to manage this change in vertical distribution it will be necessary, where traffic levels dictate, to re-evaluate the Division Flight Level (DFL) between sectors based on 500ft intervals.

4.3.3.2 The criteria applicable to sector development are common to both core EUR RVSM and EUR RVSM Transition Airspace. Changes to the vertical dimension of sectors within Transition airspace are not considered necessary for RVSM implementation, but States may take this opportunity to evaluate the feasibility of introducing a DFL. In this case the possible increase in the climbing and descending traffic close to FL 290 should be taken into consideration.

4.3.3.3 Within the core EUR RVSM airspace the change in DFL should be based on operational needs and should:

- result from the 'natural' vertical traffic distribution rather than 'force' traffic to fit in with the vertical sector design.
- consider all airspace from ground to unlimited (including lower airspace) when planning the DFL.
- seek to balance the traffic loads between layers, avoiding unnecessary vertical co-ordination between the sectors.

4.3.3.4 The criteria for route network development includes specific guidance for Transition Airspace where route structure solutions involving uni-directional routes or Flight Level Allocation Schemes, ease the Transition Task in sectors where traffic levels warrant a structural solution. The increased use of uni directional and specialised routes for segregating and integrating departure traffic with overflying routes, is also valid in core EUR RVSM airspace.

4.3.3.5 The design and application of a FLAS is complex and the studies have shown that it should be designed using common planning principles, which avoid possible conflict over the choice of FLs on individual routes and permit extension if required. The selection of the preferred/blocked FLs should be kept to a minimum, be co-ordinated along the length of a route and be made according to a global rule in order to avoid frequent changes in FL. Although the FLAS options tested in the simulations were not advantageous to the ATS system as a whole there are instances where the controller workload can be reduced through its application. Therefore, it is recommended that the application of FLAS be restricted to major confluences and crossing points within EUR RVSM airspace and, when a route network solution cannot be found, to route segments close to the EUR RVSM/non-RVSM boundary in Transition Airspace.

## 4.4 ESTABLISHMENT OF CONDITIONAL ROUTES (CDR)

### 4.4.1 General Presentation of the CDR Concept

4.4.1.1 The Conditional Route (CDR) concept encompasses, by definition, all non-permanent ATS routes. CDRs are non-permanent parts of the published ATS route network that are usually established:

- through areas of potential temporary reservation (e.g. TRA or TSA), with CDR opening/closure resulting from associated military activities, and/or -
- to address specific ATC conditions (e.g. traffic restrictions or ATC sectorisation compatibility) with CDR opening/closure resulting from purely civil needs.

4.4.1.2 CDRs will be established by the Level 1, allocated at Level 2 by the AMC and utilised at Level 3 by ACCs. CDRs will usually be established and utilised as pre-planned routing scenarios. CDRs will permit the definition of more direct and alternative routes by complementing and linking to the existing ATS route network.

### 4.4.2 Criteria for the Definition of Routing Scenarios

4.4.2.1 CDRs should be planned to complement the ATS Route network and should lead to the development of flexible, but pre-defined routing scenarios (see examples in [Annex 4D](#)). Scenarios based on CDRs should take due account of the:

- a) Expected traffic demand and nature of the traffic: *manoeuvring, overflying, arrival or departure*;
- b) Foreseen period of CDR availability and the CDR Category (see [paragraph 4.4.3.2.3](#) below and [Annex 4E](#));
- c) Expected impact on ATC Sector Capacity and flight economy resulting from CDR use;
- d) Flexibility of an eventual change in ATC sectorisation configuration required for activation/de-activation of CDRs;
- e) Existing national boundaries, airspace and route structure and TMA interface: *possibility of cross-border CDRs*;
- f) Possible impact on ATS airspace classification: *the airspace class may be different when the change of area status from TSA to CDR leads to the provision of different air traffic services*;
- g) Application of RNAV techniques;
- h) Capability of the FPPS to activate the different routing scenarios;
- i) Impact on OAT and GAT controllers' workload.

### 4.4.3 Criteria Governing the Categorisation of Conditional Routes

#### 4.4.3.1 General

4.4.3.1.1 CDRs can be divided into different categories according to their foreseen availability, flight planning possibilities and the expected level of activity of the (possible) associated AMC-manageable areas (see Para 4.4.3.3.1). A CDR can be established at Level 1 in one or more of the three following categories:

- a) Category One - Permanently Plannable CDR during the times published in AIPs;
- b) Category Two - Non-Permanently Plannable CDR, and
- c) Category Three - Not Plannable CDR.

#### 4.4.3.2 CATEGORY ONE- Permanently Plannable CDR during the times published in AIPs

4.4.3.2.1 When a CDR is expected to be available for most of the time, it can be declared as permanently plannable for stated time periods and published as a Category One CDR (CDR 1) in AIPs. CDRs 1 can either be established on a H 24 basis or for fixed time periods.

4.4.3.2.2 CDRs 1 will form part of the strategic ATS route planning process and will complement the permanent ATS route network. Consequently, CDRs 1 are expected to be available for the time period declared in the AIP. Any closure of a CDR 1, which needs action to re-file the flight plan, has therefore to be published with appropriate advance AIS notice.

4.4.3.2.3 In the event of a short notice unavailability of a CDR 1, aircraft will be tactically handled by ATC at Level 3. Operators should consider the implications of such a possible re-routing and use of the alternate ATS routes published for each CDR 1 in the "Remarks" column of the AIP (see paragraph 4.4.3.2.4).

4.4.3.2.4 Therefore, when deciding on the categorisation of a Conditional Route as CDR 1, the impact of its unavailability on ACCs handling must be carefully assessed<sup>10</sup>. But, when national ATS route closure process can be transparent to the operators and has no impact on neighbouring States, CDR 1 unavailability will be managed by the AMC at Level 2 in a similar way as CDR 2 availability and be promulgated as such in Airspace Use Plans (AUPs) only for information to Approved Agencies (AAs) and ATS units concerned.

4.4.3.2.5 Any foreseen period of non-availability of CDRs 1 known or decided at pre-tactical level would if practicable, be promulgated for information to national AAs and ACCs concerned through national AUPs in the list "BRAVO" of Closed ATS Routes. In such cases, and considering the impact on RPL/FPL processing, the unavailability information is only for AAs and ATS units and will be handled at Level 3 which will then not require flight planning actions by AOs.

4.4.3.2.6 CDR 1 closures will therefore only be promulgated in the Conditional Route Availability Message (CRAM) as repetition for safety of the decision already published with appropriate advance AIS notice.

4.4.3.2.7 When establishing CDR 1, the national high level policy body should provide the Airspace Management Cell (AMC) with clear criteria for publication of its possible unavailability especially when the consequence on ACC Sector capacity and handling is very important e.g. during Peak Hours or weekends<sup>10</sup>.

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<sup>10</sup> In the case of exceptional military activities, if this unavailability has to be applied to weekend routes, the re-routing of significant numbers of aircraft by ATC may not be feasible. In that case, AOs would be required to change their RPLs/FPLs in accordance with the CDR 1 closures published with appropriate advance AIS notice.

4.4.3.2.8 When tactical re-routing is taking place due to a CDR 1 closure, any aircraft which experiences radio communication failure before receiving re-routing instructions will continue on the flight planned route. It could therefore penetrate an active Temporary Segregated Area (TSA). Planners must be aware of the need for ATC to be able to curtail activity in a TSA at very short notice to maintain safety.

4.4.3.2.9 When establishing a CDR 1, the national high level policy body should therefore ensure that procedures are established for the safe handling of flights which experience radio communication failure.

#### 4.4.3.3 CATEGORY TWO - Non-Permanently Plannable CDR

4.4.3.3.1 Category Two CDRs (CDRs 2) will form part of pre-defined routing scenarios. CDRs 2 will be established and utilised with the aim of maximising one or more of the following benefits: - better traffic distribution, increase in overall ATC capacity and flight economy.

4.4.3.3.2 CDRs 2 availability can be requested to adjust traffic flow, when a capacity shortfall has been identified and after consideration of relevant ACC factors has been made by the FMPs/ACCs concerned.

4.4.3.3.3 Flights on CDRs 2 may be flight planned only when the CDR is made available in accordance with the appropriate AMC allocation listed in part "ALPHA" of the AUP and repeated in the CRAM.

#### 4.4.3.4 CATEGORY THREE - Not Plannable CDR

4.4.3.4.1 Category Three CDRs (CDRs 3) are those that are expected to be available at short notice. Flights will be planned on the basis of the utilisation of the permanent ATS route network around the areas.

4.4.3.4.2 After co-ordination with the military unit(s) in charge of the associated TRA, TSA, R or D Area(s), the GAT controller may offer an aircraft a short-notice routing through the area using a pre-defined CDR 3.

4.4.3.4.3 CDRs 3 can be published in AIPs as CDRs usable on ATC instructions only. CDRs 3, not being subject to allocation the day before by AMCs, will not form part of the AUP nor the CRAM.

#### 4.4.3.5 Guidelines for the Categorisation of CDRs - (see Annex 4E)

4.4.3.5.1 When States decide on the category to be applied to a CDR they should, in addition to their foreseen availability, take due account of the :

- a) Possible complexity of co-ordination with the military units involved and the opening in real-time of CDR 3;
- b) Possible Cross-Border aspects and harmonise with their neighbours to the greatest possible extent the categorisation, Flight Levels and intended availability of such routes;
- c) Possible difficulties of re-routing, in real-time, all or some aircraft;
- d) Need for the dissemination of the CDR availability the day before operations to all ATM users (ACCs, CFMU/IFPS/CADF, AOs, ...) or to confine such information to one or several ATC sector(s) within one ACC for tactical use only;
- e) Possibility to form part of different routing scenarios (see paragraph 4.4.3.2.2);
- f) Possible complexity of being used under more than one category and in particular harmonise with their neighbours the fixed period of "Weekend" routes as Category 1 and the intended availability as Category 2;
- g) Expected impact on ATC sector management (grouping/degrouping).

- 4.4.3.5.2 In order to assist national Level 1 Route Planners in the Categorisation of ATS Route in Permanent Route or one of the three different categories of CDRs, guidelines based on eight (8) major questions related to ATFM, ATC and ASM requirements are proposed at [Annex 4E](#).
- 4.4.3.5.3 A CDR can be established at Level 1 in more than one of the three categories. For example, two flight planning possibilities can be defined for a particular CDR e.g. a CDR used at week-ends can be plannable during a fixed period from Friday 17.00 to Monday 08.00 (Category One), or flight planned in accordance with AUPs at other times (Category Two).

#### **4.4.4 Harmonised Publication of Conditional Routes**

- 4.4.4.1 The possible partition of a CDR into different categories on a time and/or on vertical basis requires both the indication of the CDR category in the “Remarks” column in the AIP description of ATS routes, and the addition of an explanatory note at the front of ENR 3. A fictitious example of a harmonised publication of the three categories of CDRs is given in [Annex 4F](#).

#### **4.4.5 Depiction on the ASM Planning Chart**

- 4.4.5.1 ICAO also requires the ATS route scheme to be displayed on a chart. For that purpose Permanent Routes and the three different categories of CDRs should have a distinct depiction style to indicate how operators should flight plan for such routes.
- 4.4.5.2 For airspace planners, EUROCONTROL produces (paper) ASM Planning Charts in different scales and an electronic map (Skyview). Both of them depict permanent routes in plain black lines, CDR 1 in dashed black, CDR 2 in dashed red, CDR 3 in dashed green and mixed categories CDR 1/CDR 2 in dashed purple.

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**Annex 4A**

(Extract from "Concept and Criteria for Medium Term EUR Route Network and Associated Airspace Sectorisation")

**1. GENERAL CRITERIA FOR ATS ROUTE NETWORK DEVELOPMENT****1.1 Basic Structure**

A network of ATS routes should form the basis for the determination of the airspace organisation and the required air traffic services and facilities. It should be so established as to enable a majority of flights to operate along, or as near as possible to, the direct route from point of departure to destination.

Region-wide ATS route structures should be set up along broad alignments joining major origin/destination areas. These alignments must be structured in an operationally viable way.

In order to achieve optimum ATM capacity there may be a need for non-optimum flight levels and routings.

The restructuring of the ATS Route network should be performed in an evolutionary manner. As the restructuring of entire portions of the airspace, e.g. a major traffic axis, is agreed, implementation should not be delayed whilst waiting for the plans for restructuring of additional portions to be completed. States may need to ensure, where they cannot accept proposals being made, that they present an alternative.

**1.2 International Planning**

The process should provide States with an internationally agreed broad and basic concept of the airspace and ATS Route structure in the ECAC area serving as a basis for national or regional planning.

States should plan major changes of their airspace and ATS Route structure affecting the basic ATS Route Network with prior co-ordination and exchange of information with the largest possible number of international parties concerned. This should be carried out well in advance and preferably in multilateral fora.

**1.3 Relationship between Network and Sectorisation**

There is a close two-way inter-relationship between the network's structure and sectorisation. Consequently, from the planning phase onwards, it is necessary to ensure that a sectorisation scheme, including possible delegation of ATS, is feasible and viable in relation to the planned network. In particular, the definition of the directions of use on the uni-directional routes, as well as the final alignment of these routes may have to be adapted in consideration of sectorisation efficiency. This could be validated through simulations.

**1.4 Civil/Military Interface**

Civil/Military co-operation related to the more efficient and flexible use of airspace should be applied on as wide a scale as possible along the principles of the FUA Concept.

**1.5 Extension of the FUA concept**

Extension of the FUA concept to additional direct routings should be made available under pre-defined civil/civil conditions (Staffing/sectorisation/traffic density). This would mean the extension to larger airspaces (groups of sectors/ACCs) of the current tactical ATC practice of direct routings which is today generally applied within one sector. The automated reprocessing of flight plans would facilitate the further application of this concept.

## 1.6 Network Architecture

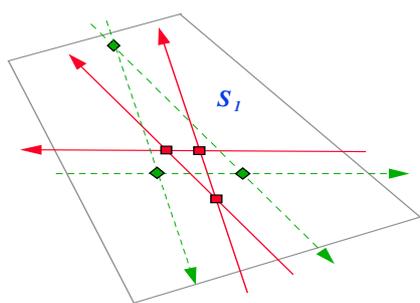
The definition of major traffic flows should include heavily loaded intra-European routes and/or segments which should be integrated in the overall structure at an early stage of the planning.

The architecture of the network should normally be developed from the core area towards the periphery.

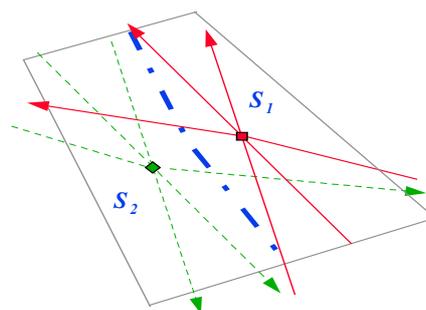
Efforts to eliminate specific traffic bottlenecks should include, as a first step, an in-depth analysis of the factors causing the congestion. In this regard, particular care should be taken to avoid worsening the situation in one area by attempting to improve it in the other.

“Roundabout” network structure should be conceived to fit with specific sectorisation and to allow the splitting of multiple crossings into different sectors.

In the context of complex multiple crossing points, “Roundabout” means the grouping of uni-directional routes of the same series of flight levels (odd and even) on to two different points (areas), thus separated one from the other, in order to allow the establishment of two different sectors and thereby achieving a spread of the workload.



*Direct routings :*  
Square shaped crossing points (even levels) and diamond shaped crossing points (odd levels) are complex and may result in an overloaded sector which cannot be split. (limited maximum capacity)



*Structured routings with “Roundabouts” :*  
The resulting location of the actual crossing points makes it possible to split the former sector into two sectors and enhance the maximum capacity.

The number of ATS Routes should be kept to a minimum but should be in line with the traffic demand in respect of ATM capacity and most direct routing.

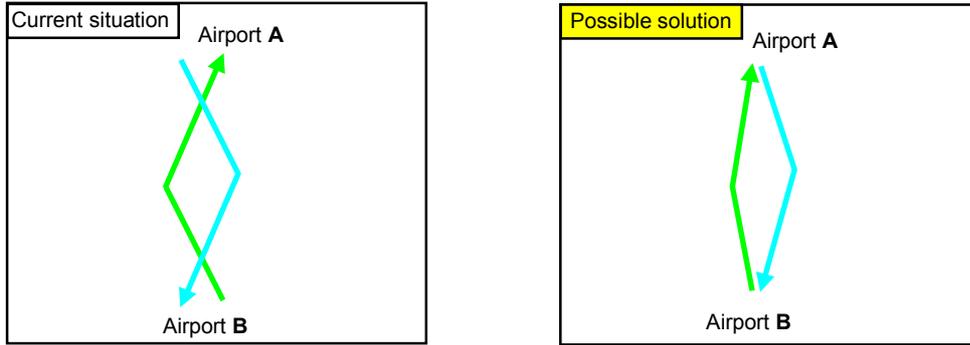
Although it is accepted that a large number of ATS routes can improve route capacity, it is also recognised that a large number of crossing points, especially in congested areas, can reduce sector capacity. Planners should optimise capacity by introducing new routes with as few crossing points as possible and these crossing points should be well clear of congested areas.

Whenever in the planning phase and based on forecast demand, an ATS route has been planned to accommodate a specific flow of traffic, its subsequent implementation should - if the traffic demand by that time is no longer met - be reconsidered. Redundant ATS routes should be deleted.

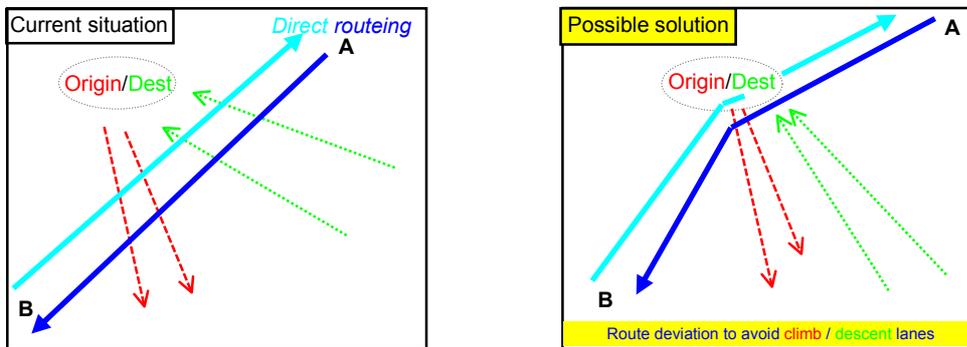
Use of uni-directional routes should be extended, particularly in areas where the interaction of climbing and/or descending traffic is a limiting factor, with the expected advantage that the improved structuring of the traffic would increase ACC Sector capacities.

1.7 Planning of Routes

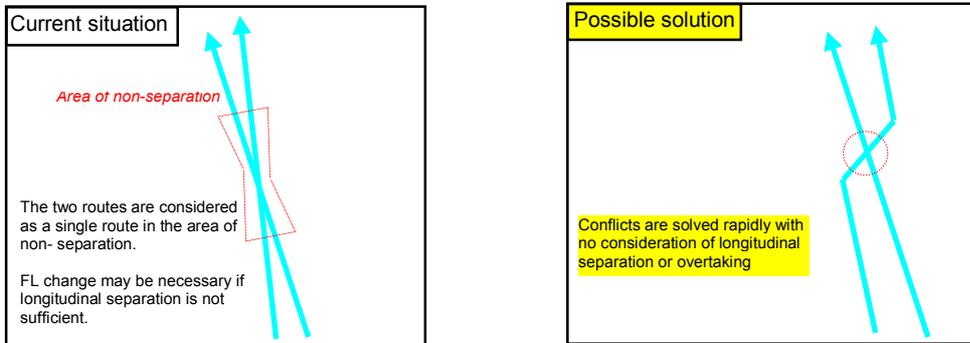
Planning should ensure that where dualised routes are used uni-directionally for opposite traffic flows, cross-overs are avoided as far as possible.



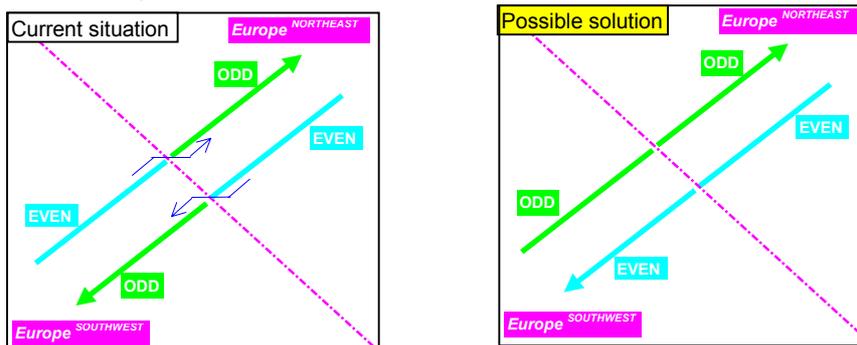
Crossing areas should not conflict with climb or descent lanes of major airports.



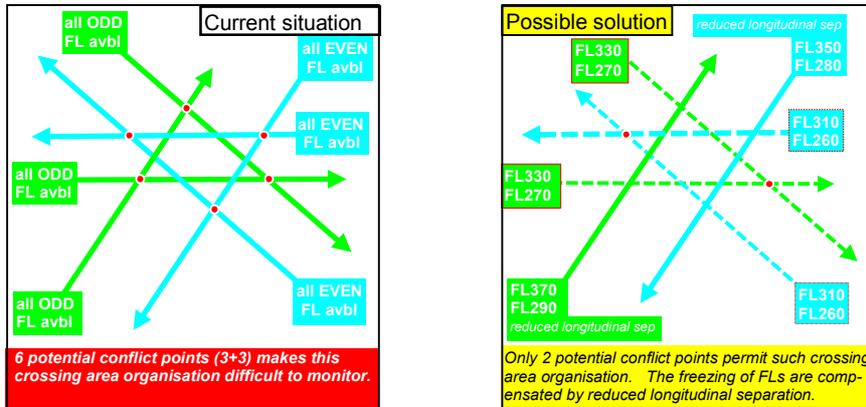
The extension of crossing areas between ATS Routes should be kept to a minimum (crossing at right angles).



Currently two different applications of the ICAO table of cruising levels coexist in the EUR Region. This leads to a requirement for aircraft transiting the boundary between the two application areas to change flight levels. Consideration should be given to the possible increase of system capacity which would result from a less rigid application of the present method of segregation of eastbound and westbound flight levels. This is already practised in some “one-way” ATS routes.



It should be recognised that the definition of a given flight level allocation scheme will have a direct impact upon the way in which major crossing points will have to be organised.



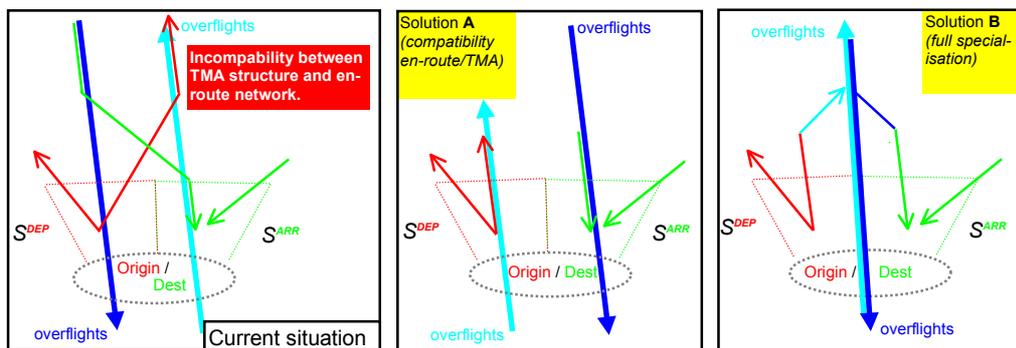
1.8 Shorthaul Routes and Levels

Specific routing and/or flight level allocation for short haul city pairs may be established.

1.9 Transition\* Routes

The traffic in the ECAC area is predominantly short haul traffic with nearly half of the flight distance spent in climb and descent phases. From the first stage of the network planning, it is therefore necessary to consistently integrate major transition\* routes in the whole structure and to ensure TMA-Network interfaces compatibility (see *Solution A below*). This is valid for the major origin/destination areas.

Fixed routes systems based on RNAV should, if necessary, be applied at airports with high traffic density to specialise arrival and departure routes. Such route systems (specialised routes) should be designed to enable arriving, departing and overflying traffic to be separated systematically, while seeking to permit economical flight paths (see *Solution B below*). In order to optimise the use of airspace and aerodrome capacity route systems should be designed, where possible, to take account of different aircraft performance capabilities.



**Annex 4B**

(Extract from "Concept and Criteria for Medium Term EUR Route Network and Associated Airspace Sectorisation")

**1 GENERAL CRITERIA FOR AIRSPACE SECTORISATION DEVELOPMENT****1.1 Introduction**

At present many of the constraints in the ECAC ATM system are caused by a lack of adequate **sector capacity**. With traffic demand increasing steadily at average annual rates of 4 to 5%, it is clear that achievement of enhanced sector capacity is a crucial objective if congestion problems and their associated delays are to be minimised.

A number of studies and analyses have been carried out in Europe, which have identified the close interrelationship between sectorisation and route network configuration. Therefore, this relationship must be taken into consideration in planning the improvement of the ECAC ATM system. In particular, it is essential to ensure that route network and airspace sectorisation are coherent and compatible, if optimum capacity gains are to be realised. In particular, the planning of Version 3 incorporates this consideration.

**1.2 Method/Rationale**

In developing the optimum airspace structure the RNDSEG has adopted a Top Down or overall ECAC wide approach (see paragraph 3.1). This approach is an outcome of the following rationale.

FIR boundaries which are mainly contiguous with State boundaries can have the affect that ATC sector boundaries are not always optimal for air traffic flows and ATM requirements. The non-optimal airspace structure then dictates the structure of the route network on which the traffic flows are accommodated. This former approach constrains the options for solutions, whereas the Top Down or Network-oriented approach (Appendix A.6 refers) is less constrained.

With this "Top Down" approach the main traffic flows are accommodated into a route network, which is independent of the existing sectorisation. Subsequent and suitable sectorisation must be developed to support the network, including the accommodation of all relevant traffic flows. A consequence of the above approach will be a re-organisation of sectors, involving at sector boundaries a delegation of ATS where necessary. At this initial proposal development stage the network requirements take precedence over sectorisation.

However, it must be recognised that because of the two-way relationship it may not be possible to develop an operationally viable and efficient sectorisation. As pointed out above, sector capacity is the crucial element in the whole ATM system. Route structure, although one of the main factors, is only one of the elements which determine sector capacity. Therefore, in those instances where the lack of adequate sector capacity may be a significant constraint on the ATM system, and whenever a proposed improvement in route alignment leads to a complication of the sector's organisation, resulting in an unacceptable reduction in capacity, then both the route alignment and sector configuration should be re-examined. Because of this two-way dependency between airspace sectorisation and route network, it is essential that both are addressed immediately after the initial proposal development stage and throughout the planning process this relationship is always taken into consideration.

Summary of method/rationale:

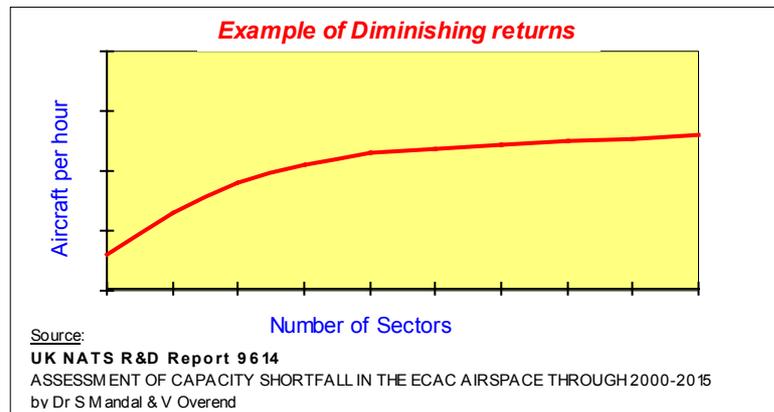
- Step 1: Route Network initial proposal
- Step 2: Examination of sectorisation viability
- Step 3: Harmonisation of outcome of step 1 and step 2

### 1.3 Airspace Structure: Options to enhance ATM capacity at the sector level

Air traffic control is currently based on sector structures. Sectorisation is the means of subdividing the totality of control tasks into manageable portions, at which throughput and capacity can be quantified. ECAC airspace has currently in excess of 400 sectors distributed in more than 50 ACCs. Capacity is a theoretical indicator of traffic loads, which can safely be handled by a sector team, rather than the loading they are currently subject to.

The main constraints on ATM capacity are airspace limitations and controller workload. The classic method to overcome these constraints is to provide more sectors. By either resizing or providing additional sectors, one can reduce the airspace volume, the number of routes/crossing points (conflicts) and the number of aircraft on the frequency at any time. This results in a reduction of workload and a corresponding increase in capacity, while maintaining at the same time a balanced co-ordination workload (e.g. through the use of improved/ automated co-ordination procedures).

The sub-division of sectors is a finite strategy and a point is reached, when the benefit of further reduction is outweighed by other factors (especially in the core area). Furthermore, the increase of capacity is not proportional to the number of sectors available (law of diminishing returns).



Therefore, the efforts to handle traffic growth have to be focused on a more efficient method, which is to increase sector productivity and consequently capacity. This can be achieved by reducing the complexity of the airspace structure, resulting not only in a more balanced distribution of traffic within different sectors, but also in a redistribution of workload. The redistribution should be made on a sector to sector balanced basis.

**Note:**

*Whichever method is used will entail a cost in either human and technical resources or non-optimum route/flight profiles*

1.3.1 Option 1: Additional Sectors

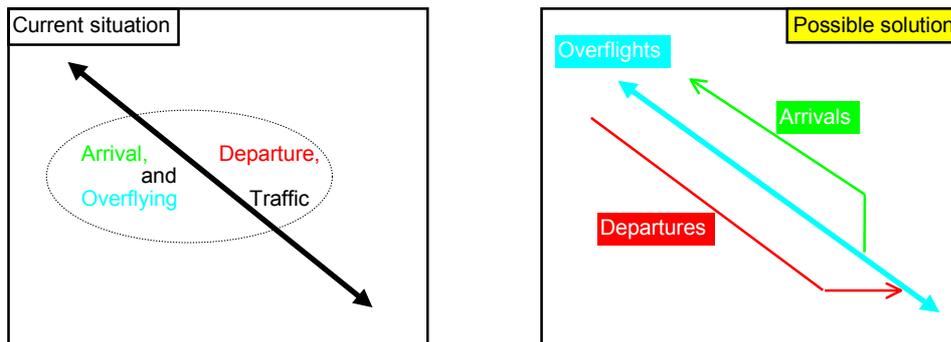
The provision of additional sectors is the classic method of increasing capacity. Although scope still exists for this in most of the ECAC airspace outside the core area or in the upper layers (vertical split), this is not always the most efficient method. Furthermore, in the core area the introduction of additional sectors is not always possible because:

- limits are almost reached (diminishing returns)
- frequency shortage
- co-ordination burden (workload increases)
- short transit times
- complex network (within Lower Airspace, especially close to TMAs)

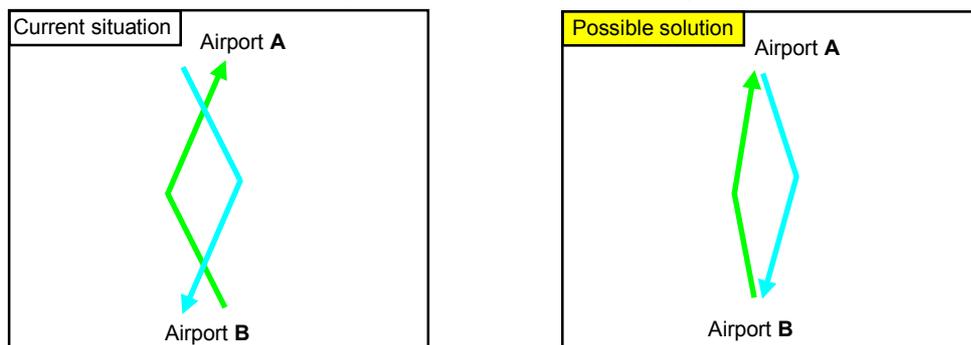
1.3.2 Option 2: Increased Sector Capacity

In the core area especially, therefore, the efforts of the RNDSG must be focused on increasing sector capacity. This objective can be facilitated, if airspace planners in the overall design of the route network bear in mind the need to reduce the complexity of ATS route structure and thereby control tasks by:

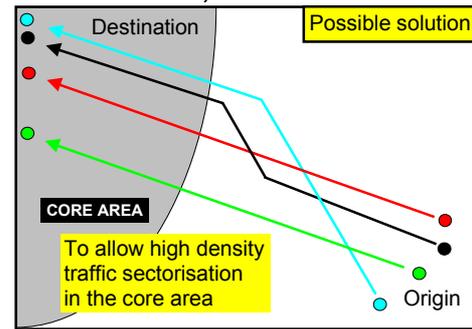
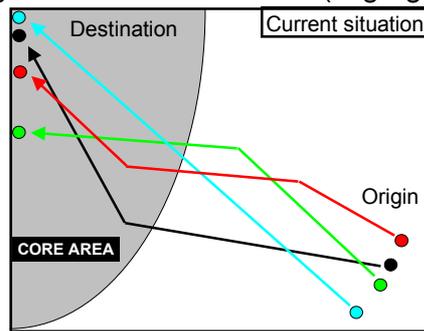
keeping the number of ATS routes controlled by a sector to a minimum  
 specialisation of routes (dualised routes/deconflicted ARR/DEP routes)



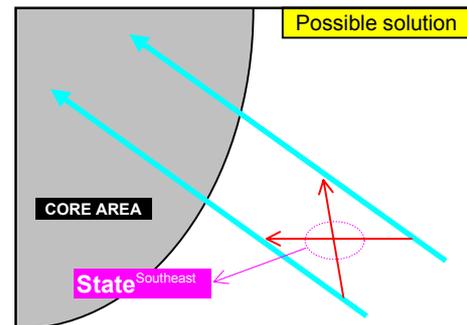
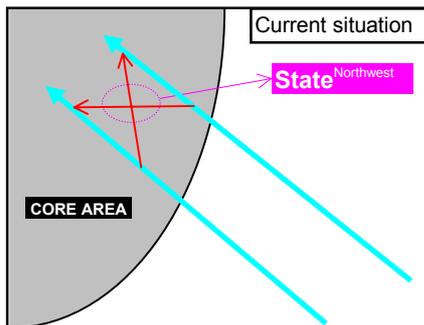
- deconfliction of traffic flows (elimination of unnecessary cross-overs)



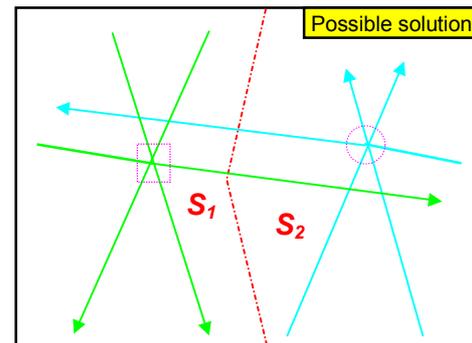
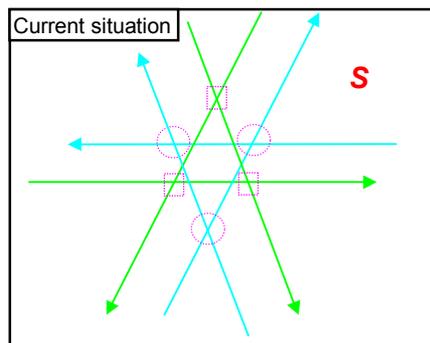
- organisation of traffic flows (segregation of main traffic flows)



- appropriate relocation of crossing points, where possible



- rationalisation of crossing points, where possible



Consequently, from the planning phase onwards, it is necessary to take into account a certain number of **criteria** to ensure that a given sectorisation scheme is feasible in relation to a planned network.

## 1.4 Criteria

As a fundamental tool to ensure the relationship mentioned above, it is necessary to have standardised criteria developed by the RND SG in order to establish, modify or validate en-route and Terminal sectors.

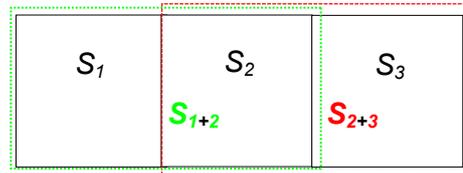
### 1.4.1 General Criteria Applicable to Sector Development :

Sectorisation architecture should be:

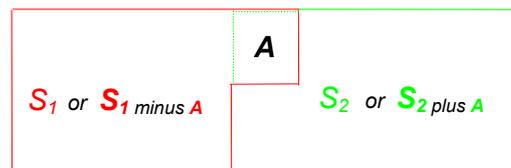
- based on operational requirements
- planned on a coordinated, international basis
- drawn up independent of FIR or national boundaries
- operationally efficient, i.e. maximise ATM capacity while accommodating user demand
- fully consistent with the evolution of the route network

- fully consistent with the airspace utilisation (CDRs / route scenarios)
- sufficiently flexible to respond to varying traffic demand and to temporary changes in traffic flows (morning, evening, week, week-end traffic), this includes:

1. *the combination of sectors to balance varying demands*



2. *the reconfiguration of sector boundaries through use of air blocks to match prevailing traffic flows*



- constructed to ensure operational and procedural continuity across national borders
- designed to take into account military requirements and those of other airspace users
- configured to ensure optimum utilisation of the ATS route network (balanced load on the sectors)
- configured to minimise co-ordination workload
- designed, where appropriate, to utilise techniques based on specialisation of task depending on the nature of traffic and its density
- designed, in general, to be laterally larger for high level sectors than the underlying lower sectors in respect to traffic density and complexity
- based on the following factors:
  - \* traffic volume/density utilising up-to-date data and projected trends
  - \* traffic complexity
  - \* nature of traffic (en-route, climbing or descending traffic)
  - \* ATC system capability

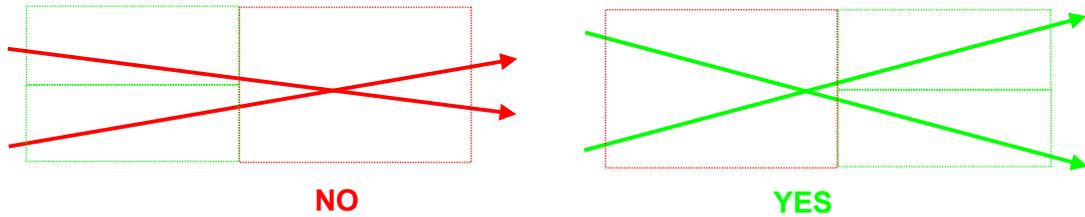
#### 1.4.2 Specific Criteria to Enhance Sector Capacity:

##### I. Conflict Points:

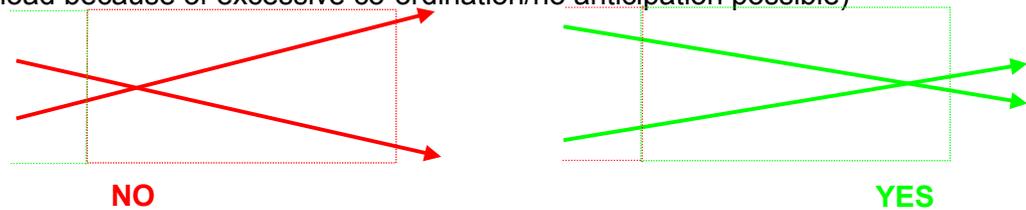
Sectorisation architecture should:

- limit number of conflict points in the same sector involving major traffic flows

- avoid different sectors feeding the same sector with converging traffic, when action to separate individual aircraft is required (two different co-ordinations for the receiving sector)



- avoid conflict points close to the boundary of a sector for entering traffic (increasing workload because of excessive co-ordination/no anticipation possible)



## II. Sector Functions/Specialisation

- in order to enhance sector capacity the functions (arrival, departure and en-route) carried out by one sector should be minimised
- 'Flight Level Allocation' procedures should be evaluated and the optimum system applied

### Note:

*Due to the upstream and downstream impact such procedures should be coordinated.*

## III. Sector Size (Big Sectors $\longleftrightarrow$ Small Sectors)

- The shape and size of a sector is a function of the tasks which can be efficiently carried out in the sector. The configuration and size of the sector therefore involves trade offs involving traffic volume, complexity and control task.
- regarding vertical and horizontal extension a sector should be:
  - small enough** to accommodate sector functions, while providing a balanced workload, and allow:

- \* one specialised function
- \* high rate of entering traffic
- \* short transit time and low instantaneous loads

### **and at the same time**

**big enough** to accommodate sector functions while not imposing an excessive workload and allow:

- \* anticipation and resolution of conflicts with a minimum of co-ordination
- \* the establishment of holding patterns without requiring co-ordination
- \* RNAV offset procedures
- \* radar vector separation techniques
- \* tactical direct routings
- \* reasonable transit time (less co-ordination)

Low traffic density allows bigger sectors, whereas as density increases, a resizing into smaller ones becomes inevitable. The relative benefits from different sizes of sectors can be indicated as follows:

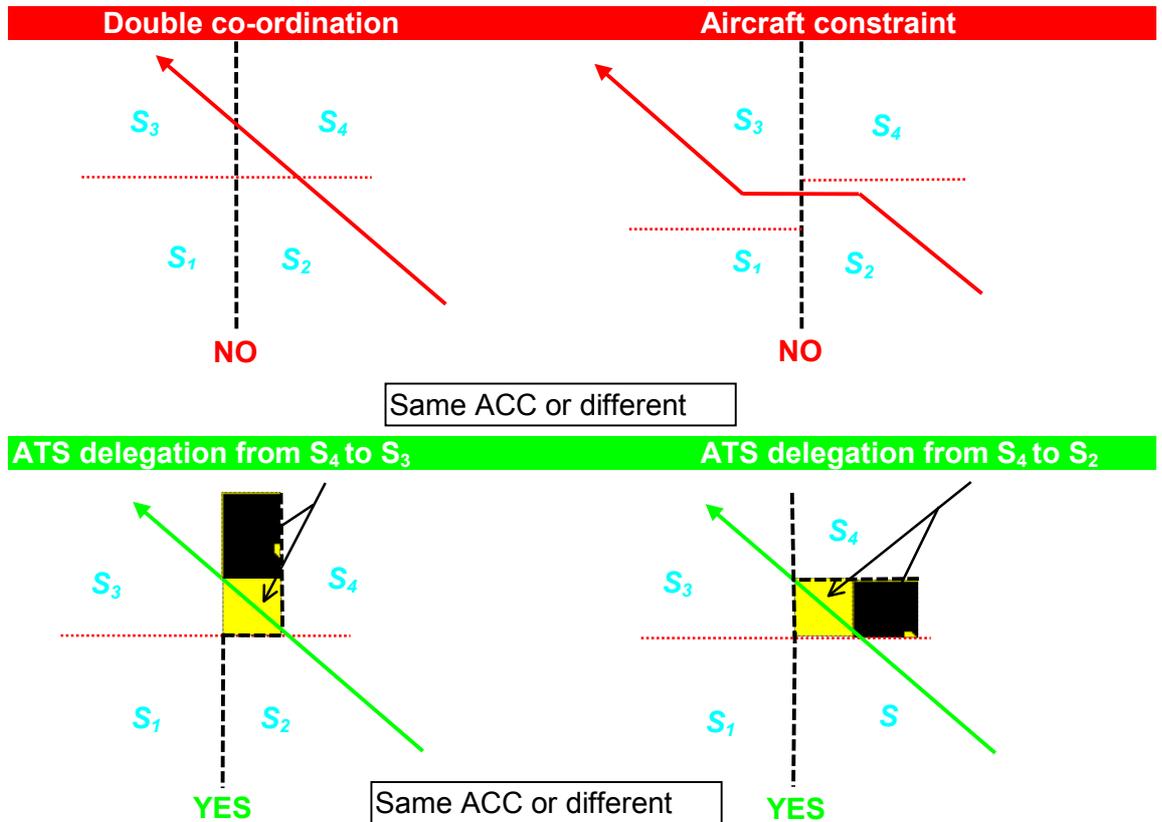
big sector	← versus →	small sector
better flexibility		better productivity
better anticipation		better efficiency through specialisation
more appropriate for varying flow demand		more rigid

The optimum size of sectors will therefore depend upon a case-by-case analysis.

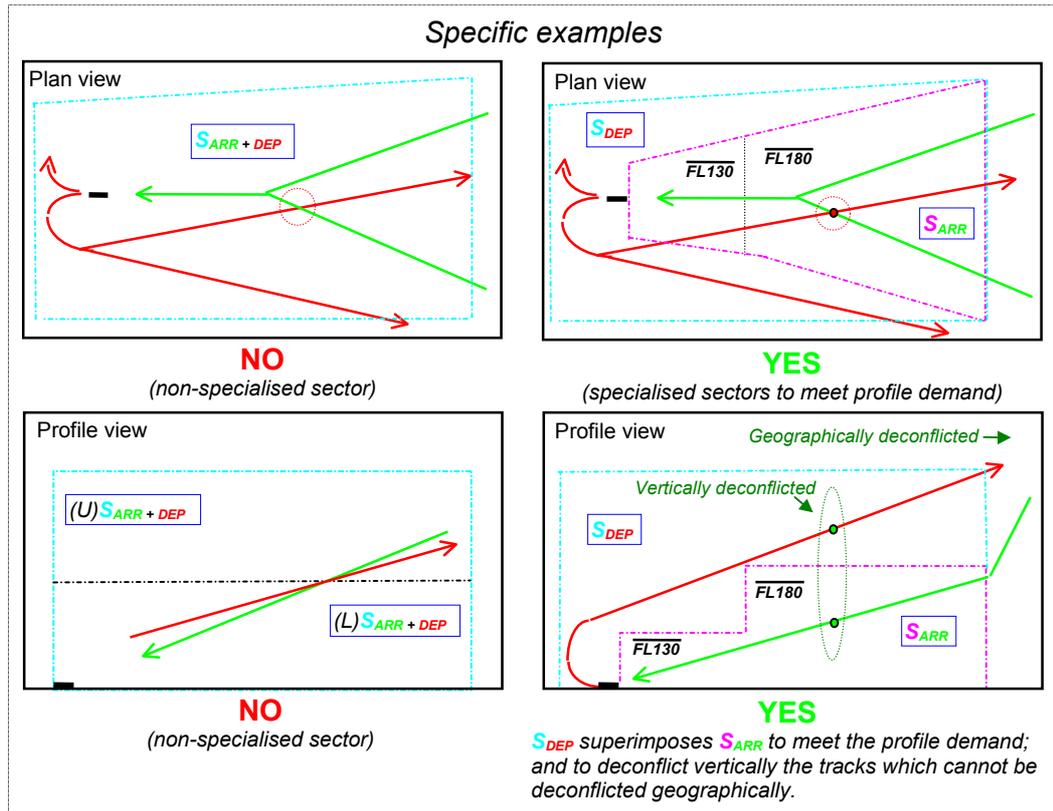
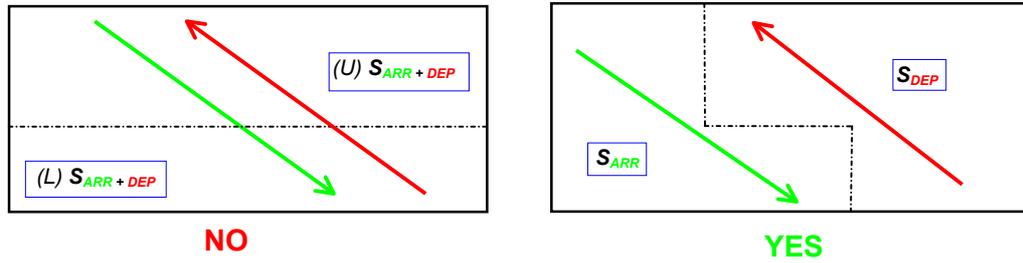
#### IV. Sector Boundaries/Sector Shape

Sectorisation architecture should:

- be based on operational requirements rather than national boundaries
- promote overall system flexibility (grouping/de-grouping of sectors/collapsed sectors because of FUA/CDRs or during low traffic periods)
- reduce co-ordination/workload and facilitate radar hand-over
- avoid too short a transit time within one sector, e.g. by delegating a part of the airspace (ATS delegation)



- shaped along main traffic flows
- take into account the ideal profile and performance of aircraft



- promote overall system flexibility in support of fuel-efficient direct routes
- have varying division levels/level splits all over Europe depending on traffic patterns/source of traffic and the performance of aircraft (this means that a “standard” division FL 245 between Upper and Lower Airspace could be a constraint)
- arrange sector splits horizontally, if overflying traffic is dominant (sector slices)
- arrange sector splits vertically, if climbing and/or descending traffic is dominant (sector columns)

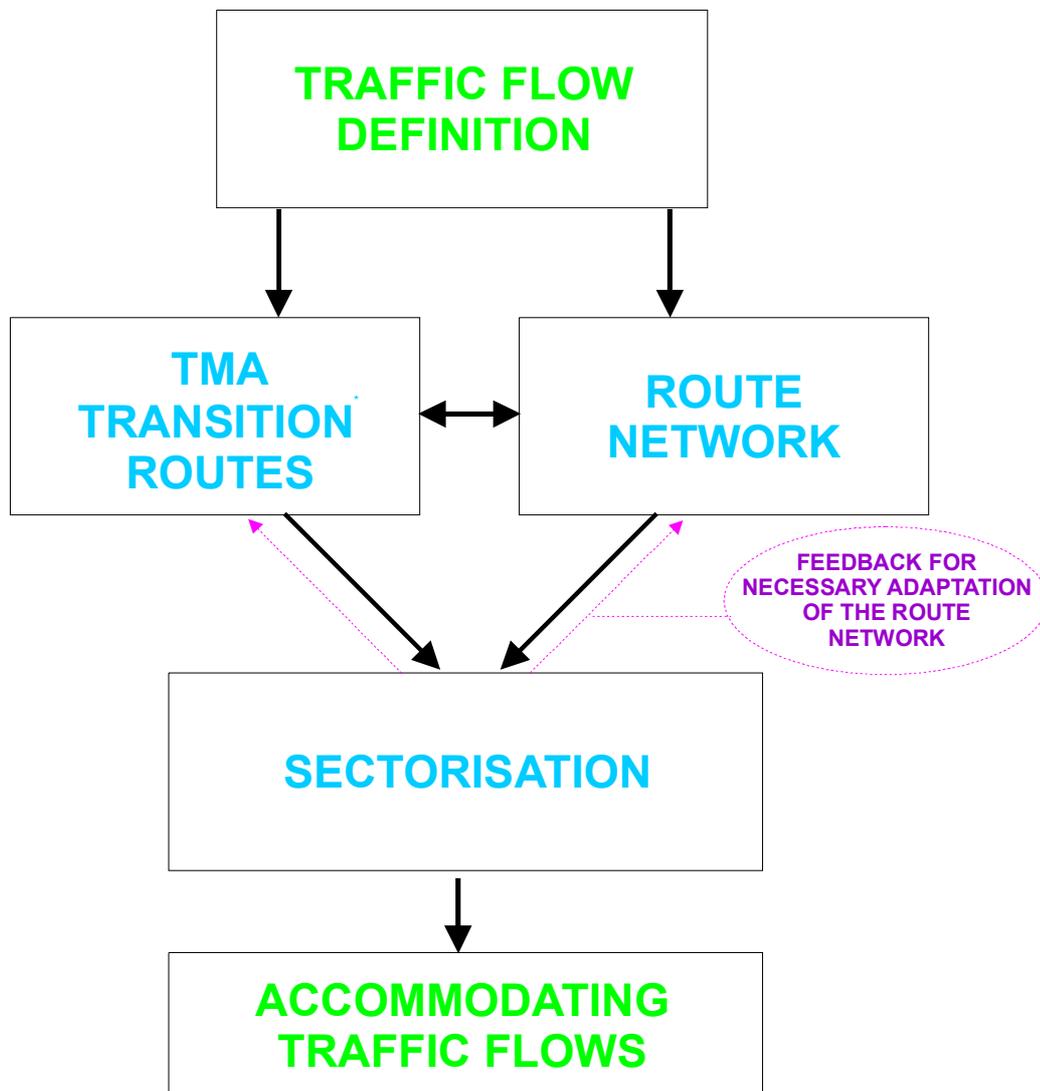
1.5 Application of Criteria

In regard to the all of the foregoing criteria it should be noted that local requirements will dictate their appropriateness or otherwise. Airspace planners must also ensure that the application of any of the criteria or the solution of a local problem should not adversely affect adjacent airspace, or the overall capacity of the ECAC airspace.

**Annex 4C**

**'Top Down'  
APPROACH**  
*(para 4.2 refers)*

**NETWORK ORIENTED DEVELOPMENT  
TO FIT IN WITH THE TRAFFIC DEMAND**

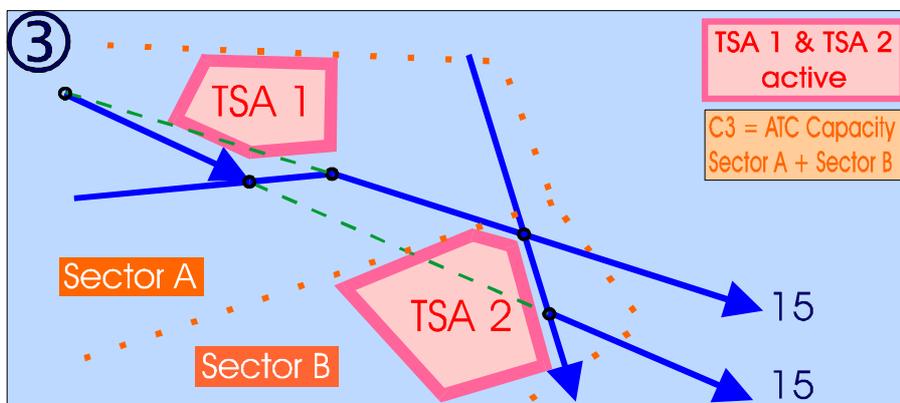
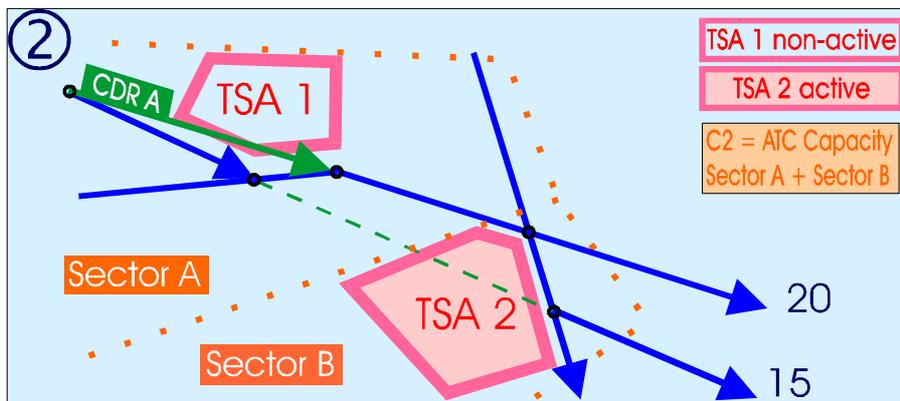
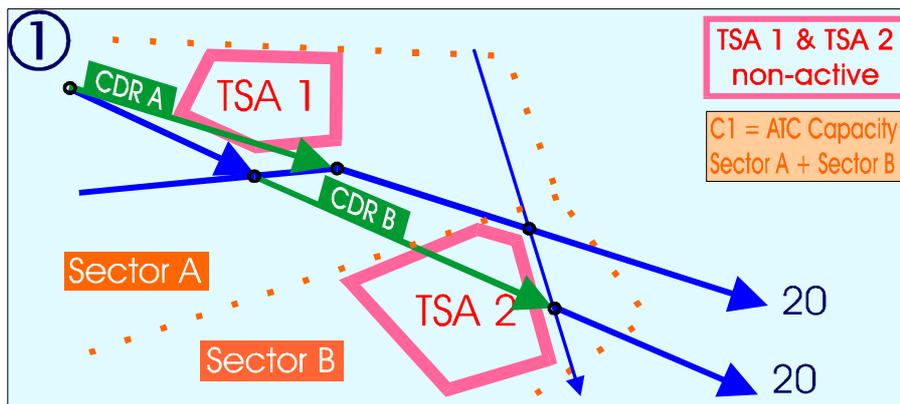


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**Annex 4D**

**EXAMPLES OF CDR ROUTING SCENARIOS**

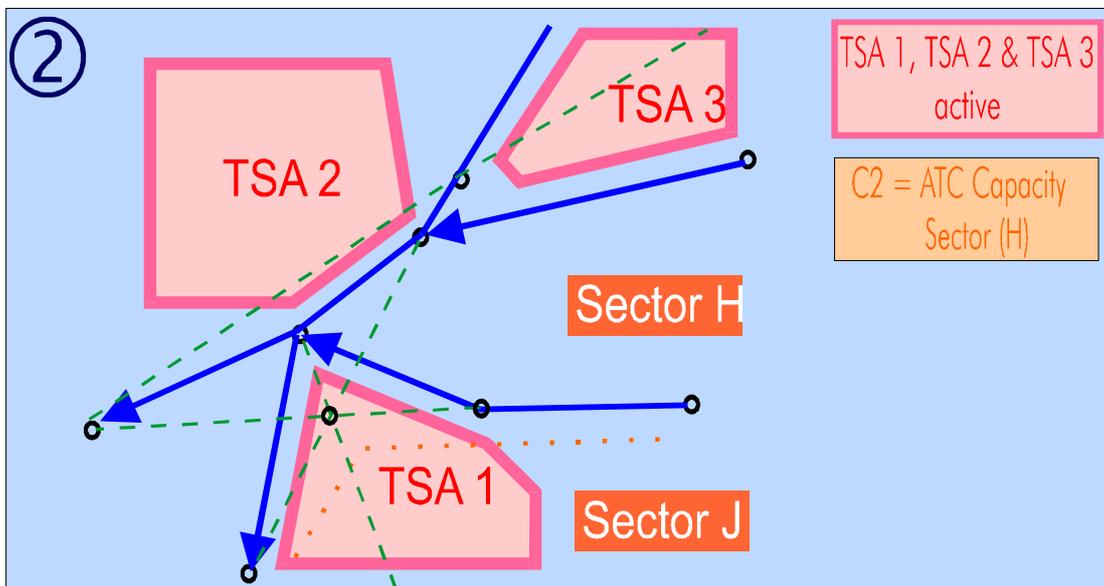
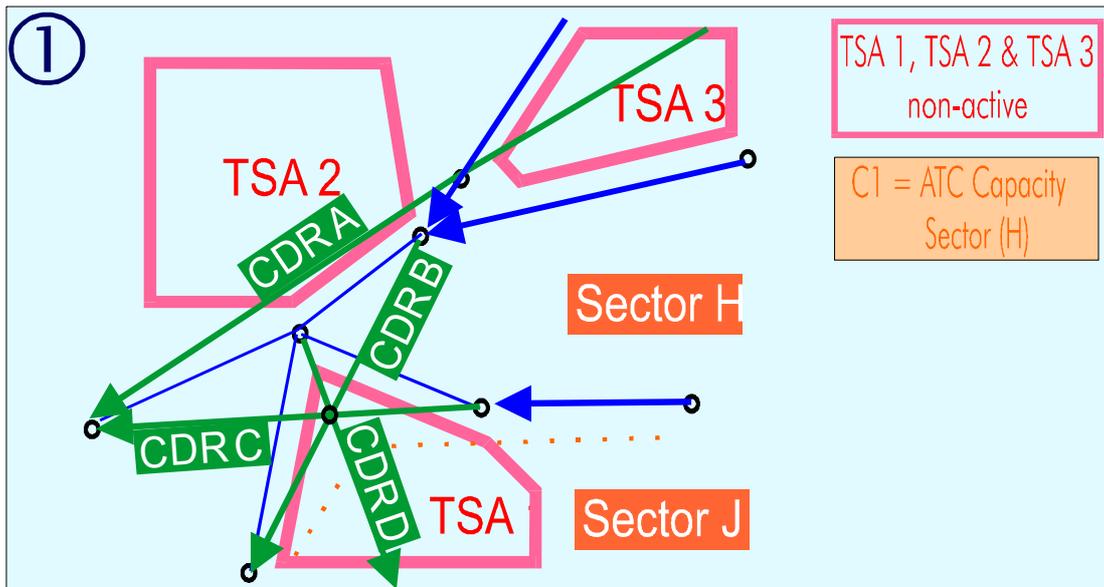
**① SCENARIO 1**



**C1 > C2 > C3**

**EXAMPLES OF CDR ROUTING SCENARIOS (cont'd)**

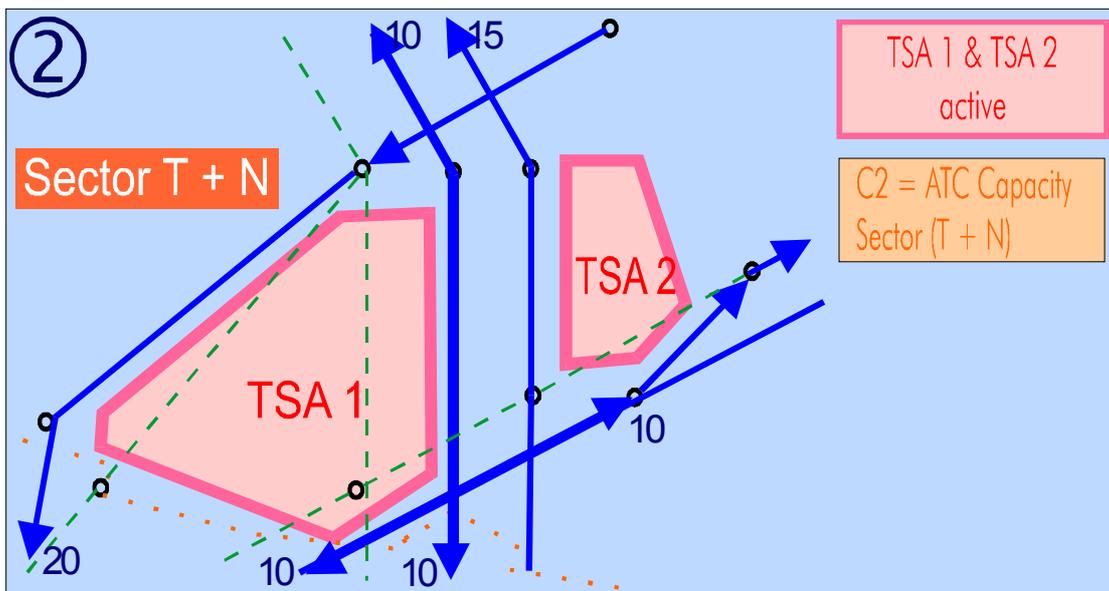
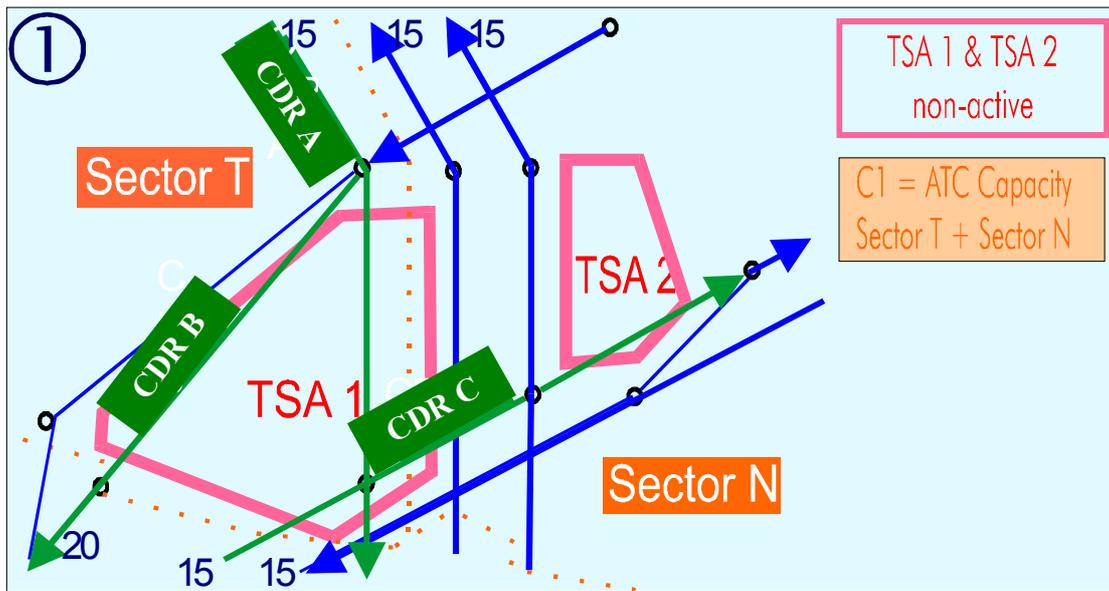
**② SCENARIO 2**



**C1 = C2**

### EXAMPLES OF CDR ROUTING SCENARIOS (cont'd)

#### ③ SCENARIO 3



$C1 > C2$

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**Annex 4E****GUIDELINES FOR CDR CATEGORISATION****1. GENERAL**

- 1.1 Guidelines for CDR Categorisation are based on the following eight major questions which should be read in conjunction with the diagram on page 4.
- 1.2 The expected rate of CDR availability would obviously be dependent on the foreseen usage of the associated TSA, but would only be one parameter amongst others used to determine the CDR category.
- 1.3 Thus, in order to profit from the daily pre-tactical co-ordination with 24H advance notice, the following requirements should be considered for the three ATM components:
- **ATFM**: allow the CFMU to manage potential gains in ATM system capacity;
  - **ATC** : provide ATC with correct flight data without controller intervention;
  - **ASM** : give enough stability and provision to ATM system and military activities.

**2. DIFFERENTIATION BETWEEN PERMANENT ROUTE AND CDRs (See ♦ ① )**

- 2.1 The first question associated with ♦ ① is: would the proposed route be qualified as a "Permanent" Route or as a CDR?
- 2.2 Apart from other factors such as the existence or otherwise of associated AMC-manageable area(s), the decision would only be based on whether the route would be permanently available or not.
- 2.3 Any very rare route closure known sufficiently well in advance such that it could be published by appropriate AIS notice would be applicable to both Permanent Route and Category One CDR. This criteria would therefore not be used to differentiate a CDR from a Permanent ATS Route.
- 2.4 When the route would not be permanently available, it should be considered as a Conditional Route (CDR). The Conditional Route would either be expected to be available during fixed time period as for Category One CDR or could be daily managed by the AMC with 24H advance notice as for Category Two CDR or be declared (un)available at short notice and the associated re-routing be tactically handled by ATC at Level 3 as for Category One and Category Three CDRs.

### 3. ATFM REQUIREMENTS

#### 3.1 Expected Impact on ATC Sector Management (See ♦ ② )

3.1.1 The question associated with ♦ ② is: would the proposed route and its alternate be established in two different ATC sectors? If 'yes', progress to ♦ ③, if not progress to ♦ ④

3.1.2 Consideration should be given in particular to the possibility of establishing the proposed route in a sector currently under utilised, or, to relieve an adjacent critical sector from frequent overloading, or, from imposing repeated delays.

#### 3.2 Possible Demand/Capacity Imbalance (See ♦ ③ )

3.2.1 The third question associated with ♦ ③ based on the expected demand/capacity imbalance is: should correct flight data processing be requested for ATFM Pre-Tactical measures? if the answer is 'yes', progress directly to ♦ ⑦a, if the answer is 'no' progress to ♦ ⑤.

#### 3.3 Increase in ATC Sector Capacity (See ♦ ④ )

3.3.1 The question posed in ♦ ④ is: would the availability of the proposed route lead to a formal change in the sector capacity figure? The related ATFM actions having no direct impact in the CDR categorisation process, progress directly to ♦ ⑤, if the answer is either 'yes' or 'no'.

Note: This means that the CFMU will react on sector capacity changes whatever category of CDR is involved.

### 4. ATC REQUIREMENTS

#### 4.1 Correct FPLs Requested by ATC (See ♦ ⑤)

4.1.1 The question posed in ♦ ⑤ is: should correct FPLs be requested by ATC? If the answer is 'yes', progress to ♦ ⑥. If the answer is 'no', progress directly to ⑦b.

#### 4.2 Correct Flight Processing Done Locally (See ♦ ⑥ )

4.2.1 The question posed in ♦ ⑥ is: would local reprocessing of FPL be impossible? If the answer is 'yes', which means that FPLs **can't** be reprocessed locally, progress to ⑦a. If the answer is 'no', which means that FPLs **can** be reprocessed locally, progress directly to ⑦b.

Note: If the answer to ♦ ⑤ or to ♦ ⑥ is 'no', this means that in the event of short notice (un)availability of a CDR, tactical re-routing will be instructed by ATC.

**5. ASM REQUIREMENTS****5.1 Expected High CDR Availability for most of the time or during fixed time (See ♦ 7 a)**

5.1.1 The question associated with ♦ 7 a, based on expected high CDR availability, is: would the proposed route expected to be available for most of the time (i.e. H 24) or during fixed time period (e.g. at week-ends, nights or at peak hours) and any very rare long-term closure be published with appropriate AIS notice? If the answer is 'yes', the route should be categorised as a CDR1. If the answer is 'no', progress to 8.

*Note:* If the answer to ♦ 7 a is either 'yes' or 'no', this means that tactical rewriting being not possible, CDR (un)availability requires in any case action to refile the flight plan.

**5.2 Expected High CDR Availability for most of the time or during fixed time (See ♦ 7 b)**

5.2.1 The question associated with ♦ 7 b, based on expected high CDR availability, is: would the proposed route expected to be available for most of the time (i.e. H 24) or during fixed time period (e.g. at week-ends, nights or at peak hours) and in the event of short notice unavailability, tactical re-routing be instructed by ATC (See Note below ♦ 5 and ♦ 6)? If the answer is 'yes', the route should be categorised as a CDR1. If the answer is 'no', then the route proposal should be categorised as a CDR3.

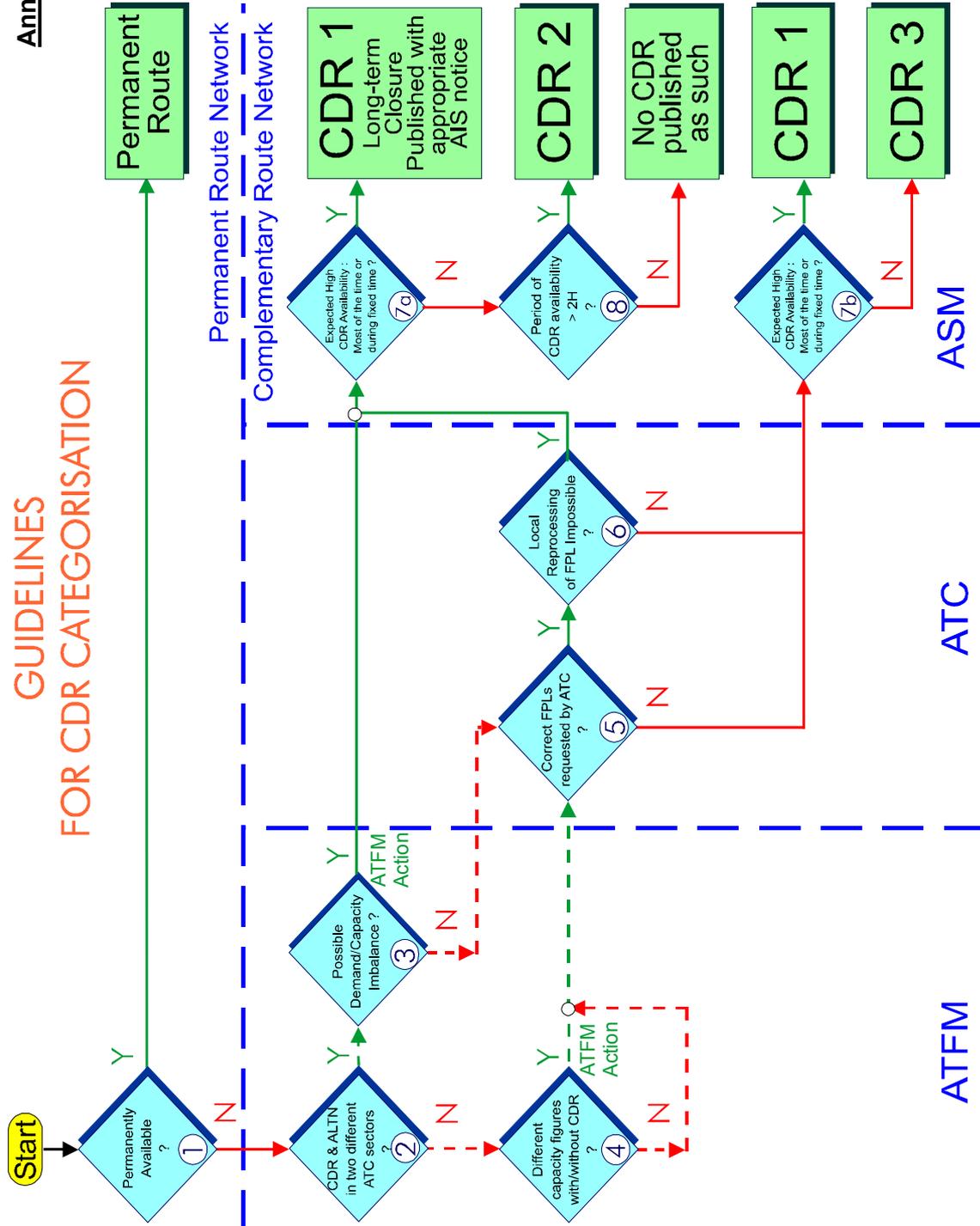
**5.3 CDR 2 Availability Criteria (See ♦ 8)**

5.3.1 The question associated with ♦ 8, to confirm that a proposed route was eligible for categorisation as a CDR 2 is: would the minimum activation time of the route be two hours or more as defined in para. 4.5.4.i? If the answer is 'no', it should be rejected for categorisation as a CDR altogether.

**6. EXAMPLES OF CDR CATEGORISATION (See next Pages)**

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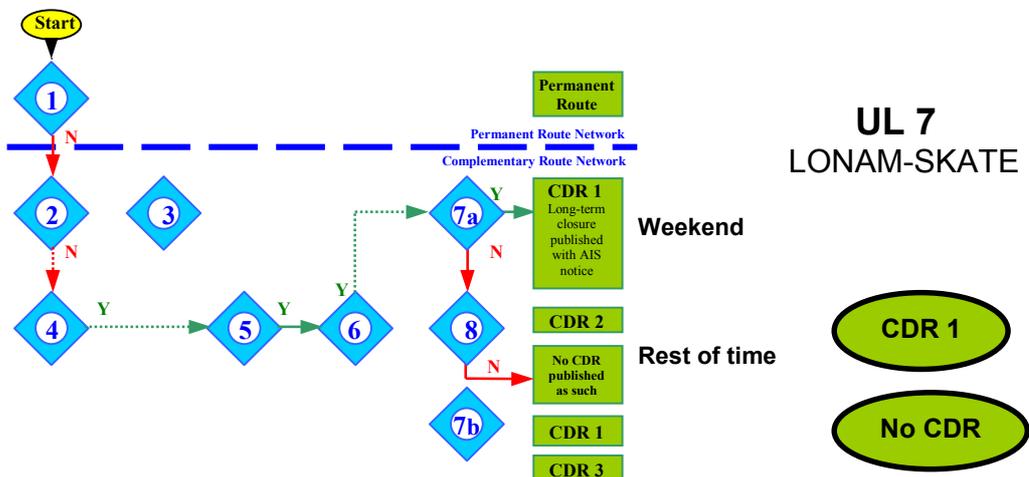
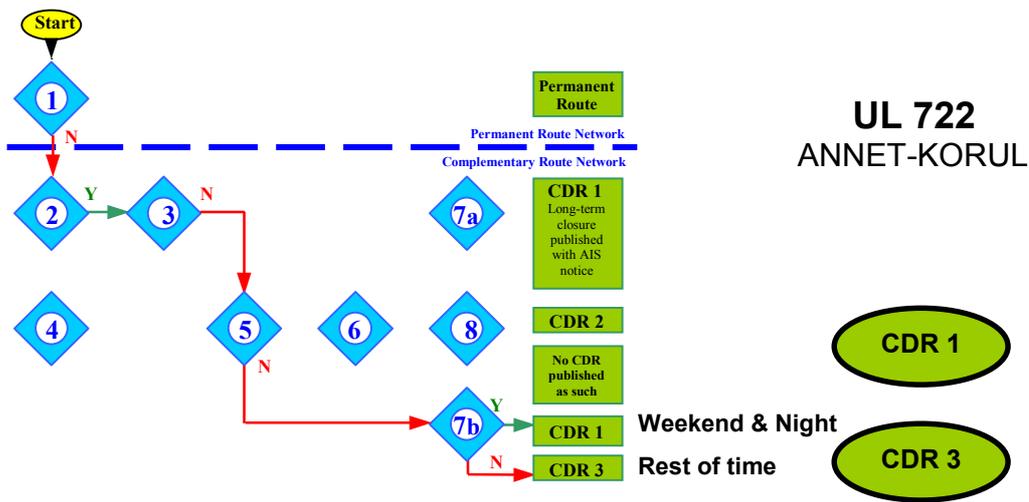
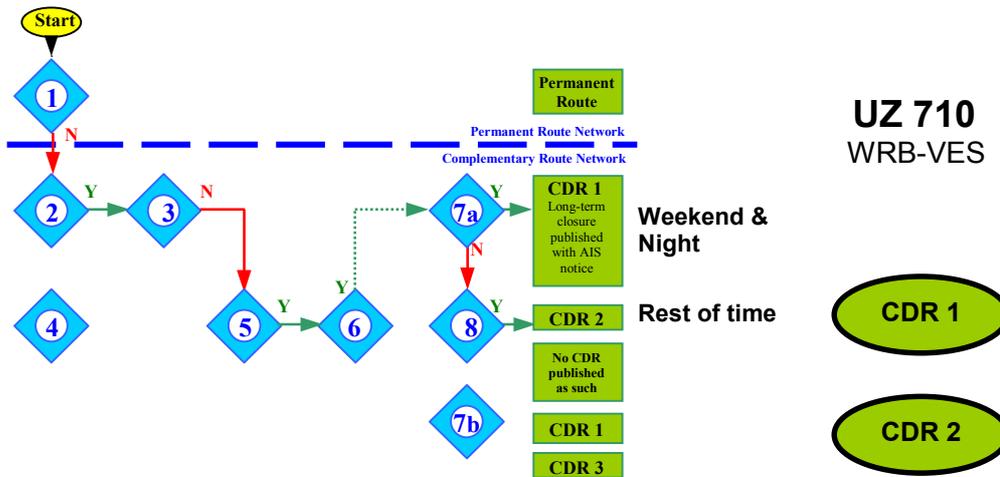
GUIDELINES FOR CDR CATEGORISATION



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## EXAMPLES OF CDR CATEGORISATION



**Annex 4F**

**FICTITIOUS EXAMPLES OF CDR PUBLICATION**

AIP  
XXXXXX

ENR 3-2-x  
From 23 APR 98

Route designator (RNP type) Name of significant points Coordinates	Track MAG VOR RDL DIST (COP)	Upper limits Lower limits  Airspace classification	Minimum IFR cruising levels		Type	Remarks Controlling unit
			Direction	Availability		
			Odd	Even		
1	2	3	4		5	
<b>UA 1 (EXAMPLE OF CONDITIONAL ROUTE - CATEGORY ONE)</b>						
<i>(RNP 5)</i>						
<input type="checkbox"/> BRAVO VOR (BBB)	<u>012°</u> 192° 69 NM	<u>FL460</u> FL195  <i>Class A</i>	FL210 ↓	↑ FL200	CDR 1 H 24	TEMPO CLSD on UAC Instructions ALTN ROUTE: UA 7  Malmö UAC FREQ: ..MHZ
<input type="checkbox"/> CHARLIE VOR (CCC)						
<b>UB 2 (EXAMPLE OF CONDITIONAL ROUTE - MIXED CATEGORIES ONE &amp; TWO)</b>						
<i>(RNP 5)</i>						
<input type="checkbox"/> DELTA VOR (DDD)	<u>036°</u> 216° 56 NM	<u>FL460</u> FL195  <i>Class C</i>	FL210 ↓	↑ FL200	CDR 1 EV NGT FM 22 00 (21 00) TIL 06 00 (05 00)	TEMPO CLSD on UAC Instructions ALTN ROUTE: UA 8
<input type="checkbox"/> EEEEE	<u>032°</u> 212° 81 NM				CDR 2 EV DAY FM 06 00 (05 00) TIL 22 00 (21 00)	
<input type="checkbox"/> FOX VOR (FFF)	<u>020°</u> 200°					Berlin UAC FREQ: ..MHZ
<input type="checkbox"/> ICARD	19 NM					
<b>UG 3 (EXAMPLE OF CONDITIONAL ROUTE - CATEGORY THREE)</b>						
<i>(RNP 5)</i>						
<input type="checkbox"/> GOLF VOR (GGG)	<u>056°</u> 236° 66 NM	<u>FL460</u> FL245  <i>Class A</i>	FL250 ↓	↑ FL260	CDR 3 H 24	TEMPO OPN on UAC Instructions NML ROUTE: UB 9  Bordeaux UAC FREQ: ..MHZ
<input type="checkbox"/> HHHHH	<u>052°</u> 232° 18 NM					
<input type="checkbox"/> ICARD						

**FICTITIOUS EXAMPLES OF CDR PUBLICATION (Cont'd)**

AIP

ENR 3-2-x

xxxxxx

From 23 APR 98

Route designator (RNP type) Name of significant points Coordinates	Track MAG VOR RDL DIST (COP)	Upper limits Lower limits Airspace classification	Minimum IFR cruising levels		Type Availability	Remarks Controlling unit Frequency
			Direction Odd	Even		
1	↓2↑	3	4		5	
<b>UR 4</b> <u>EXAMPLE OF MIXED CATEGORIES ONE &amp; TWO - Night Route &amp; Weekend Route</u> (RNP 5)						
<input type="checkbox"/> VOR HIJ	089° 269° 92 NM	FL460 FL195 Class A	FL210 ↓		CDR 1 EV NGT FM 22 00 (21 00) TIL 06 00 (05 00)  & EV Week-end FM FRI 17 00 (16 00) TIL MON 07 00 (06 00)  CDR 2 Rest of the Week  Geneva UAC FREQ: ..MHZ	TEMPO CLSD on UAC Instructions ALTN ROUTE: UA 7
<input type="checkbox"/> KLMNO	089° 269° 28 NM			↑		
<input type="checkbox"/> VOR OPQ				FL200		
<b>UR 5</b> <u>EXAMPLE OF MIXED CATEGORIES ONE &amp; TWO - Vertical Division</u> (RNP 5)						
<input type="checkbox"/> VOR RST	086° 266° 9 NM	FL460 FL245 Class C	FL250 ↓		CDR 1 H 24 FL 450 - FL 310  CDR 2 H 24 FL 290 - FL 250  Wien UAC  FREQ: ..MHZ	TEMPO CLSD on UAC Instructions
<input type="checkbox"/> MNMNM	085° 265° 58 NM			↑		
<input type="checkbox"/> VOR UWW				FL260		
<b>UG 6</b> <u>EXAMPLE OF PERMANENT PORTION FOLLOWED BY CONDITIONAL ROUTE - CATEGORY TWO</u> (RNP 5)						
<input type="checkbox"/> VOR XYZ	019° 199° 162 NM	FL460 FL245 Class A	FL250 ↓		PERM H 24  London UAC FREQ: ..MHZ	
<input type="checkbox"/> DDDDD	006° 186° 29 NM	FL460 FL245 Class A		↑		
<input type="checkbox"/> VOR YZX				FL260		

## EXAMPLE OF EXPLANATORY NOTE ON CDR IN FRONT OF AIP ENR 3-2

AIP  
XXXXXX

ENR 3-2-x  
From 23 APR 98

<p><b><u>Purpose of CDRs</u></b></p> <p>“Conditional Routes” (CDRs) complement the permanent ATS route network. The purpose of CDRs is to allow flights to be planned on and to use ATS routes, or portions thereof, that are not always available. CDRs are established:</p> <ul style="list-style-type: none"> <li>- through any potential areas of temporary segregation identified under the generic term “AMC- Manageable Areas” (TRAs, TSAs or R or D Areas), with CDR opening/closure resulting from associated military activities and/or</li> <li>- to address specific ATC conditions (e.g. traffic restrictions or ATC sectorisation compatibility), with CDR opening/closure resulting from purely civil needs.</li> </ul> <p>The conditions for the use of CDRs will be daily published in the national “Airspace Use Plans” (AUPs) and the “Conditional Route Availability Message” (CRAM).</p> <p><b><u>Categories of CDRs</u></b></p> <p>CDRs are divided into three different categories according to their foreseen availability and their flight planning potential. A CDR can be established in one or more of the three following categories:</p>	
<p>1. <b><u>Category One (CDR 1)</u></b> - <i>Permanently Plannable CDR</i> -</p> <ul style="list-style-type: none"> <li>• Category One CDRs are CDRs expected to be available for most of the time.</li> <li>• Flights will be planned on Category One CDRs in the same way as planned for all permanent ATS routes.</li> <li>• Any re-routing around associated TRAs/TSAs will be made on ATC instructions only.</li> <li>• For the calculation of fuel consumption, alternate routes are published in the “Remarks” column.</li> </ul>	<p><u>Depicted on maps as follows :</u></p> <p style="text-align: center;">UR 80 (CDR 1)</p> <p style="text-align: center;">-----</p>
<p>2. <b><u>Category Two (CDR 2)</u></b> - <i>Non-Permanently Plannable CDR</i> -</p> <ul style="list-style-type: none"> <li>• Category Two CDRs are part of pre-defined routing scenarios which respond to specific capacity imbalances.</li> <li>• Flights will be planned on Category Two CDRs <u>only</u> in accordance with conditions daily published in the CRAM.</li> </ul>	<p><u>Depicted on maps as follows :</u></p> <p style="text-align: center;">UA 20 (CDR 2)</p> <p style="text-align: center;">-----</p>
<p>3. <b><u>Category Three (CDR 3)</u></b> - <i>Not Plannable CDR</i> -</p> <ul style="list-style-type: none"> <li>• Category Three CDRs are published as CDRs usable on ATC instructions only.</li> <li>• Flights will be re-routed on Category Three CDRs on ATC instructions as short notice routing proposals.</li> </ul>	<p><u>Depicted on maps as follows :</u></p> <p style="text-align: center;">UG 100 (CDR 3)</p> <p style="text-align: center;">-----</p>

## **SECTION 4**

# **ATS ROUTE AND SECTOR DESIGN**

## **FINAL PAGE**

### **SUGGESTION - COMMENTS**

To report any errors, or to propose a modification to the present Section 4 "ATS Route and Sector Design", please contact:

Mr Alain Duchêne  
EUROCONTROL  
Airspace & Flow Management and Navigation Business Division (AFN)  
Rue de la Fusée, 96  
B-1130 BRUSSELS  
(E-mail: [alain.duchene@eurocontrol.int](mailto:alain.duchene@eurocontrol.int))

### **SECTION 4 - SPONSOR: ROUTE NETWORK DEVELOPMENT SUB-GROUP**

Whenever material received, in accordance with the above procedure, makes it apparent that an amendment of the present Section 4 is required, such amendment will be first discussed within the Route Network Development Sub-Group (RNDSG) before its adoption by the Airspace & Navigation Team (ANT).

### **PUBLICATION OF AMENDMENT**

The agreed amendment will then be issued by EUROCONTROL in the form most convenient for its insertion in the Planning Manual.

## **SECTION 5**

# **GUIDELINES FOR TERMINAL AIRSPACE DESIGN**

### **5.1 FOREWORD**

- 5.1.1 The aim of the Terminal Airspace Design Criteria is to provide generic operational guidelines for those involved in terminal airspace design.
- 5.1.2 Many national administrations are devolving responsibility for terminal airspace design to those units responsible for providing service within that airspace. In many cases, the responsibility falls upon operational personnel who have not previously carried out the task. Whilst this section is aimed primarily at assisting such individuals, it can also be used as a first reference by States who are considering changing their terminal airspace structures.
- 5.1.3 The methodology described in this section is aimed at assisting the process of assessing and evaluating the terminal airspace structure by following a methodological approach which includes the identification of constraints. An outline of the principles involved in terminal airspace design are also provided.
- 5.1.4 The guidelines have been written in a generic manner in recognition of the fact that each terminal airspace is unique. Furthermore, because there are many parameters which affect the design of terminal airspace (such as a need to respond to changing circumstances or certain policies adopted by States) a multiplicity of design criteria is inevitable. This said, there are many areas of commonality which can be identified and which form the basis of this section.
- 5.1.5 Similarly, the guidelines are operational in aspect; they do not seek to replicate existing Procedures design criteria already well document in ICAO Doc. 8168 Vols. I & II or EUROCONTROL publications.
- 5.1.6 Whilst the current version of this section does not explore the navigation aspect of terminal airspace, the revised version will take into account the implementation or development of navigation technology such as Area Navigation.
- 5.1.7 It is therefore intended to review completely these guidelines within the next two years in the light of recent developments and experience gained.

## 5.2 BACKGROUND

### 5.2.1 Introduction

There is a requirement to establish an area of airspace in the vicinity of certain airports to provide a degree of protection for aircraft operations in order to provide a safe system of Air Traffic Control. Generally this airspace is established in the vicinity of airports at which Air Traffic Control Services (ATS) are provided to aircraft operating under Instrument Flight Rules (IFR).

Due to the dynamic development of aviation a complex system of terminology has evolved. A number of terms are used to describe the airspace in the vicinity of aerodromes, all of which are, essentially, providing a similar function. Some of these terms are defined within ICAO others are not.

For the purposes of this document the following definition is used:

"**TERMINAL AIRSPACE** is a generic term describing airspace surrounding an airport within which air traffic services are provided. It encompasses all the various terminologies currently used throughout the ECAC region".

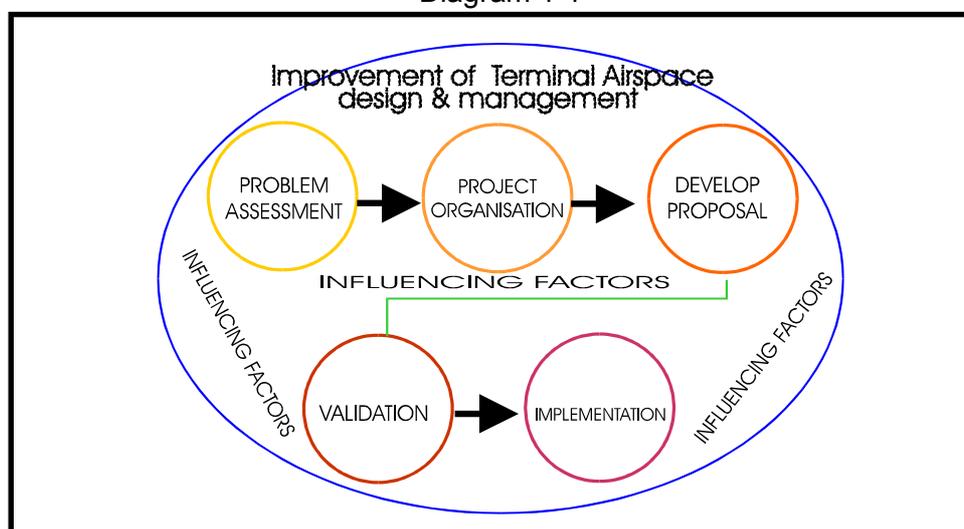
[Explanatory note: The above is aimed at including TMA, CTA, CTR, SRZ, ATZ airspace classification or any other nomenclature used to describe the airspace around an airport].

*N.B. ICAO does not currently use or define the term ' Terminal Airspace '.*

The design of such areas of airspace is subject to many considerations which will inevitably vary from location to location dependent upon local requirements. Therefore to lay down a comprehensive outline of airspace design principles relevant to all locations is unwise. However, a broad methodology for airspace design is a factor common to the majority, if not all, areas of terminal airspace.

This methodology may be illustrated as follows:

Diagram 1-1



## 5.2.2 ICAO Basis for terminal airspace design

ICAO documentation provides extensive information for the design of terminal airspace. This provides for progressive development of the airspace concerned. The information is contained in a variety of documents which include:

Annex 2	Convention on Civil Aviation - Rules of the Air.
Annex 11	Convention on Civil Aviation - Air Traffic Services.
Doc. 4444-RAC	Rules of the Air and Air Traffic Services.
Doc. 9426-AN	Air Traffic Services Planning Manual.
Doc. 8168-OPS	Aircraft Operations - Volume II.
Doc. 9368-AN	Instrument Flight Procedures Constructions Manual.
Doc. 9371-AN	Template Manual for Holding, Reversal and Racetrack Procedures.

The information relates to four main subjects :

- a. *Procedure design aspects.*
- b. *The configuration of terminal airspace structures.*
- c. *The division of responsibility for the provision of ATS.*
- d. *The determination of ATS airspace classifications.*

These subjects provide the basis for terminal airspace design at all levels of traffic density. Many other subjects are also covered in the ICAO documentation e.g. standard departure and arrival routes and associated procedures, the use of radar, mixed IFR/VFR operations, construction of visual and instrument flight procedures, etc. These subjects complement and expand upon the basic provisions and are utilised at locations requiring these types of operations.

### 5.2.2.1 Procedure Design Aspects

ICAO provides extensive information regarding the design of terminal airspace procedures.

Information relating to their construction is provided for guidance of procedure design specialists and describes the essential areas and obstacle clearance requirements for the achievement of safe, regular instrument flight operations.

Procedure design information relates to three main aspects of terminal airspace operations:

- a. Departure procedures - these are established for each runway where instrument departures are expected to be used.
- b. Arrival procedures - which may have five separate segments: arrival, initial, intermediate, final and missed approach.
- c. Holding procedures - in which a holding area is established based upon a number of variable factors.

Clearly, the design of terminal airspace structures will be closely linked to the associated departure, arrival and holding procedures established for the aerodrome(s) in question. Therefore it is necessary for an airspace planner to have a knowledge of the existing, or proposed, procedures for the location that the airspace structure will serve.

### 5.2.2.2 The Configuration of Terminal Airspace Structures

ICAO requires that, once it has been decided that ATS are to be provided, the airspace, wherein such services are rendered, should be designated by the following terms :

- a. *Flight Information Region (FIR)* - That portion of the airspace where it is determined that flight information service and alerting service will be provided shall be designated as a flight information region.
- b. *Control Area (CTA)* - A controlled airspace extending upwards from a specified limit above the earth. The lower limit of a control area shall be established at a height above the ground or water of not less than 200 m (700 ft).

Control Areas may be formed by:

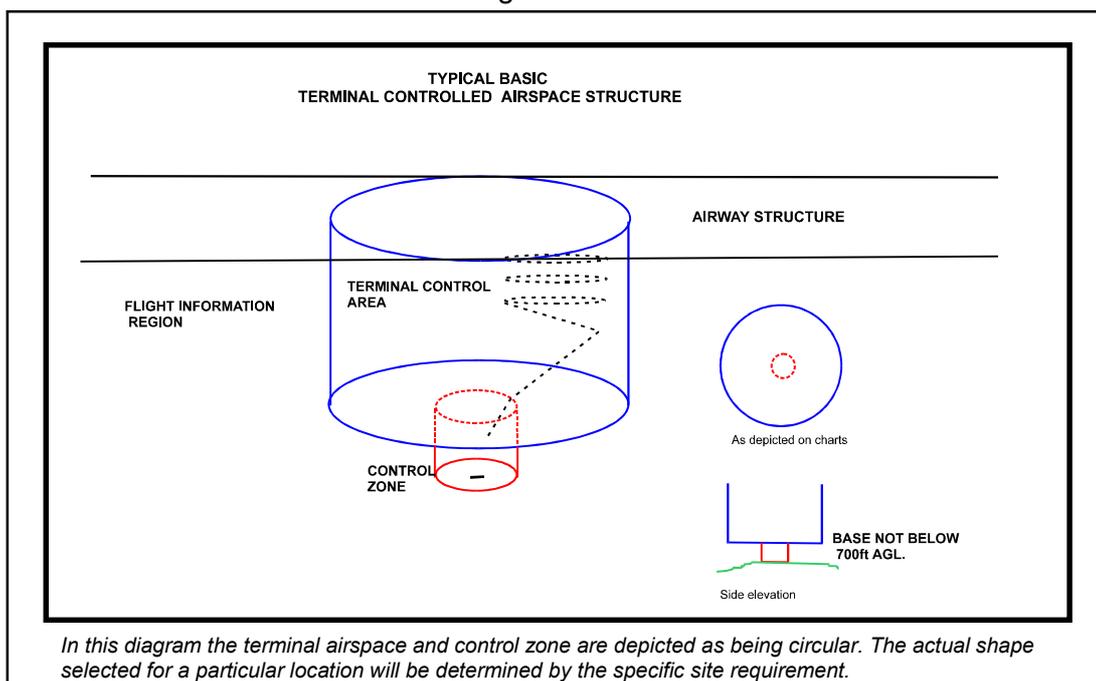
- i. terminal control areas (TMAs)
  - ii. interconnecting airways
  - iii. area-type control areas
- c. *Control Zone (CTR)* - A controlled airspace extending upwards from the surface of the earth to a specified upper limit. The lateral limits of a control zone shall extend to at least 9.3 km (5 NM) from the centre of the aerodrome or aerodromes concerned, in the directions from which approaches may be made.

*N.B. A control zone may include two or more aerodromes situated close together.*

***Those portions of the airspace where it is determined that air traffic control service will be provided to IFR flights shall be designated as control areas or control zones.***

These basic structures are used by States in a variety of different ways with the intention of providing sufficient controlled airspace to encompass (where necessary) the flight path of IFR traffic arriving and departing from an aerodrome. In this context aircraft holding in the vicinity of aerodromes are considered as arriving aircraft. A basic configuration is shown in Diagram 1-2.

Diagram 1-2



### 5.2.2.3 Terminal Airspace Classifications

ICAO requires that ATS airspace be classified and designated according to the ICAO published ATS Airspace Classification list. The annotation of a portion of airspace as being a particular airspace classification serves a similar purpose as annotating that airspace as an airspace structure, for example, a control zone or control area.

Airspace classification selection may significantly impact upon the capacity of terminal airspace. This is associated with the consideration for:

*'measures required to ensure that a possible mix of instrument flight rules (IFR) and visual flight rules (VFR) operations at and around the aerodrome(s) in question do not impair the safety of flight operations.'*  
- Doc. 9426

Annex 11 makes provision for controlled airspace which allows VFR operations without any restrictions together with that which includes VFR restrictions. This leads to the concept of three types of controlled airspace:

- **instrument restricted airspace** **classification A**  
allows for IFR operations only.
- **instrument / visual** **classifications B, C, D**  
allows for both IFR and VFR operations in a controlled environment.
- **visual exempted** **classification E**  
allows for both IFR and VFR operations but VFR operations are not controlled.

In addition, provision is made for uncontrolled airspace :

- **air traffic advisory / flight information service** **classification F**  
allows for both IFR and VFR operations in which all participating IFR flights receive an air traffic advisory service.
- **flight information service** **classification G**  
allows for both IFR and VFR operations in which aircraft receive a flight information service if requested.

It is a matter of policy for the particular terminal airspace authority concerned to assess the level of control required for VFR operations and to provide a solution to the problem of mixed IFR/VFR flights in the same airspace. Total prohibition, as in classification A airspace, deprives certain users of airspace and associated facilities. However, if there is a likelihood of collision risks, a degree of restriction upon VFR operations may be necessary, for example, a requirement for aircraft to carry specific equipment, restriction of flight to certain areas and/or routes.

This restriction of VFR operations may be applied by the use of airspace classification. When VFR operations need a lower degree of containment, then the airspace classification can be correspondingly less restrictive.

*In applying this concept, Class B airspace shall therefore be considered less restrictive than Class A airspace, Class C airspace less restrictive than Class B airspace etc.*

In general, a more restrictive class of airspace is introduced as traffic density increases. However the actual classification associated with a particular density of traffic will vary from location to location depending upon circumstance and preference. For example, the classifications in the vicinity of the busiest airports in Europe vary from Class A airspace to Class E airspace. In addition, a general trend, mainly to accommodate General Aviation, is to use less restrictive class airspace at lower altitudes than is used at higher altitudes.

An example of this is of a control zone being annotated Class D so that VFR flights may access the associated airport (while providing protection for IFR flights) whilst the control area established above the control zone is annotated Class B airspace. VFR operations are thus restricted to a greater degree but are still able to operate *beneath* such a control area.

#### 5.2.2.4 Terminal Airspace Division of Responsibility

ICAO provides guidance on the division of responsibility for the provision of air traffic services, *inter alia*:

*'The division of responsibilities between TWR and APP and between APP and ACC cannot be rigidly defined because the responsibilities depend very much on local conditions which vary from location to location. They must therefore be determined in each case and with due regard to traffic conditions, its composition, the airspace arrangements, prevailing meteorological conditions and relative workload factors. However, arrangements governing the division of responsibilities between these different parts of the ATS service, should not result in increased requirements for co-ordination and/or an undesirable inflexibility in the use of airspace, nor in an increased workload for pilots because of unnecessary transfers of control and associated radio communication contacts.'*

*- Doc. 9426*

The division of responsibility for the provision of ATS between ACC and APP is increasingly becoming a major influencing factor of terminal airspace capacity and efficiency. This is especially so in areas of high traffic density in which the potential requirement for co-ordination is extensive thus imposing greater workload upon controllers and pilots.

ICAO indicates that the division between the provision of an area control service and the provision of an approach control service is not clearly defined. At some locations, approach control units carry out area control functions whilst, at others, area control units perform approach control functions.

*'The parts of air traffic services .... shall be provided by the various units as follows:*

**a. Area control service**

- i. by an area control centre*
- or*
- ii. by the unit providing approach control service in a control zone or in a control area of limited extent which is designated primarily for the provision of approach control service and where no area control centre is established.*

**b. Approach control service**

- i. by an aerodrome control tower or area control centre when it is necessary or desirable to combine under the responsibility of one unit the functions of the approach control service with those of the aerodrome control service or the area control service*
- or*
- ii. by an approach control office when it is necessary or desirable to establish a separate unit.*

- Doc. 4444

It can be seen, therefore, that many approach control responsibilities may be divided between different air traffic units.

### 5.2.3 The tasks associated with approach control

#### 5.2.3.1 The Overall Responsibility

The Approach Control task is primarily concerned with the control of IFR flights arriving at and departing from aerodromes. Prescribed separation standards are applied between aircraft. These separation standards are determined for an individual location dependent upon equipment standards and operational practices. In order to fulfil this task, and in order to apply the appropriate separation, consideration must also be given to VFR flights and transit aircraft operating in the same airspace. A number of factors will influence the method by which this task is performed. Main factors will include the design of the airspace and the associated functional division of the airspace. To provide an analysis of terminal airspace design it is necessary to understand the operations occurring within the airspace. For this purpose the Approach Control task may be divided into three *sub-tasks*, as shown below.

#### 5.2.3.2 The Approach Control Tasks

##### **a. The arrival task**

In the arrival task, aircraft are sequenced into an orderly traffic flow in an area of convergence with a diminishing volume of airspace.

A major feature of arriving traffic in terminal airspace is the lack of adherence to the published route structure. Many airports publish Standard Arrival Routes (STARs) which are intended to permit transition from the en-route element to the approach phase of flight. In addition, Instrument Approach Procedures are published for individual runways. However, these procedures are rarely fully utilised. Preference is given instead to positive ATC handling, using altitude, speed variation and heading instructions with the aid of radar (i.e. vectoring). When vectoring is employed within terminal airspace, aircraft are neither expected to nor allowed to follow published routes or to deviate from headings issued until specifically cleared to commence an instrument or visual approach to the airport. Therefore, (except at those locations operating a procedural approach system without radar) STARs, although used by pilots for flight planning purposes, do not necessarily provide an indication of terminal area routing. Actual routings are influenced by a number of factors, including traffic density, weather conditions, aircraft characteristics, controller technique, etc.

Radar vectoring allows the flexibility to adjust traffic flows in order to optimise separation between arriving aircraft to a greater degree than is possible with other conventional navigation/management tools. The degree of vectoring is dependent upon the availability of airspace for use by the controller exercising the Approach arrival function, and this will be determined by the design and functional division of the airspace.

**b. The departure task**

The departure task entails aircraft moving from a defined point, i.e. the runway, to an area of airspace with greater volume i.e. the en-route structure. Separation between departing aircraft may, in many cases, occur geographically soon after departure by application of diverging departure tracks. Separation may also be achieved by application of appropriate time intervals between aircraft on the same route. Two identifiable systems are employed for addressing the tasks associated with the departure phase:

- i. the introduction of Standard Instrument Departure routes (SIDs).
- ii. a flexible system in which individual departure clearances are given.

ICAO recommends that SIDs should be established to permit aircraft to navigate along the routes without radar vectoring. This reduces the workload of the controller responsible for departing traffic. This workload reduction may allow for an increase in capacity within the ATC system. However, at some locations, the intervention of radar may assist in increasing departure capacity by vectoring aircraft to the connection point with the en-route environment, thus providing an alternative strategy to a rigid SID structure.

**c. Interacting traffic flows**

This task entails the provision of separation between arrival and departure traffic flows. At many locations it will also entail separation between these traffic flows and overflying aircraft.

This separation may be established by two basic methods:

- i. the introduction of a SID and STAR structure which will establish a strategic deconfliction of traffic flows.
- ii. a flexible system in which each aircraft is provided with the required separation on an individual basis.

The strategic deconfliction of arrival and departure routes may provide for a reduction of ATC workload and, therefore, the potential for an increase in capacity. This deconfliction of arrival and departure routes may be achieved on a geographic (lateral) basis or by vertical means (level separation). The method utilised will be determined by the traffic flows associated with a particular location and the design principles adopted.

### 5.2.3.3 The Division of Tasks

The three *sub-tasks* associated with Approach Control may be exercised by one individual controller or, particularly at busy locations, may be divided between two or more controllers. A number of methods may be used for this division of responsibility. The method chosen will be determined by the airspace design and functionality principles adopted for the particular location. The division may result in a controller being given responsibility for a specific area which is geographically or vertically divided from adjacent areas. Alternatively, a controller may be given responsibility for a particular traffic flow e.g. arriving or departing traffic.

These divided *sectors* may be opened or combined, depending upon the traffic density at any given time. This provides for flexibility in operations and optimisation of ATC resources.

## 5.3 THE FUNCTION OF TERMINAL AIRSPACE

### 5.3.1 Progressive development of terminal airspace

Due to the evolutionary nature of terminal airspace design at the majority of locations, it is becoming increasingly necessary to monitor developments in order to ensure that the airspace structure provided meets, *as far as practical*, the requirements demanded from it. Many existing terminal airspace structures have been in place, without significant alteration, for a period of thirty years or more and in many cases reflect the requirements of previous generations of aircraft.

The actual terminology and formal structures associated with terminal airspace are reducing in importance. The primary concern now is with the *functions associated with the airspace in question*.

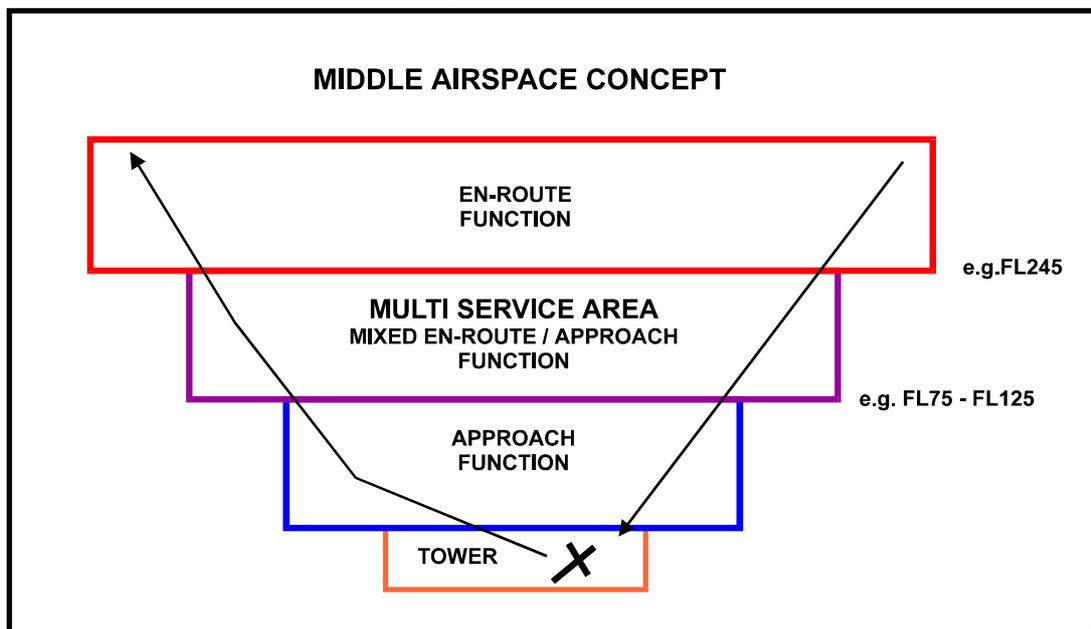
ICAO Doc. 9426, the Air Traffic Services Planning Manual, states:

*The division of responsibilities between APP and ACC requires particularly careful consideration because it can have a significant effect on the capacity of the ATC system at the location concerned, especially as regards the requirement for co-ordination and the workload imposed on both controllers and pilots. It has, for instance, been found that at some busy major aerodromes, the arrangement whereby departing traffic is transferred directly from the aerodrome control tower to a departure control position in the associated ACC, or only that part of arriving traffic which has been brought into a position where it no longer constitutes traffic to other departing or overflying traffic is released to APP by the associated ACC, has contributed to an optimum flow of considerable amounts of air traffic while keeping the workload within manageable proportions. It should, however, be noted that such arrangements depend specifically on the local situation and that they should only be applied after careful consideration of all the relevant factors by all parties concerned.*

*In numerous cases it has been found that arrangements between APP and ACC, which leave the transfer of control of departing as well as arriving traffic between them to **ad hoc** agreements made in the light of the overall traffic situation, have worked well whenever the will on both sides to obtain results has prevailed over the thinking in pure categories of competence.*

The division of responsibility for the provision of ATS is seen as a major influencing factor on terminal airspace capacity. However, it may not be possible to identify clearly the division between en-route and terminal airspace. That airspace associated with the upper en-route function may be distinguishable, as may be the lower levels of airspace in which no significant en-route functions occur and where the approach service is the predominant function. However, there is airspace situated between these areas of airspace in which both the en-route and approach elements are provided. This *middle* airspace may also be called *multi-service* airspace. This is illustrated in Diagram 2-1. However, note that the Flight Levels given are examples only and are not prescriptive.

Diagram 2-1



This *middle* or *multi-service* airspace does not require a formal new airspace designation but can be catered for by:

- a. increasing the upper limit of the area of responsibility of an Approach Control unit.  
*and/or*
- b. lowering the base of the area of responsibility of an Area Control unit.

The *multi-service* tasks associated with the Approach Control function which are carried out in this airspace include:

- transition from the departure phase to the en-route phase
- initial descent management to a holding facility
- radar vectoring for the approach sequence
- lower level en-route services interacting with arriving/departing traffic.

### 5.3.2 The functional division of terminal airspace

ICAO requires that an Approach Control Service shall be provided by an area control centre or by an approach control office when it is necessary or desirable to establish a separate unit.

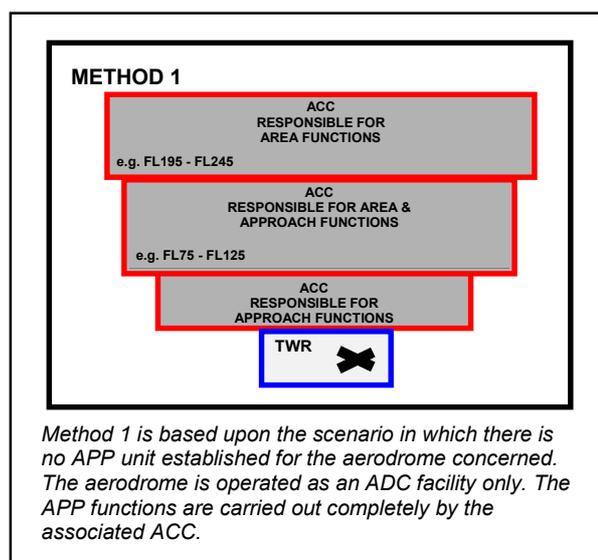
This results in a number of methods being utilised for the division of Approach Control functionality.

Three basic methods of design (in terms of ATC function) may be identified, as follows:

#### Method 1

This type of configuration may be associated with locations at which no Approach facility is established. All functions associated with approach control are carried out by the ACC, as shown in Diagram 2-2. A lower ACC sector may be established with responsibility for the approach function together with its en-route responsibilities. Alternatively, this may be incorporated into one en-route sector dependent upon the existing sectorisation and traffic density.

Diagram 2-2



This method may be more increasingly utilised with the development of combined ACC/APP units in order to reduce co-ordination requirements. In this situation the APP unit is absorbed into the ACC facility and a 'stand-alone' Aerodrome Control (ADC) developed at the aerodrome concerned.

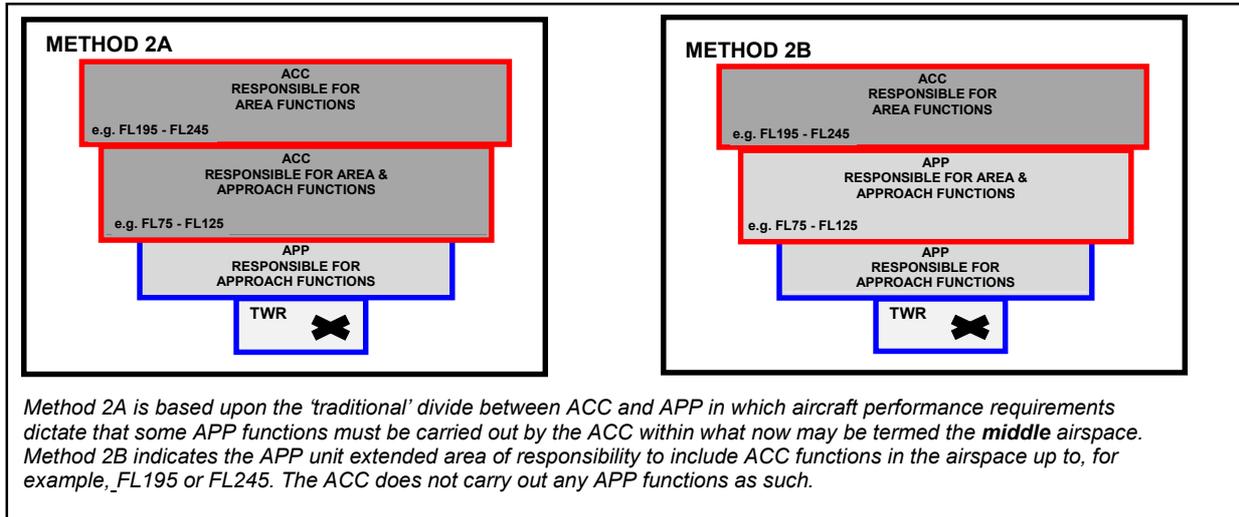
#### Co-ordination procedures associated with Method 1

There is clearly a reduction in overall co-ordination requirements consequent upon the absence of a dedicated APP unit, whilst co-ordination methods used in the ACC will be dependent upon the ACC sectorisation.

**Method 2**

This method involves the division of responsibility by flight level. Dependent upon local circumstances, it may be found that the type of configuration shown here is able to handle substantial numbers of operations in an efficient manner. This method may be further divided into method 2A or 2B, dependent upon whether ACC or APP takes the *middle airspace* function responsibility. These options are depicted in Diagram 2-3.

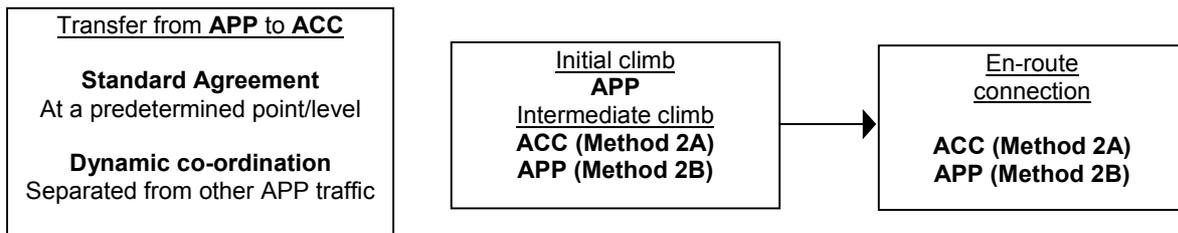
Diagram 2-3



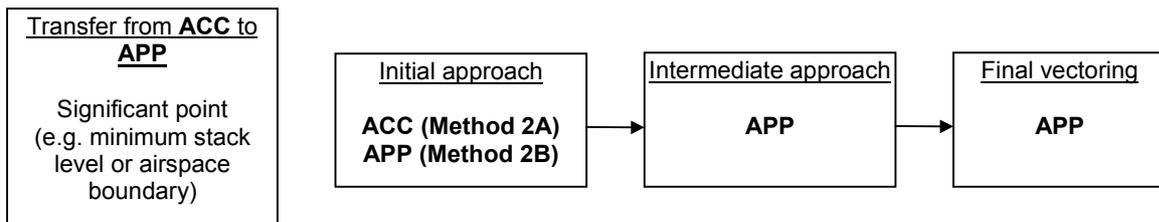
**Co-ordination procedures associated with Method 2**

The functional division associated with Method 2 may be operated by the use of **dynamic co-ordination** (in which each aircraft is subject to individual co-ordination) or by the use of **standard co-ordination** (in which standard procedures for transfer of control are agreed).

**Departing aircraft**



**Arriving aircraft**

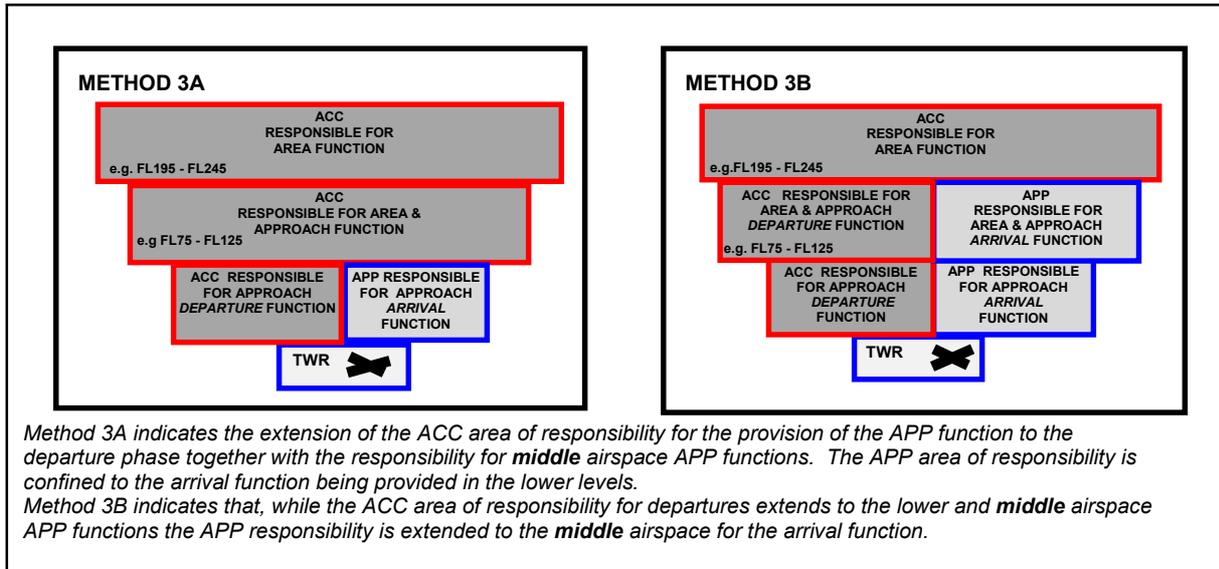


**Note:** SIDs/STARs may not be established. However, if they are, then they may not necessarily be strategically deconflicted.

**Method 3**

An alternative method for handling high density traffic is the division of arrival and departure functions on a geographic basis. This configuration enables co-ordination to be kept to a minimum with regard to departing aircraft and may enable these departing aircraft to utilise a near optimum climb performance. The use of this method will be determined by the local conditions and operational practices in the airspace concerned. Method 3 is also subdivided into 3A and 3B dependent upon the division of responsibility, as shown in Diagram 2-4.

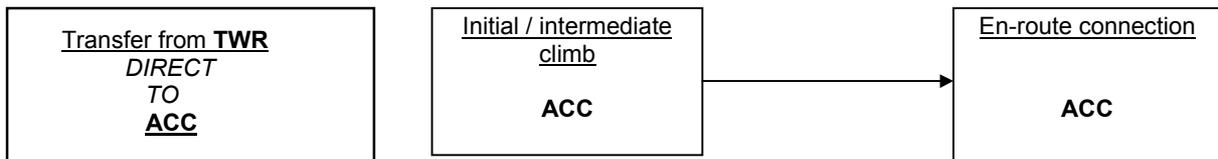
Diagram 2-4



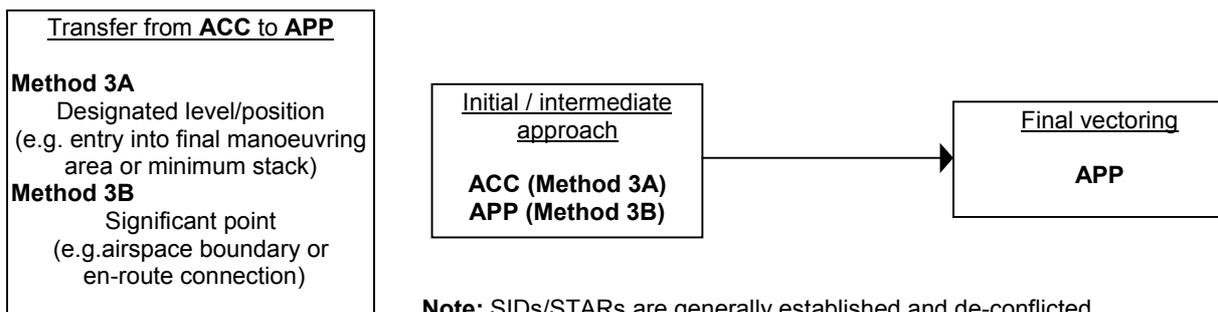
**Co-ordination procedures associated with Method 3**

The functional division associated with method 3 may be operated by the use of **dynamic co-ordination** (in which each aircraft is subject to individual co-ordination) or by the use of **standard co-ordination** (in which standard procedures for transfer of control are agreed). However, due to the complexity of co-ordination associated with Method 3B, a standard co-ordination agreement may be the preferred option.

**Departing aircraft**



**Arriving aircraft**



**Note:** SIDs/STARs are generally established and de-conflicted.

### 5.3.3 Sectorisation of approach control and terminal areas

The functional division appropriate for a particular location will also influence the method of *sectorisation* within that airspace. There may also be more than one airport established at a particular location, and this may dictate the sectorisation requirements. This sectorisation may be a division of responsibility within the approach control unit *itself* or between APP and ACC. The division of responsibility between sectors should be assessed to provide for an optimised total ATC capacity. Flexibility is another consideration when determining sector configuration as the demand upon a sector may not be consistent throughout a given period. The potential for 'collapsing' sectors during periods of reduced traffic demand by combining two or more sectors together in order to optimise resources should also be considered.

The need for the sectorisation of the APP function and actual division of responsibility is site-specific. However, it is likely to be a function of traffic density and associated controller workload. At low density locations it may be possible to operate the APP function as one sector. As density increases, the need for sectorisation may occur. Options for the introduction of sectorisation include the establishment of a final approach director or the division of responsibility between arrival and departure functions. Within terminal airspace a geographic division between arrival and departure sectors or with sectors being divided either side of the runway in use is more common than a vertical division (due to aircraft performance characteristics). Another common consideration is the complexity of operations which is introduced when airports are situated in close proximity to one another. In some cases, there may be advantages to be gained by combining the approach functions of the individual airports, but this is again site-specific and may not always be possible.

#### 5.3.3.1 Sectorisation Considerations

Some of the issues relevant to sectorisation are shown below:

- ATS route structure, entry and exit points, intersections, holding patterns
- aerodromes and runway configurations to be served by the sectors
- flight profiles
- navigation tolerances on ATS routes and holding areas
- airspace required for ATC-initiated flight paths (i.e. vectoring areas)
- routing and flight levels for transit air traffic
- control methods applied to air traffic within the sector
- factors influencing the division of responsibilities and co-ordination between APP and other units
- physical considerations (operational positions, communications and/or radar coverage, etc.)
- other airspace user requirements (e.g. military operations).

*Note: The number of aircraft handled at a given time by a controller in approach control is normally significantly less than a controller in area control. This is due to the generally more complex nature of aircraft operations in the terminal airspace environment.*

#### 5.3.3.2 Sectorisation Options

Sectorisation may occur between ACC and APP operations. In this situation, sectorisation may be established in a similar way to that employed for division of functionality, with responsibility being divided between ACC and APP. Of course, in Method 1 all sectorisation occurs in the ACC operation.

Sectorisation may also be operated with separate Approach sectors. Although these may be used with either Method 2A or 3A, they are more commonly associated with Methods 2B or 3B in which APP has an extended area of operational responsibility.

Some sectorisation options associated with the particular functionality division are given below in Diagrams 2-5, 2-6 and 2-7. These options are not exhaustive and it must be re-emphasised that sectorisation will be site-specific.

Diagram 2-5

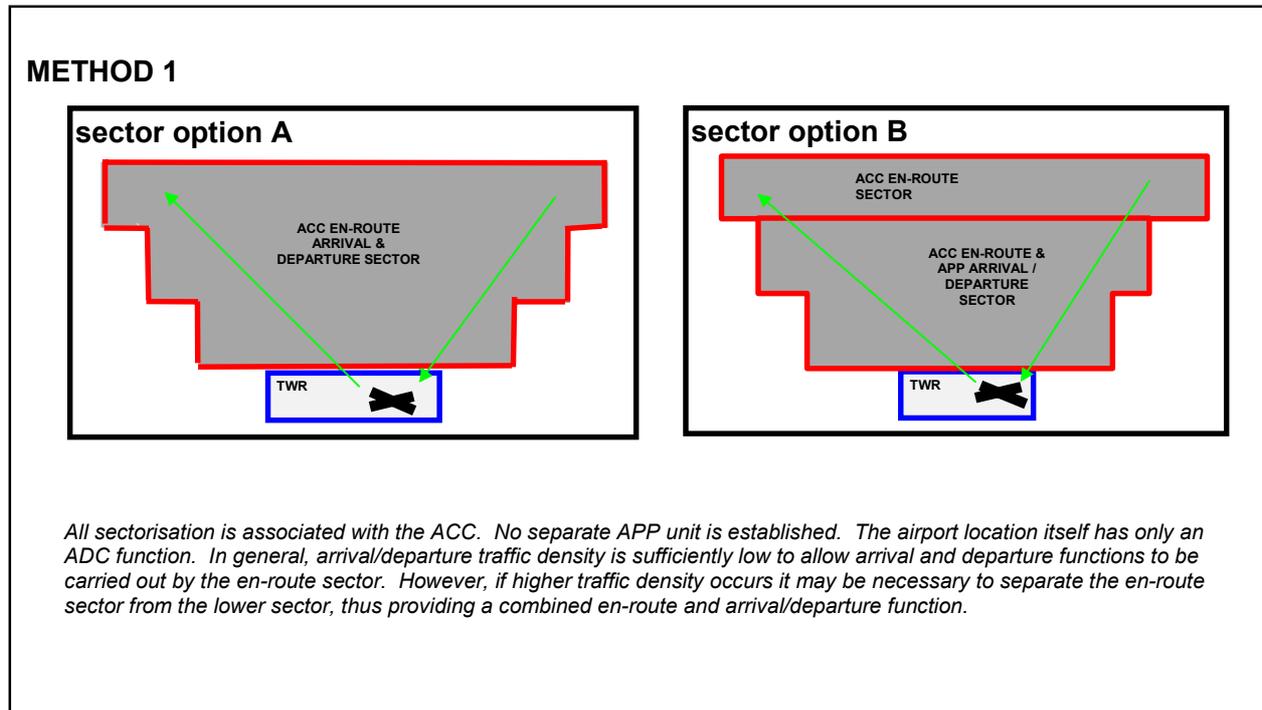


Diagram 2-6

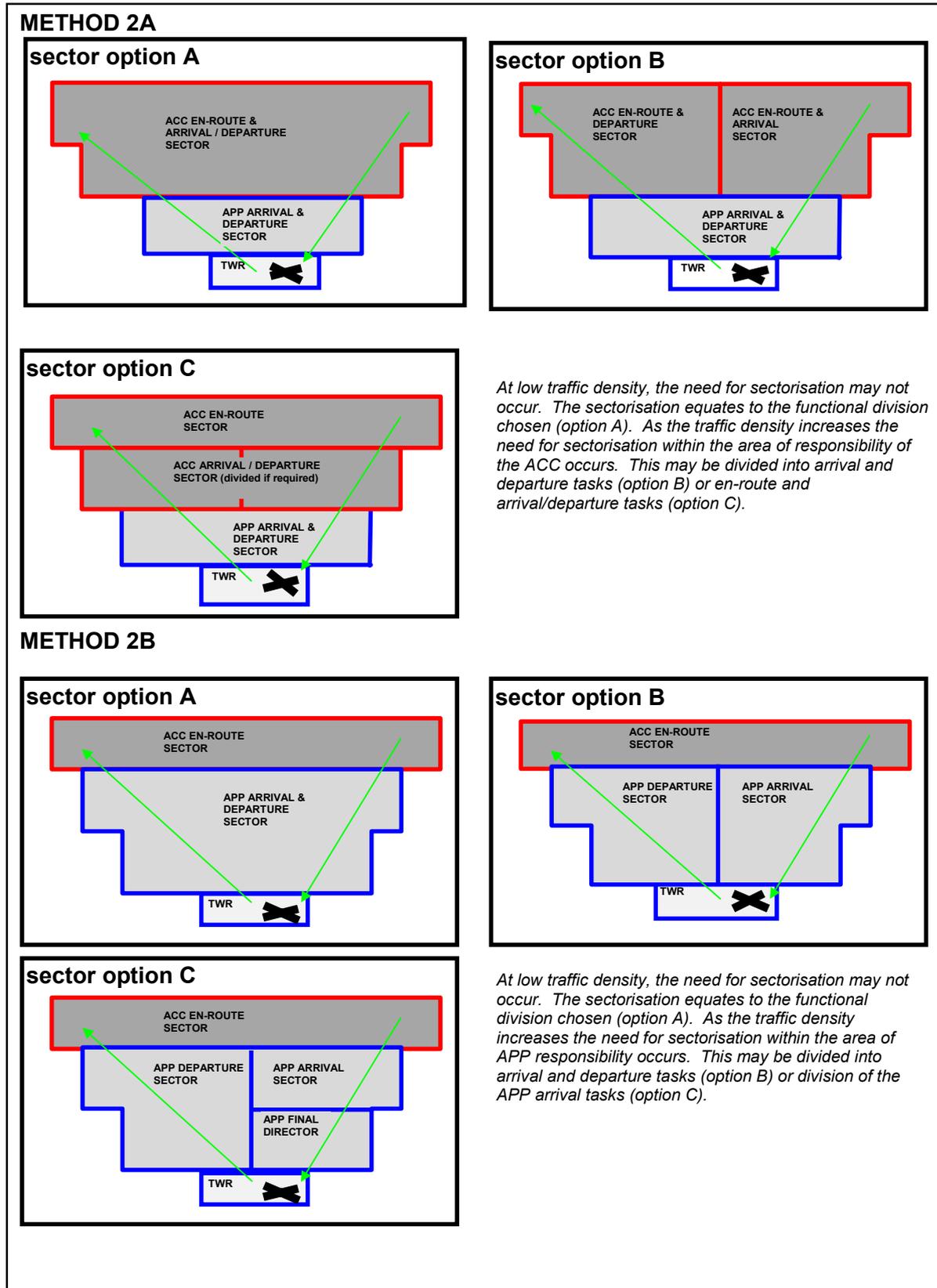
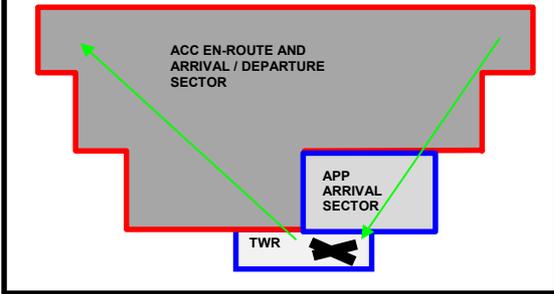


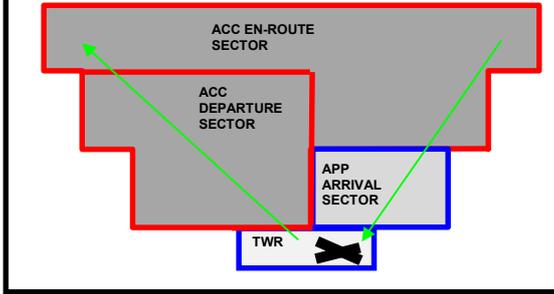
Diagram 2-7

**METHOD 3A**

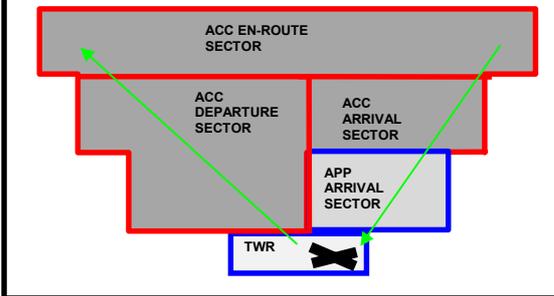
**sector option A**



**sector option B**



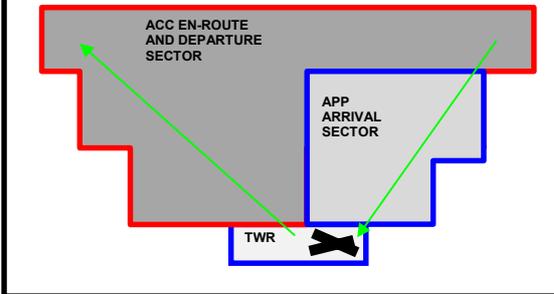
**sector option C**



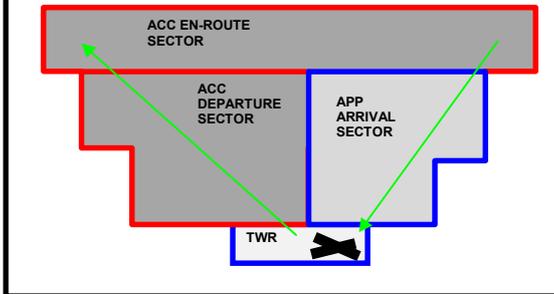
*At low traffic density, the need for sectorisation may not occur. The sectorisation equates to the functional division chosen (option A) in which the APP unit has responsibility for only the final vectoring tasks. As traffic density increases the ACC enroute function is separated from the ACC departure function by the creation of an ACC departure sector (option B). At high traffic density an ACC arrival sector is introduced to separate the ACC arrival function from its enroute responsibilities (option C).*

**METHOD 3B**

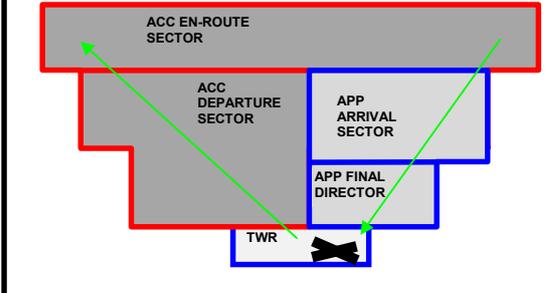
**sector option A**



**sector option B**



**sector option C**



*At low traffic density, the need for sectorisation may not occur. The sectorisation equates to the functional division chosen (option A) in which the APP unit has extended responsibility for the arrival phase. As traffic density increases the ACC enroute function is separated from the ACC departure function by the creation of an ACC departure sector (option B). At high traffic density an APP initial arrival sector is introduced to separate the initial and intermediate arrival function from the final vectoring responsibilities (option C).*

### 5.3.3.3 Co-ordination Procedures Associated with a Divided Approach Function

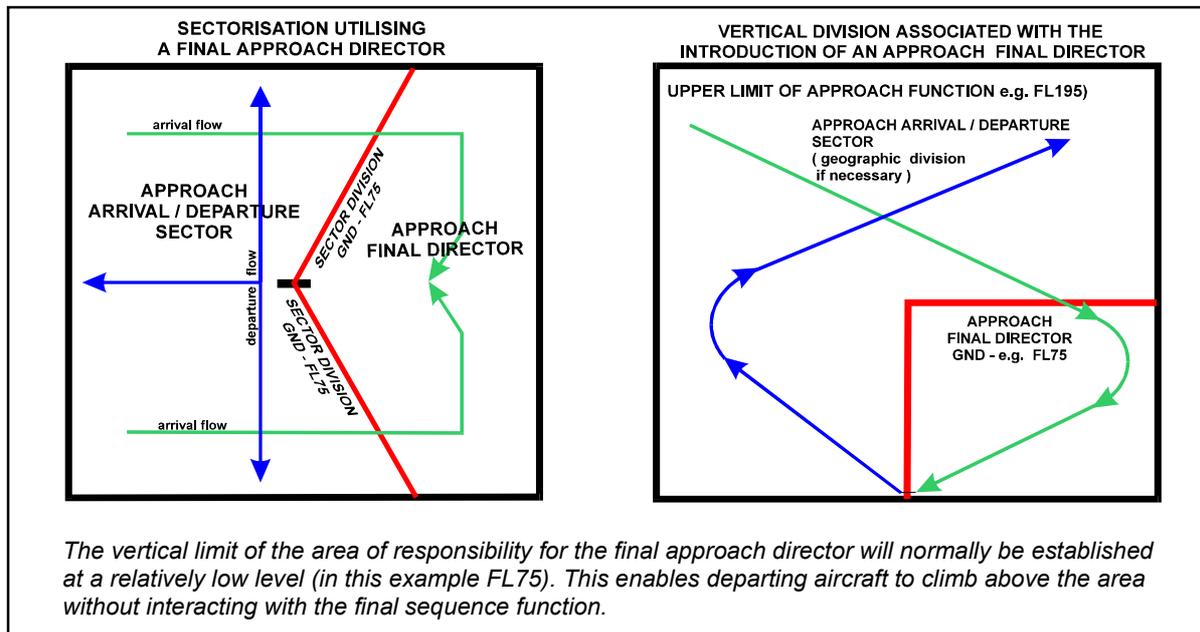
The Approach unit itself may be operated with separate sectors. These may utilise dynamic co-ordination agreements but, due to the relatively small area concerned and the need for multiple co-ordination, standard agreements are usually established.

Alternatively, it may be possible at some locations to divide the arrival and departure tasks *without the need for sectorisation*. This scenario requires highly active dynamic co-ordination to ensure separation is maintained. Careful consideration should be given to effective and efficient co-ordination between adjacent sectors, particularly when dynamic co-ordination will assist in supporting ATC capacity levels. Excessive co-ordination requirements may contribute to a reduction in sector capacity.

### 5.3.3.4 Potential Sectorisation of the Approach Unit

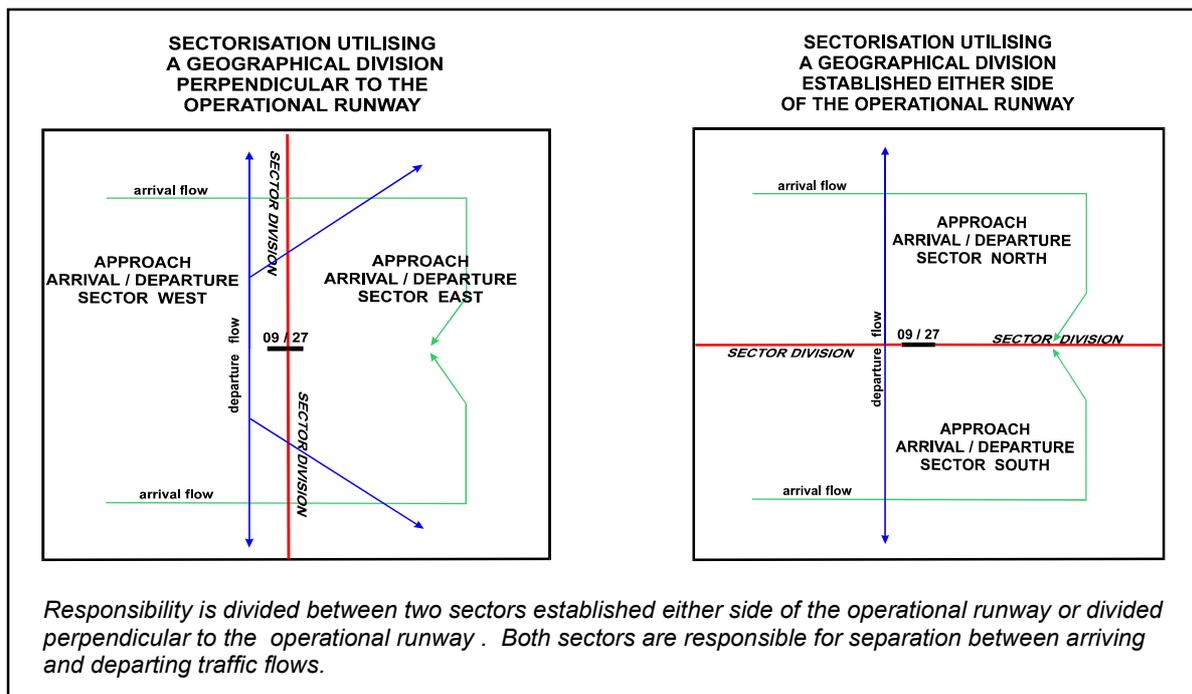
The division of the final approach sequence tasks from other approach tasks may be accomplished by the introduction of a 'final approach director' sector. This sector will be established according to the runway in use and will generally encompass airspace in the immediate vicinity of the final approach area. The vertical extent of such a sector is usually relatively low (e.g. FL75 - FL100). This enables the sector to be dedicated to the task of final approach sequencing without the interaction of other traffic in the terminal area. Diagram 2-8 shows a typical sectorisation in both the vertical and horizontal planes.

Diagram 2-8



Division of the approach unit tasks may also be introduced by geographic sectorisation. The structure of these sectors will be determined by the needs of a specific location. An example of such sectorisation is the division between operations on each side of the runway in use. In this example both sector controllers are responsible for arriving and departing traffic in their assigned sector. The division may also be established perpendicular to the runway in use. Both these options are shown in Diagram 2-9.

Diagram 2-9



## 5.4 TERMINAL AIRSPACE DESIGN

### 5.4.1 The design of terminal airspace structures

It has already been established that terminal airspace structures may be identified in a number of ways. The ultimate aim of all of these structures is to provide a safe system of air traffic control for aircraft operating under Instrument Flight Rules (IFR) in the vicinity of the airport, or airports, concerned. The actual terminology used to identify this airspace is, for operational purposes, of little consequence. However, the design principles upon which this airspace is constructed are very important.

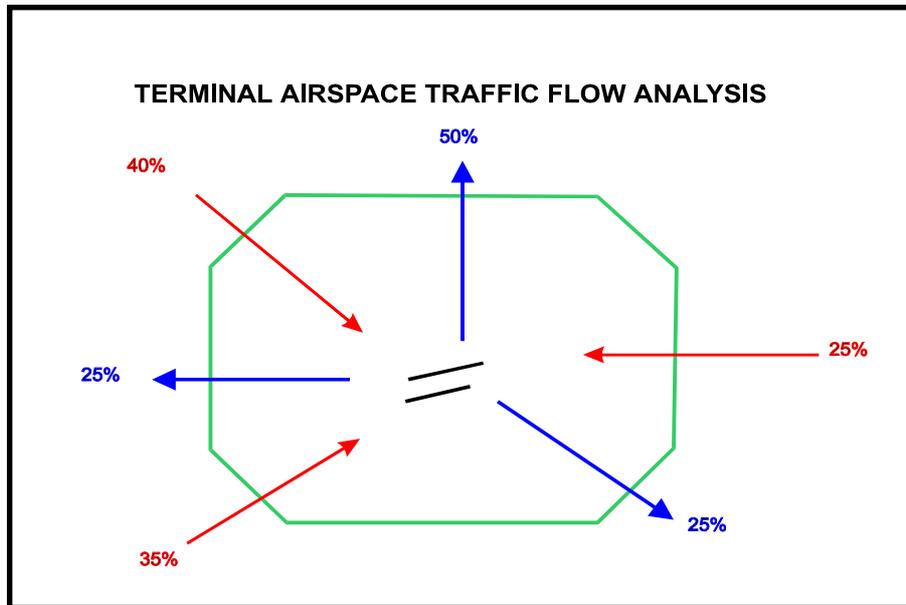
The principles of design of the airspace will have a large impact upon the methods used for separation within the airspace and, therefore, the associated airspace capacity.

As airspace structures have evolved over a number of years it is necessary to carefully analyse existing structures. This analysis should identify the airspace concerned for a specific location.

#### 5.4.1.1 Assessment of Traffic Flows

An assessment of existing traffic or anticipated traffic flows is an important process in the initial stages of terminal airspace design. The characteristics of the traffic flow (bi-directional, multi-directional, etc.) will influence the design and operation of the airspace to a large degree. The development of potential new routes should also be considered. A basic traffic flow assessment is shown in Diagram 3-1.

Diagram 3-1



#### 5.4.1.2 Identification of Airspace in which Approach Control is Exercised

An analysis of aircraft flight profiles may be carried out in order to identify the area in which the approach function is provided. It is not the purpose to identify specifically the top of climb or beginning of descent as these points, in many locations, may be considered an area control function. Rather, it will be a site-specific decision which should take into account such issues as adjacent unit requirements, ACC sectorisation, etc.

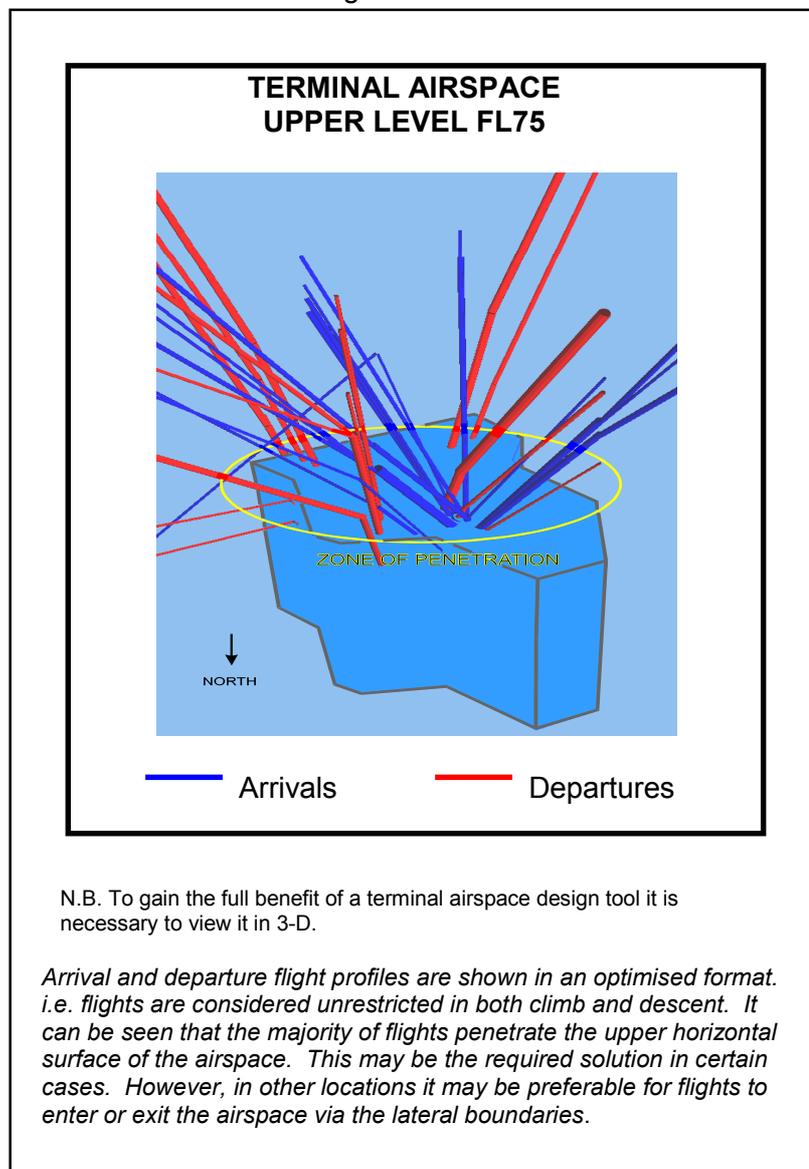
A flight profile analysis may consist of a computer-assisted visualisation of the airspace as shown in Diagram 3-2. This diagram depicts a terminal area with an upper limit of FL75. Optimised climb and descent profiles are shown. A comparison of both standard and existing operational profiles will indicate existing constraints upon aircraft performance although it cannot be stressed too strongly that, in order to utilise the full capability of this tool, it is necessary to view the results in 3-D format. However, if computer-assisted analytical tools are not available, flight profiles may be constructed manually.

#### 5.4.1.3 Development of New Locations

In some locations the requirement for terminal airspace may be associated with a new airport development or the expansion of airport infrastructure at sites which have not previously served the type of operation envisaged. In this situation it is not possible to utilise an existing traffic sample to carry out a flight profile analysis or to determine traffic flow characteristics. When this occurs a traffic sample can be constructed utilising the aircraft types and routes that it is considered will form the basis of aircraft operations. In addition to flight profile and route issues, the requirement for navigation aids, the location of such facilities and other influencing factors, e.g. existing airspace constraints will determine the design of the terminal airspace.

When a new location is being developed it is important that reviews of the operation are carried out at regular intervals to ensure that the need for alteration of the structure, if required, is identified at an early stage.

Diagram 3-2

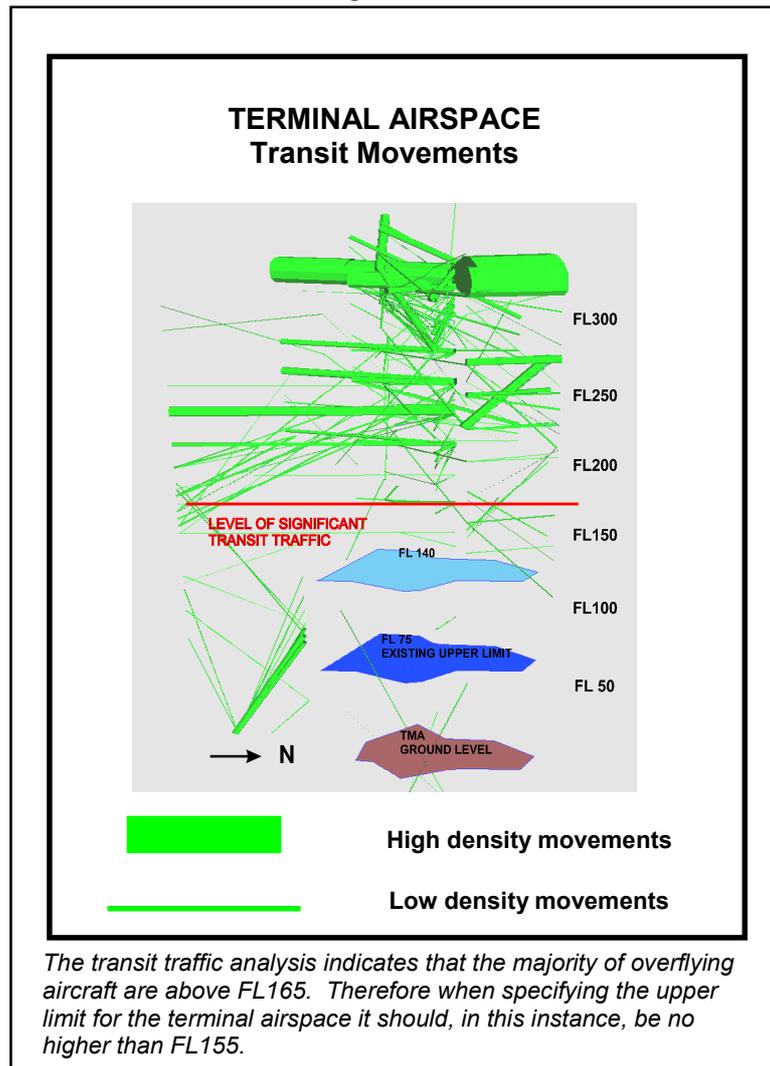


#### 5.4.1.4 Identification of Overflying Traffic Flows

When designing the airspace in which the Approach function is to be carried out, an underlying principle should be to avoid the inclusion of overflying aircraft to the greatest extent possible. Therefore the identification of significant transit traffic flows is imperative. Again, computer-assisted tools may easily identify these traffic flows. Diagram 3-3 indicates a typical analysis of transit aircraft movements. In this example the existing upper limit of the terminal area is FL75. It might be considered that the terminal airspace management could be improved by raising this upper limit and the analysis shown here indicates that the upper limit may be raised as high as FL155 without introducing significant transit traffic flows into the terminal area.

In some locations restrictions are imposed upon aircraft wishing to transit via an area of terminal airspace. These restrictions may require the aircraft to route around or above the airspace in question. However, in many locations this is not considered an acceptable solution.

Diagram 3-3



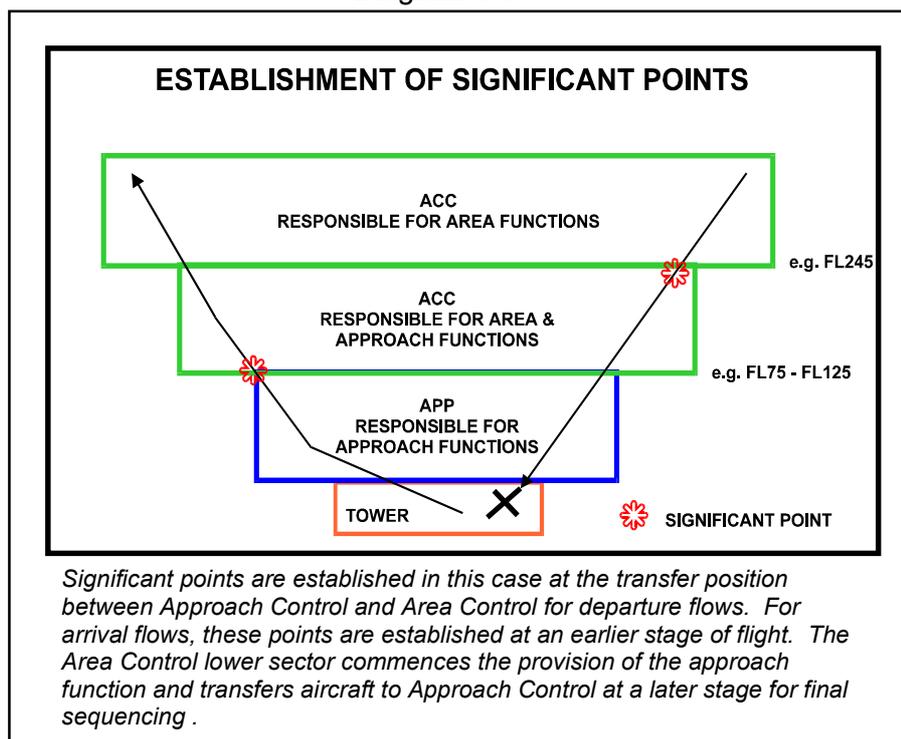
#### 5.4.1.5 Establishing the Connection with the En-route Environment

The dimensions required for a particular area of terminal airspace may not be laid down in definitive documentation. However, the establishment of *significant points*\* at which it is considered that aircraft transfer from the en-route phase to the approach phase (and vice versa) for a particular area will assist in defining dimensions.

The choice of location for these *significant points* will depend to a large extent upon the selection of the terminal airspace *functional methodology* to be applied. The position of these *significant points* will not necessarily coincide with the top of climb or beginning of descent if this is considered to be an area control function at the given location. For example, if functional design Method 2A is selected, the location of the *significant point* may well be at an earlier stage of the departure route (e.g. between FL75 and FL125). The arrival route *significant point* may also be established at an earlier stage (e.g. at FL245). This is illustrated in Diagram 3-4 .

\* ICAO definition - A significant point is a specified geographical location used in defining an ATS route or the flight path of an aircraft and for other navigation and ATS purposes.

Diagram 3-4



## 5.4.2 Operational practices within the defined terminal area

Operations within the area established as being associated with the APP function (i.e. that area contained within the confines of the defined *significant points*) will be associated with the aerodromes served by that terminal airspace. The operational practices utilised by the location concerned are dependent upon a number of factors. These include:

- a. traffic density.
- b. flow complexity.
- c. type of aircraft operations.
- d. local conditions and/or restrictions.
- e. RNAV requirements and/or navaid infrastructure.
- f. Other user activity (e.g. military requirements).

At many airports, notably those with a low density of aircraft operations, operational practices may be flexible with no formalised arrival (STARs) and departure (SIDs) routes established. At other locations and where appropriate, formal arrival and departure routes should be used. These can be published in the form of SIDs and STARs or by agreed operating procedures for controllers.

### 5.4.2.1 The Establishment of SIDs and STARs

SIDs and STARs should be established, when required, to facilitate:

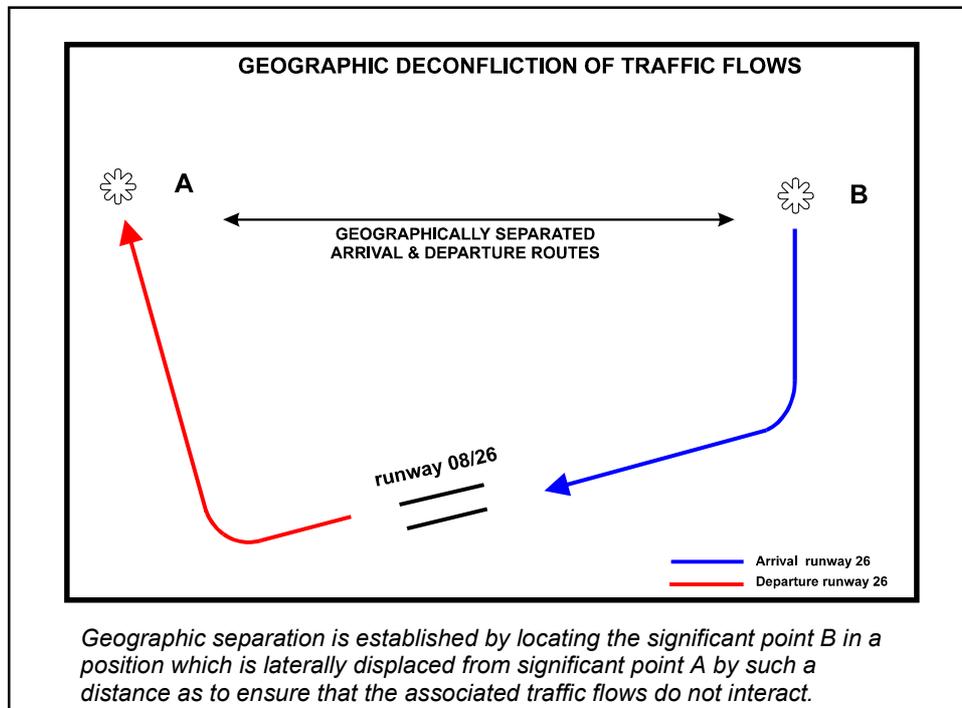
- a. the maintenance of a safe, orderly and expeditious flow of air traffic.
- b. the description of the route and procedures in ATC clearances.
- c. the reduction of workload.
- d. the potential for an increase in capacity.
- e. the coding of navigation databases.
- f. the support of modern flight data processing systems.

Generally, such routings are established at the busier locations where the traffic flows are complex. Where possible, such routes should be strategically deconflicted. This may be achieved on a *geographic* basis or on a *vertical* basis or by a combination of both methods. The goal of strategic deconfliction is the operation of a steady and routine stream of arriving and departing aircraft, thereby providing for an overall increase in capacity. However, at many locations, capacity is further enhanced by tactical radar vectoring in order to 'fine tune' the traffic flows.

#### 5.4.2.2 Geographic & Vertical Deconfliction of Traffic Flows

*Geographic* separation is established by deconflicting traffic flows on a *lateral* basis. This principle is shown in Diagram 3-5. The use of *geographical* separation may, in many cases, provide for an optimised aircraft performance. This is due to the fact that climb and descent profiles will not be interfered with to a great extent. However, the application of *geographic* separation may result in extended track mileage for arriving or departing aircraft.

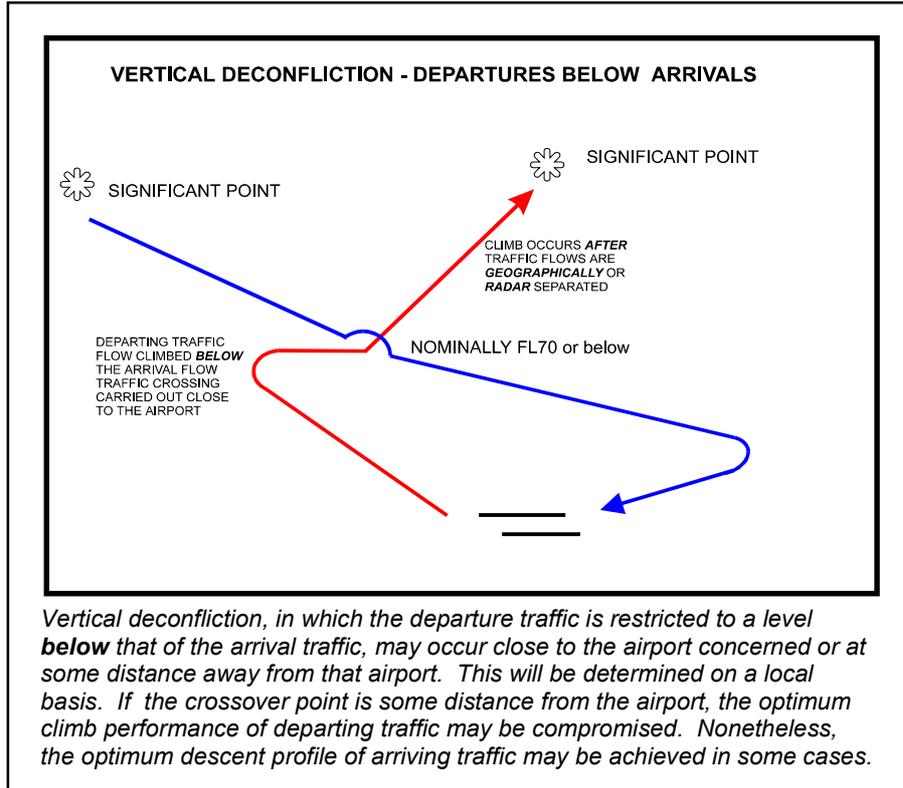
Diagram 3-5



The use of *vertical* separation may allow for more direct routing and thus reduced track mileage compared to the use of *geographic* separation. However, climb and descent profiles may be compromised. This may be minimised by analysing traffic flow confliction points and associated levels.

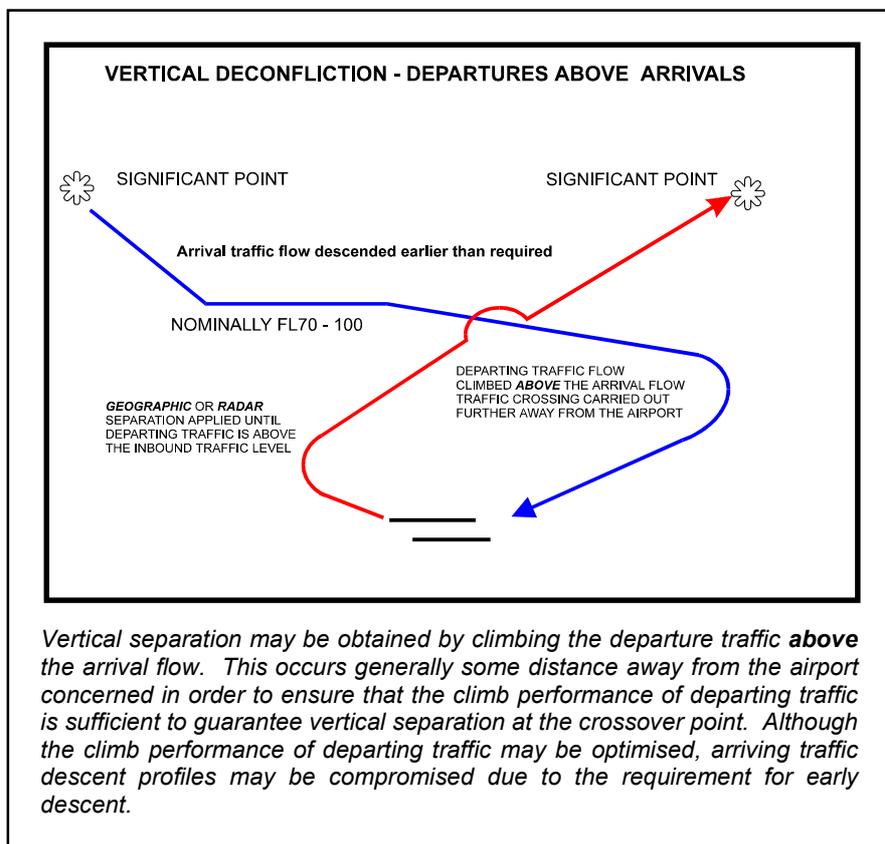
When considering separation of arrival and departure flows by *vertical* means, it must be determined at what distance from the airport concerned the traffic flows will cross. This may be close to the airport and, in consequence, the departing traffic will be restricted to a level below that of the arrival traffic. In this case, the vertical division will be determined on a local basis but, in general, the crossover point will occur at FL70 (nominally) or below. This is indicated in Diagram 3-6. In some cases it may prove an advantage to arrange the arrival tracks to route *overhead the airport*. This may allow an unrestricted climb for departing aircraft.

Diagram 3-6



If the crossover point is at some greater distance from the airport, the possibility of departing traffic being climbed *above* the arrival flow may be considered, as shown in Diagram 3-7.

Diagram 3-7



The performance of the aircraft concerned must be considered when determining the method to be utilised. If a choice is made to restrict departing aircraft to a level below that of arriving traffic this should normally be carried out close to the airport concerned to minimise the effect on aircraft climb and descent performance. The determination of the area for such a crossover will be influenced by local conditions. However, in order to allow sufficient time and airspace for the further descent of arriving traffic to final approach a crossing towards the start of the downwind leg may be beneficial.

If it is decided to climb departing aircraft above the arrival traffic flow, it is necessary that the area for such a crossover point is established in a location that will ensure that the climb performance of departing aircraft is sufficient to ensure that vertical separation will exist at the point of crossing. A crossover towards the end of the downwind leg may in this instance be advantageous, allowing a greater track mileage for departing aircraft to achieve the higher level required for the crossing. Correspondingly, arriving traffic will be at a lower level in this area.

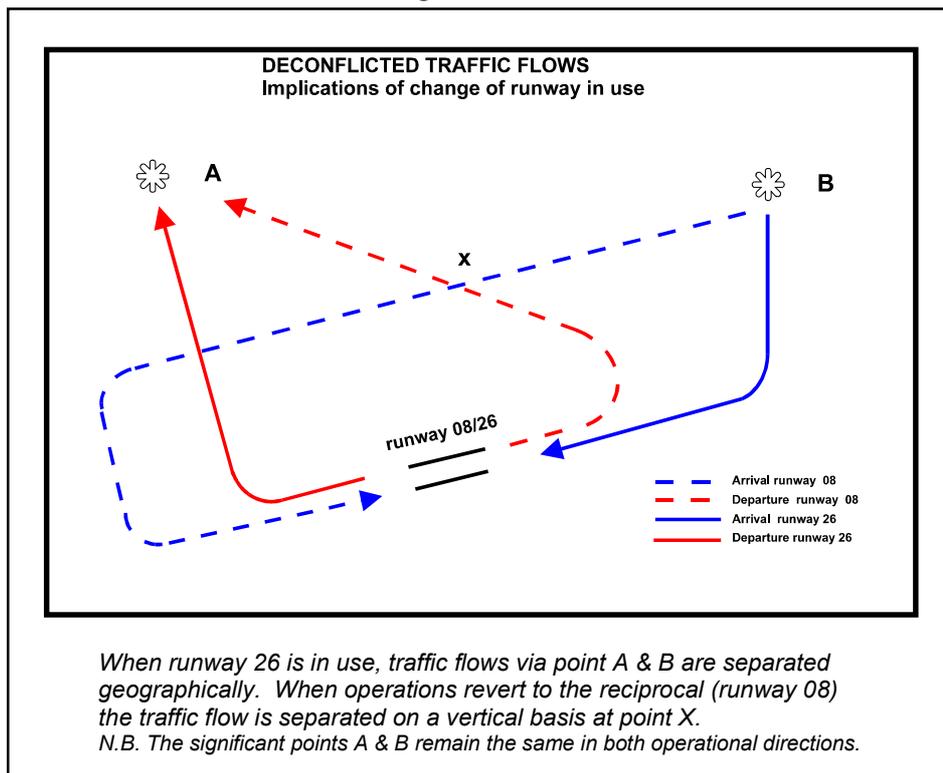
#### 5.4.2.3 Preferential Runway Requirements

The majority of airports have a preferential runway system. The determination of this preferential runway may be dictated by factors such as:

- a. prevailing wind conditions.
- b. environmental considerations.
- c. provision of approach procedures.
- d. terrain.

The preferential runway may be in use for a significant majority of the time and traffic flows will, in the main, be developed to optimise operations on that runway. When operations revert to a runway other than the preferential runway, they may be made more difficult and less efficient due to the introduction of conflicting traffic flows etc. Terminal airspace should ideally be designed so that capacity is maintained whichever runway is in use. One method of achieving this is to move towards a design in which traffic flows separated geographically revert to vertical separation and vice versa as runway operations change. This is shown in Diagram 3-8. However, many influencing factors such as environmental considerations will mitigate against this principle.

Diagram 3-8

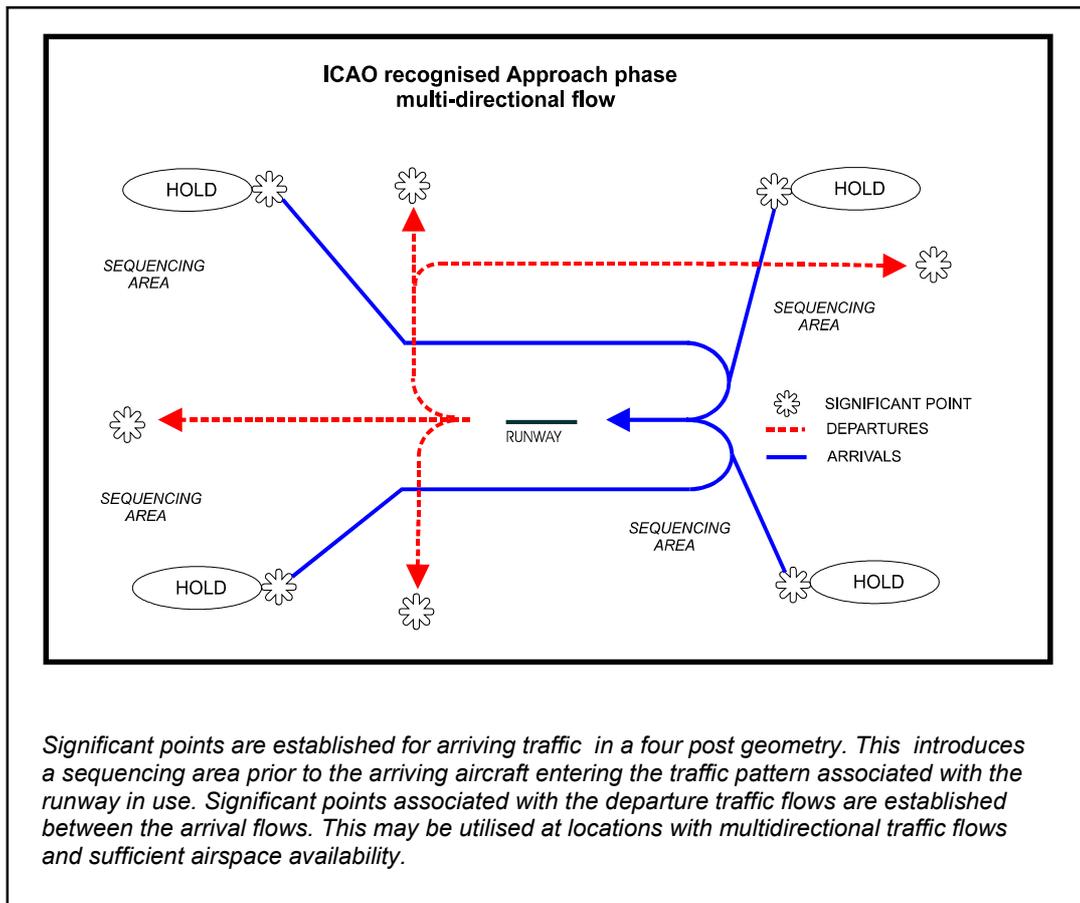


### 5.4.3 Idealised location of the significant points

#### 5.4.3.1 The Four Post Multi-Directional System

In a theoretical environment in which traffic flows arrive and depart from a number of directions the airspace design, based upon the deconfliction of traffic flows by vertical or geographical means, may tend towards a *four post* system in order to incorporate the principles of strategic deconfliction. This is illustrated in Diagram 3-9. This provides for a sequencing area prior to the arriving aircraft entering the traffic pattern associated with the runway in use (downwind, base and final approach legs). This sequencing area is used to establish the desired landing sequence. *Significant points* associated with departing traffic flows are established between the arrival traffic flows.

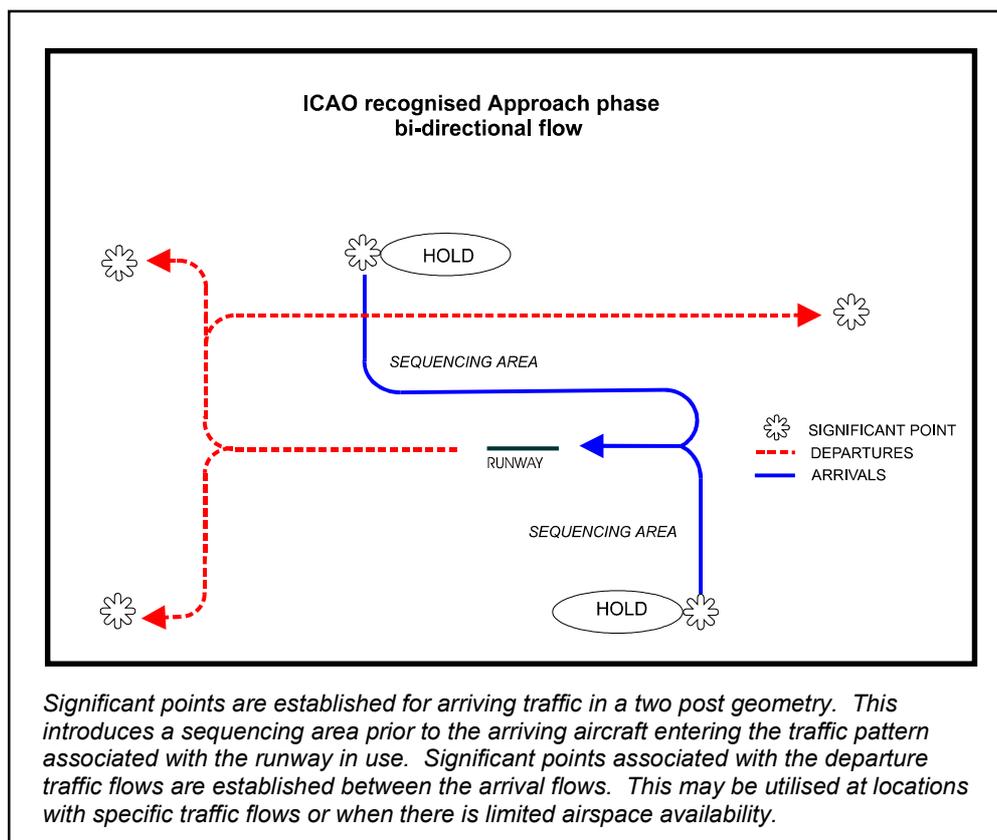
Diagram 3-9



The four post multi-directional system may be utilised when there is sufficient airspace available. However, in Europe, many locations have limited airspace availability. This limitation, together with other constraints such as traffic flows and runway geometry, will result in few locations being able to apply this concept in its entirety.

The four post multi-directional system may be varied by introducing a two or three post system where traffic flows and constraints dictate that this is the preferred option. A bi-directional system is illustrated in Diagram 3-10.

Diagram 3-10



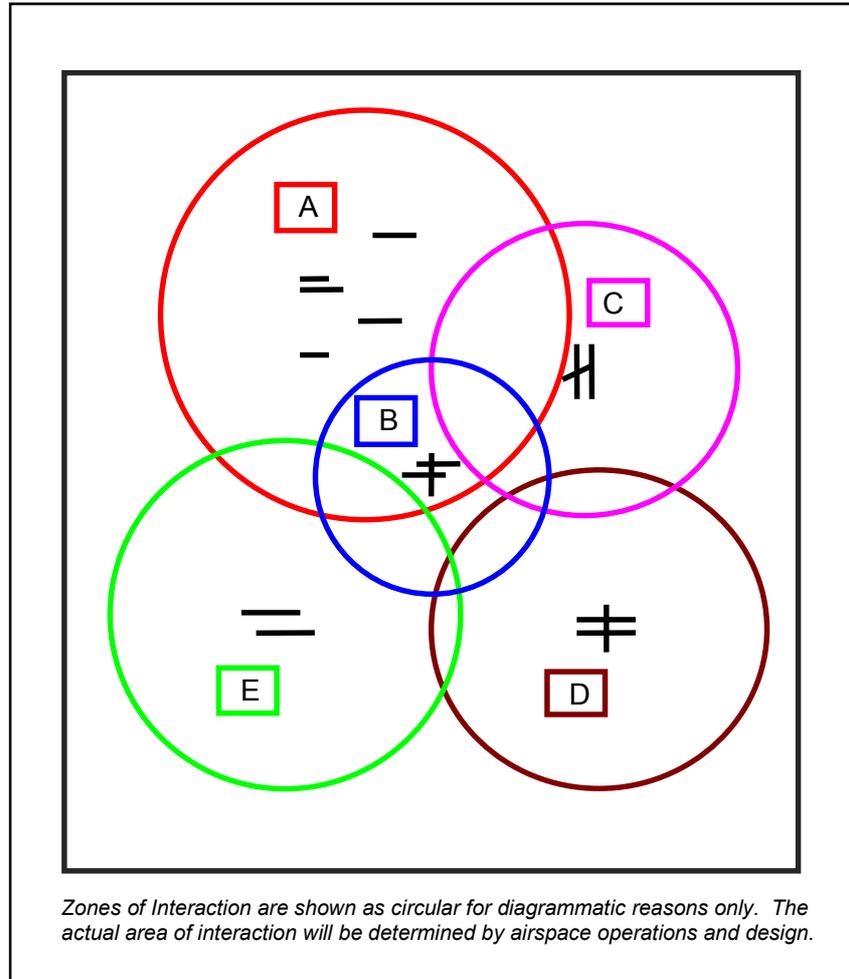
#### 5.4.3.2 Establishing a Consistent Relationship with the En-route Environment

Altered traffic flows within terminal airspace when runway changes occur are, to a large degree, inevitable as the traffic origin/destination requirements will remain the same no matter which runway configuration is used. It is generally desirable that the choice of runway in use at an airport and the consequential utilisation of SIDs and STARs should be neutral in impact on the en-route system. Therefore traffic flows entering or leaving the terminal area *beyond* the defined *significant points* should ideally remain constant and should not be determined by internal terminal airspace traffic flow requirements. The rationale underlying this is that the change of traffic flows caused by a switch of runway would introduce a level of non-standardisation and unpredictability into the en-route system. This, in turn, could adversely affect en-route sector capacity and require variable flight plan routing.

#### 5.4.4 **Zones of interaction**

It is evident that the redesign of an individual area of terminal airspace may have implications for other areas of terminal airspace in the immediate vicinity, as shown in Diagram 3-11. What is not so obvious is that this impact may extend to operations in areas some considerable distance away. The extent of this influence is an unknown factor, but will be a function of traffic (the number of airports within the airspace, the number of runways associated with these airports, etc. being influencing factors). For example, the area of influence of Amsterdam Schiphol airport is considered to be in the region of 100 NM (source: Director Operations Schiphol ATC). Even more complex multi-airport airspace may well exert influence as far away as 200 NM or more.

Diagram 3-11



The implications for such a concept are important for areas in which the *significant points* overlap. The internal traffic flow operations of one area will be linked to the operations of other overlapping areas. The actual route of aircraft proceeding from one such airspace may be determined by the utilisation of runways at aerodromes associated with other overlapping terminal airspace. In this situation, close co-ordination in planning and operations is vital in order to integrate the systems in an efficient manner. In such locations the application of ICAO Standards and Recommended Practices should be harmonised where possible.

## 5.4.5 Delegation of ATS

### 5.4.5.1 The Principles of Delegation of ATS

The delineation of airspace should be related to the need for efficient service rather than to national boundaries. Many areas of terminal airspace are located adjacent to a national boundary. To provide an optimised airspace design in this circumstance it may be necessary for the operations of a State's air traffic services to extend into the territory of the adjacent State. ICAO makes provision for this situation by the introduction of the concept of Delegation of Air Traffic Services. Guidance on the basic principles of Delegation of Air Traffic Services is given in Annex 11 to the Chicago Convention. (see Section 6)

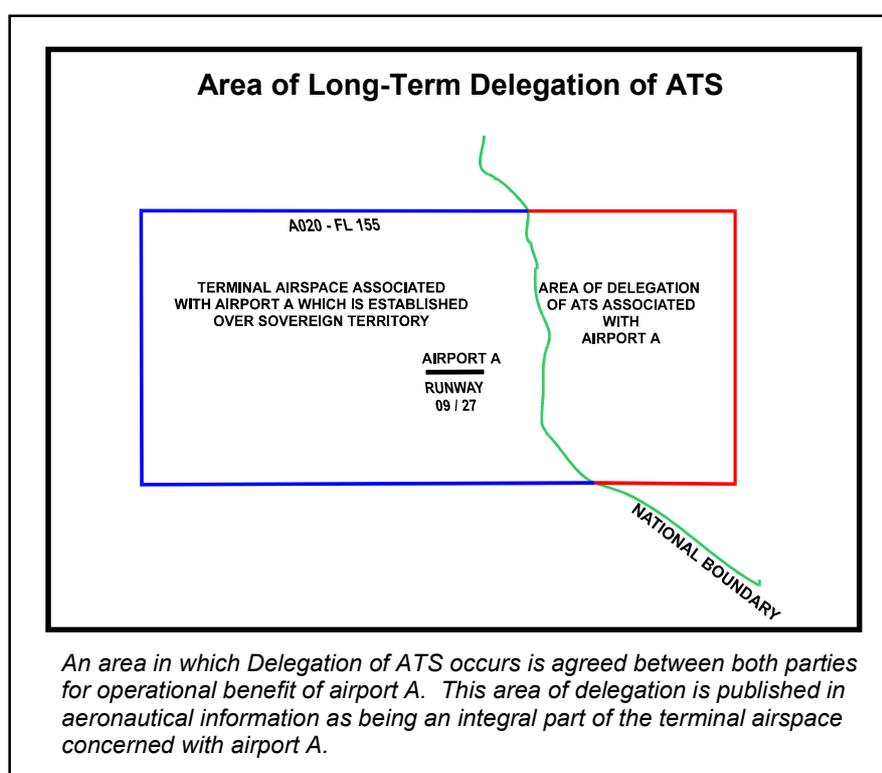
*N.B. It must be noted that generally the notion 'Delegation of Airspace' is **not** utilised as this may imply the transfer of sovereign rights associated with the airspace concerned.*

The concept of Delegation of ATS is intended to permit the delineation of airspace lying across national boundaries when such action will facilitate the provision of air traffic services. This may be established on a long-term or short-term basis.

#### 5.4.5.2 Long-Term Delegation of ATS

Delegation of the responsibility for the provision of ATS to another State can be agreed on a long-term basis as illustrated by Diagram 3-12. The availability of the airspace concerned will not be withdrawn or the conditions for use modified without prior consultation with the providing State. Operationally, the airspace appears as an integral part of the terminal airspace that the delegation is intended to facilitate. In the situation where a State delegates to another State the responsibility for the provision of ATS in a portion of the airspace above its territory on a 'long-term' basis, both the Delegating and Providing State should publish all relevant information regarding the portion of airspace concerned in their national AIPs.

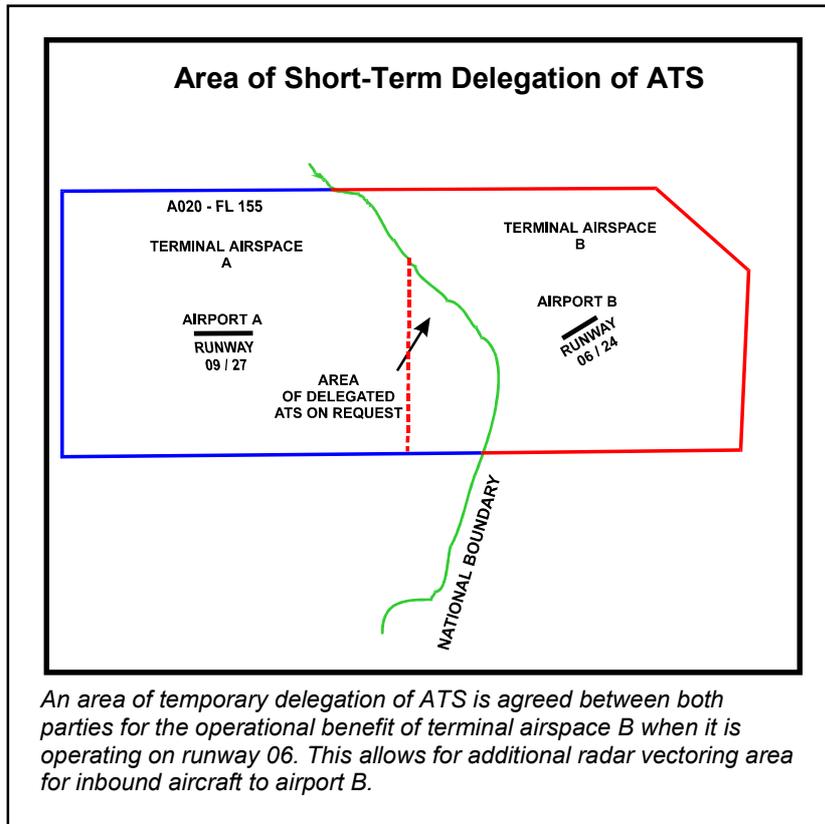
Diagram 3-12



#### 5.4.5.3 Short-Term Delegation of ATS

Delegation of the responsibility for the provision of ATS to another State can also be agreed on a temporary basis as shown in Diagram 3-13. The availability will be for a limited period of time as determined by both parties. This principle may be associated with a specific situation e.g. the use of a particular runway. In the situation where a State delegates to another State the responsibility for the provision of ATS in a portion of the airspace above its territory on a 'short-term' basis, information relating to the portion of airspace concerned *may not necessarily be published in national AIPs*.

Diagram 3-13



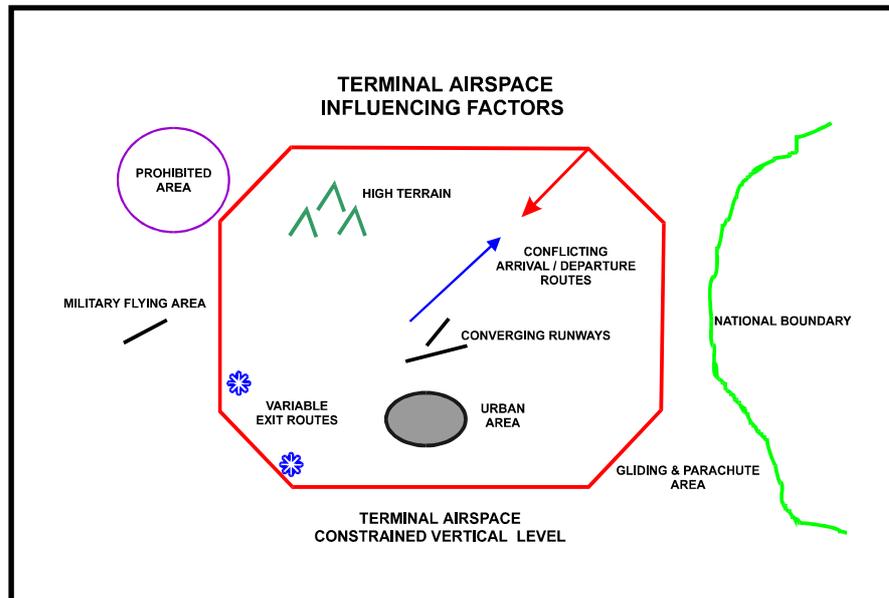
#### 5.4.5.4 Zones of Interaction and Delegation of ATS

The principles involved with Delegation of ATS may also be associated with the concept of the Zones of Interaction in which the operations of one airport are directly affected by the proximity of another airport. An analysis based upon the Zones of Interaction concept may identify areas in which Delegation of ATS may enhance operations of one, or more, airports.

### 5.5 INFLUENCING FACTORS & IDENTIFIED PROBLEMS

There are a multitude of influencing factors with regard to terminal airspace design and management. The number and effect of these factors will vary from location to location. However, a *general* view of potential influencing factors and associated problems may have validity. In many cases, capacity-restricting factors may be found to originate from a source significantly different from that first presumed. Some of these constraints are studied below and illustrated in Diagram 4-1.

Diagram 4-1



Type of constraint affecting terminal airspace	Effect of the constraint upon terminal airspace operations	Potential solution to alleviate the constraint (not prioritised)
Airport Geometry		
Insufficient parking area or airport terminal capacity.	Landing restrictions imposed leading to holding delays & airspace congestion.	<ol style="list-style-type: none"> <li>1. Additional infrastructure development.</li> <li>2. Introduction of flow control measures.</li> </ol>
Incomplete or non-optimised taxiway system.	Increased Runway Occupancy Time leading to increased separation on final approach.	<ol style="list-style-type: none"> <li>1. Additional taxiway provision.</li> <li>2. Introduction of other available runway options.</li> </ol>
Converging and/or intersecting runway approaches.	Increased final approach separation in IMC conditions.	<ol style="list-style-type: none"> <li>1. Introduction of Converging Runway Display (CRDA).</li> <li>2. Development of independent converging runway approaches.</li> <li>3. Deconfliction of missed approach procedures.</li> </ol>
Use of secondary runway - other than the reciprocal.	Requires sector alteration within the terminal airspace leading to reduced capacity.	<ol style="list-style-type: none"> <li>1. Reconfiguration of sectors.</li> <li>2. Introduction of greater flexibility in sector design.</li> </ol>
Lack of approach aids (including lighting) associated with secondary runway.	Visual manoeuvring required resulting in increased separation.	<ol style="list-style-type: none"> <li>1. Installation of approach aids/lighting for the secondary runway.</li> <li>2. Explore the possibility of using non-ground-based systems.</li> </ol>

Type of constraint affecting terminal airspace	Effect of the constraint upon terminal airspace operations	Potential solution to alleviate the constraint (not prioritised)
<p>Parallel runway lateral separation distance below ICAO prescribed minima.</p>	<p>Inability to operate independent parallel approaches.</p>	<ol style="list-style-type: none"> <li>1. Implementation of ICAO requirements for parallel approaches to runways 1035 m or more apart.</li> <li>2. Dependent parallel approach operations (i.e. use of diagonal separation on final approach to both runways).</li> <li>3. Segregated operations of parallel runways.</li> </ol>
<p>Use of reciprocal runway to the main runway.</p> <p>N.B. main runway = the runway with the highest usage</p>	<p>SID/STAR design for the main runway is not compatible with operations on the reciprocal runway. This leads to reduced capacity.</p>	<ol style="list-style-type: none"> <li>1. Redesign of SIDs/STARs to provide a 'mirror image' structure.</li> <li>2. Use of vertical separation rather than geographical segregation for reciprocal operations.</li> </ol>
<p>Use of reciprocal runway - lack of airspace availability.</p>	<p>Reduced airspace available for radar vectors and consequent airspace congestion as well as a reduction in the protection area available for procedure design.</p>	<ol style="list-style-type: none"> <li>1. Increase in lateral size &amp; depth of terminal airspace.</li> <li>2. Agreement with adjacent users for areas of 'dynamic airspace' to be provided.</li> </ol>
<p>Lack of runway capacity.</p>	<p>Resulting in holding delays, extended routing &amp; airspace congestion.</p>	<ol style="list-style-type: none"> <li>1. Construction of additional runway facility.</li> <li>2. Utilisation of other airports in the vicinity.</li> <li>3. Introduction of runway capacity enhancing procedures.*</li> </ol> <p>*e.g. reduced final approach spacing &amp; anticipated separation.</p>

Type of constraint affecting terminal airspace	Effect of the constraint upon terminal airspace operations	Potential solution to alleviate the constraint (not prioritised)
Multiple airports in close proximity to each other.	A non-integrated system leads to reduced potential capacity at one or more of the airports concerned.	<ol style="list-style-type: none"> <li>1. Provide an integrated approach system for the appropriate airports.</li> <li>2. Deconflict SIDs/STARs for the airports concerned.</li> <li>3. Develop facilities at one location &amp; close secondary airports.</li> </ol>
User requirements		
Military flying area adjacent to the terminal airspace.	<p>Reduced radar vectoring area available, leading to additional workload for the controller and airspace congestion.</p> <p>Extended routing in order to avoid military area.</p>	<ol style="list-style-type: none"> <li>1. Introduction of the Flexible Use of Airspace principles.</li> <li>2. Dynamic co-ordination introduced between appropriate civil &amp; military ATSUs.</li> <li>3. Adapt civil procedures to accommodate military use.</li> <li>4. Relocation of military training areas.</li> </ol>
Military flying area within the terminal airspace. (possibly due to a military airfield being located within the airspace concerned).	Restrictions imposed upon radar vectoring area imposing additional workload upon the controller as well as restricted aircraft manoeuvring ability.	<ol style="list-style-type: none"> <li>1. Introduction of the Flexible Use of Airspace principles.</li> <li>2. Integration of the civil &amp; military ATSUs.</li> <li>3. Relocation of military flying area. (possibly introducing an entry/exit lane to the military airport ).</li> </ol>
Required access of VFR aircraft to the main airport within the terminal airspace concerned.	Reduces available runway capacity for commercial IFR operations. Increases airspace traffic density.	<ol style="list-style-type: none"> <li>1. Provide an appropriate airspace structure in order that access is available with the minimum possible penetration of controlled airspace.</li> <li>2. Introduction of specific VFR routes.</li> <li>3. Relocate VFR operations to other adjacent locations.</li> </ol>

Type of constraint affecting terminal airspace	Effect of the constraint upon terminal airspace operations	Potential solution to alleviate the constraint (not prioritised)
Required access of VFR aircraft to a satellite airport within the terminal area.	Increases airspace traffic density & provides additional controller workload.	1. Provide entry / exit corridors and appropriate airspace classification.
Aviation sports activities within or adjacent to the terminal airspace.	Increased airspace density & sterilised areas of airspace.	1. Introduction of dynamic co-ordination between ATSU & sport organisation. 2. Relocation of sport activity area.
Different requirements of aircraft operators within the terminal airspace. e.g. aircraft with diverse performance capabilities.	Multiple requirements may introduce additional complexity into the airspace or prejudice other users.	1. Standardise all operations to accommodate all users. 2. Provide separate routings for certain categories of aircraft. 3. Modify instrument approach procedures for certain categories of aircraft.
<b>National boundaries</b>		
The proximity of an airport to a national boundary.	Reduces the availability of terminal airspace resulting in reduced radar vectoring area and extended routing.	1. Introduce the concept of delegation of ATS on a long-term basis. 2. Provide for flexibility of areas of airspace by temporary delegation of ATS.
Within areas of airspace in which delegation of ATS occurs, different rules of the air and airspace classification are applicable.	Provides an uncertain basis for the provision of ATS. May introduce a more complex ATC environment.	1. Standardisation of airspace classification. 2. Introduce Letters of Agreement including delegation issues. 3. Clear identification of such differences in controllers' local operation orders.

Type of constraint affecting terminal airspace	Effect of the constraint upon terminal airspace operations	Potential solution to alleviate the constraint (not prioritised)
The proximity of multiple airports separated by national boundaries.	Restricted terminal airspace availability. Complex co-ordination procedures leading to reduced airspace capacity.	<ol style="list-style-type: none"> <li>1. Provision of a single multinational service facility.</li> <li>2. Provision of an integrated airspace with separate ATSUs ensuring deconfliction of routes.</li> <li>3. Introduction of the concept of delegation of ATS on a permanent or temporary basis.</li> </ol>
Incompatible or incomplete data or communication exchange.	Additional co-ordination required leading to increased workload.	<ol style="list-style-type: none"> <li>1. Introduction of compatible data or communications exchange links.</li> </ol>
Inefficient airspace organisation due to national requirements.	Lack of radar vectoring area. Increased co-ordination requirements.	<ol style="list-style-type: none"> <li>1. Introduction of the concept of delegation of ATS on a permanent or temporary basis.</li> <li>2. Provision of a co-ordinated airspace design.</li> </ol>

Type of constraint affecting terminal airspace	Effect of the constraint upon terminal airspace operations	Potential solution to alleviate the constraint (not prioritised)
<b>Physical Location</b>		
The proximity of an airport to high ground.	The restriction of arriving and departing traffic flows to particular tracks results in: <ol style="list-style-type: none"> <li>extended routes</li> <li>no deconfliction of SIDs/STARs</li> <li>non-divergence of departure flows thus preventing the use of minimum departure separations.</li> </ol>	<ol style="list-style-type: none"> <li>Redesign of SIDs/STARs based upon new generation aircraft performance.</li> <li>Introduction of routes based upon RNAV capability.</li> <li>Utilisation of radar vectors for departing aircraft.</li> <li>Introduction of procedures based upon visual reference.</li> </ol>
Location in areas of adverse climatic conditions.	Inability to carry out an approach during adverse weather conditions, leading to holding delays & airspace congestion.	<ol style="list-style-type: none"> <li>Reduced declared capacity.</li> <li>Introduction of flow control measures.</li> <li>Improved approach navigation aids.</li> <li>Provide additional optimised holding facilities.</li> </ol>
<b>Environment</b>		
Restricted operations imposed upon optimum runway configuration utilisation due to environmental considerations.	Optimum runway operations only useable during restricted times leading to reduced airport capacity and complex airspace operations.	<ol style="list-style-type: none"> <li>Construction of new runway facilities for environmental reasons.</li> <li>Prohibition of non-Chapter 3 aircraft.</li> <li>Use of capacity-enhancing procedures.</li> </ol>

Type of constraint affecting terminal airspace	Effect of the constraint upon terminal airspace operations	Potential solution to alleviate the constraint (not prioritised)
Mandatory Noise Preferential Routes.	Optimised departure route system not introduced due to noise constraints.	<ol style="list-style-type: none"> <li>1. Introduction of more accurate track-keeping navigation systems.</li> <li>2. Prohibition of non-Chapter 3 aircraft.</li> <li>3. Introduction of specific routes for 'low environmental impact' aircraft.</li> <li>4. Reassessment of SIDs/STARs taking account of new generation aircraft performance.</li> </ol>
Inability to utilise a reciprocal runway due to environmental reasons. e.g. noise constraints.	<p>If a preferential runway is used during tailwind conditions, increased final approach separation may be required.</p> <p>Utilisation of secondary (crossing) runway with associated potential reduction in capacity.</p>	<ol style="list-style-type: none"> <li>1. Use of continuous descent approaches.</li> <li>2. Use of RNAV to avoid populated areas.</li> </ol>
<b>Route Structure</b>		
No deconfliction of SIDs/STARs.	Resulting in multiple conflicts within the airspace and increased controller intervention.	<ol style="list-style-type: none"> <li>1. Strategic deconfliction of SIDs/STARs on a geographic or vertical basis.</li> <li>2. Increased use of standardised radar procedures.</li> </ol>
Terminal airspace entry/exit points change according to runway in use.	Inability to standardise routes from terminal airspace which connect to en-route airspace. This causes flight plan inconsistencies and airspace planning problems.	<ol style="list-style-type: none"> <li>1. Redesign SIDs/STARs to provide standard entry/exit points independent from runway utilisation/selection.</li> </ol>

Type of constraint affecting terminal airspace	Effect of the constraint upon terminal airspace operations	Potential solution to alleviate the constraint (not prioritised)
Inconsistent requirements between airspace design and aircraft performance.	Conflicting requirements resulting in non-optimised operation & increased controller / pilot workload.	<ol style="list-style-type: none"> <li>1. Reassessment of SIDs/STARs taking account of new generation aircraft performance.</li> <li>2. Imposition of standardised requirements upon aircraft operators.</li> <li>3. Better use of radar separation.</li> </ol>
Design of SIDs/STARs for one runway inconsistent for use on reciprocal or secondary runway.	Results in multiple conflicts within the airspace and increased controller intervention.	<ol style="list-style-type: none"> <li>1. Redesign of SID/STARs to provide a structure that is consistent for all runway configurations.</li> <li>2. Revert from vertical deconfliction to geographical deconfliction when the reciprocal runway is utilised.</li> </ol>
Use of the same routes by aircraft of different performance capability.	Delays introduced by less than optimal departure/arrival flow. e.g. slow speed aircraft operating on a specific SID followed by a high speed aircraft on the same SID.	<ol style="list-style-type: none"> <li>1. Increased use of radar intervention.</li> <li>2. Introduction of conditional routes for certain categories of aircraft.</li> </ol>
<b>Staffing / Equipment</b>		
Reduced availability of suitably qualified staff.	Reduced ATC capacity. Sector division not possible.	<ol style="list-style-type: none"> <li>1. Train additional staff.</li> <li>2. Redesign sectors to allow for any imbalance of staff.</li> </ol>
Suitable equipment not available/unserviceable.	Non-optimal use of the available airspace. Increased spacing between aircraft.	<ol style="list-style-type: none"> <li>1. Provide the required equipment and improve redundancy of systems.</li> <li>2. Use other facilities (e.g. contingency arrangements).</li> </ol>

## 5.6 METHODOLOGY FOR TERMINAL AIRSPACE DESIGN

### 5.6.1 Stage 1 – Problem assessment

Prior to initiating a terminal airspace design project it is necessary to determine the aim and scope for such a requirement. The airspace may be performing adequately and only require optimising or, alternatively, a problem may be identified\*. The problem may be an existing one or be one which is anticipated to occur in the future due to increased traffic levels or altered traffic characteristics etc. Anticipation of problems requires that traffic demand is monitored and **traffic forecasts** are made.

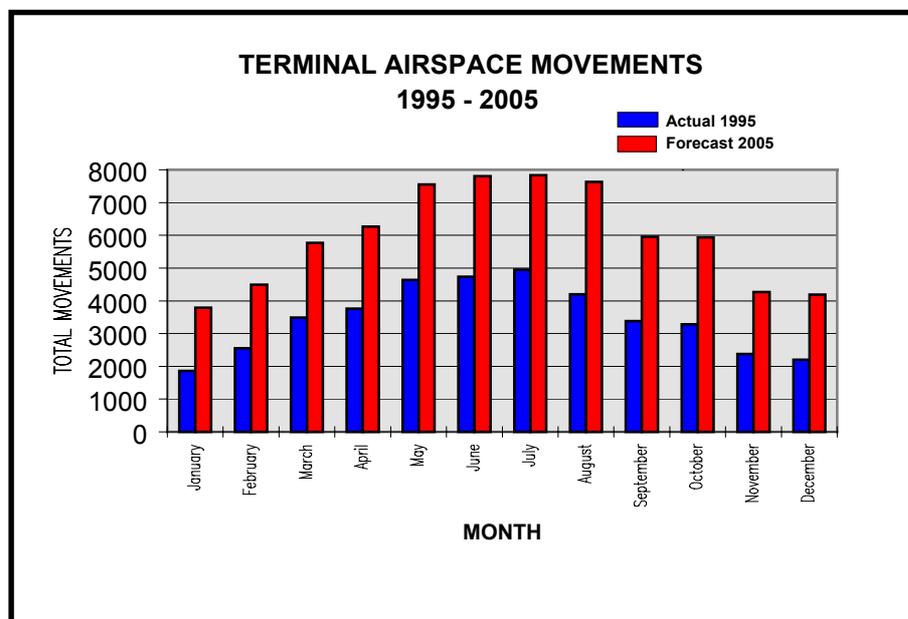
Monitoring of traffic demand requires that an accurate statistical data base is established to provide a basis for future planning. A further requirement is for a comprehensive analysis of existing traffic flows and forecasts which should include not only directional flow but also aircraft types and flight profile assessments.

\* In a limited number of cases the airspace may be a completely new structure. However the methodology used remains the same.

#### 5.6.1.1 Forecasting Techniques

A number of forecasting methods have been developed, ranging from simple forecasts based upon judgement to analytical model forecasts. Most techniques take account of economic, political, financial and competition factors. The actual method chosen will depend upon the available data types and sources. An example is given in Chart 5-1.

Chart 5-1



Forecasts may be on an aggregated basis or, to provide a more accurate pattern, a disaggregated basis. They should indicate changes in traffic demand on a seasonal, weekly or daily basis. In some instances, especially if demand is forecast to reach, or exceed, runway capacity, hourly forecasts may prove beneficial.

Forecasts must be re-assessed and adjusted at regular intervals to ascertain trends in the traffic pattern.

#### 5.6.1.2 Performance Indicators

The performance of terminal airspace can be monitored to enable problems to be anticipated rather than react when they occur.

The development and use of *performance indicators* is a management tool which is widely employed in many industries. A system of indicators may provide early warning of likely problem occurrence. A well-established system of indicators may also identify areas in which problems are likely to develop e.g. shortage of runway capacity as opposed to airspace restrictions.

Most, if not all, areas of terminal airspace will benefit from the establishment of a system of performance indicators. Information gained from a simple system may well be as useful as that from a more complicated system, especially in a less complex terminal airspace environment.

A variety of sources exist for such performance indicators, some of which are shown below:

<p><b>EUROCONTROL Central Flow Management Unit. *</b> (CFMU)</p> <p>e.g. departure slot allocation</p>	<p>Regular reports are issued from the CFMU regarding areas in which significant delays occur.</p>
<p><b>EUROCONTROL Central Office for Delay Analysis. *</b> (CODA)</p> <p>e.g. airport delay statistics</p>	<p>Reports are issued monthly indicating delay statistics based upon allocated departure slot times.</p>
<p><b>EUROCONTROL Central Route Charges Office *</b> (CRCO)</p> <p>e.g. extended routings</p>	<p>Records on the collection of en-route charges and associated city pairs may provide relevant information for traffic flow performance analysis.</p>
<p><b>International Air Transport Association. *</b> (IATA)</p> <p>e.g. operator complaints</p>	<p>IATA monitor delay statistics utilising disaggregated data thus providing method of identifying delays associated with air traffic control, weather problems, etc.</p>
<p><b>State Civil Aviation Authorities.</b></p> <p>e.g. airborne incident reports</p>	<p>Various statistics are published by Civil Aviation Authorities including airport movement comparisons, categories of aircraft, hazard reports, etc.</p>
<p><b>Airspace User Groups.</b></p> <p>e.g. general aviation reports</p>	<p>Users of the airspace may have formal or informal methods of recording data relevant to the performance of airspace.</p>
<p><b>Airport statistics.</b></p> <p>e.g. runway occupancy times</p>	<p>A variety of statistics are collated by airports. These include movements of all categories of aircraft, services provided, approach facilities utilised, environmental complaints, etc.</p>
<p><b>Controller associations.</b> (e.g. IFATCA)</p> <p>e.g. controller workload</p>	<p>Many controller associations provide statistics and comment upon the performance and function of airspace. These may provide a basis for performance monitoring, especially with regard to human factors.</p>

\* mainly for use from a **MACRO** organisation level.

### 5.6.1.3 Examples of Problem Assessment

#### **Airspace dimensions**

The majority of terminal airspace areas have evolved over a period of time. However, in some cases these are based upon the requirements of previous generations of aircraft. Therefore it is necessary to reassess airspace dimensions with regard to existing aircraft flight profiles.

#### **Standard Instrument Arrival / Departure Routes**

The requirement for published SID's and STAR's is associated with the density and complexity of the terminal airspace concerned. At many locations with a low density of aircraft operations, published SIDs and STARs may not be necessary. In this situation a flexible system may be operated. As the density of aircraft movements increases, techniques to increase efficiency and contain (or reduce) workload may be required, as a result of which SIDs and STARs may be introduced.

#### **Environmental issues**

Environmental issues may, arguably, prove to be the most restricting factor in terminal airspace design. Flexibility for realigning traffic flows is restricted in many locations due to the requirement of Noise Preferential Routes. A number of other issues, such as the visual impact of aircraft and toxic emissions, are becoming more critical. Therefore consideration and monitoring of environmental issues is imperative.

#### **Airspace classification**

Airspace classification selection may significantly influence the capacity of terminal airspace. For example, within ICAO classification E controlled airspace VFR traffic does not require a clearance to enter, whereas in classification A airspace no VFR operations are allowed. If airspace is not classified appropriately, or if ambiguity exists regarding the airspace classification, this may have an impact upon the operation of the airspace.

#### **Airspace management**

Aspects of airspace management practices should be constantly monitored to assess existing and future requirements. For example, changing political situations may introduce the possibility of the principle of the Flexible Use of Airspace being adopted to provide a more optimised terminal airspace structure. Flow control measures may also require to be addressed. Airspace capacity should be monitored together with demand associated with the airspace in question. Demand in excess of given capacity may require flow management to be introduced.

#### **Airport infrastructure & configuration**

The provision of runways, their configuration and associated infrastructure is closely associated with airspace design. Excessive runway occupancy times, excess demand for runway slot allocation, delays caused by periods of poor weather conditions, require constant assessment in order to optimise capacity and efficiency.

#### **Navigation aid requirements**

Conventional standard instrument departure and arrival routes within terminal airspace require navigation with reference to ground-based radio navigation facilities. ICAO recommends that significant points be established by the siting of a radio navigation facility or the position defined in relation to a VOR or DME facility. The use of NDB bearings is kept to a minimum. Navigation aid provision and coverage require assessment if routes are to be realigned. The development of new generation navigation equipment may also introduce pressure for reassessment of existing airspace structures.

#### **Terrain**

At many locations terrain considerations will influence the design of terminal airspace to a large degree. The ability to introduce arrival and departure routes may be constrained due to the inability to provide the required obstacle clearance. Terrain features may also influence the position of ground-based navigation facilities which, in turn, may influence the design of SIDs and STARs.

## 5.6.2 Stage 2 – Project organisation

### 5.6.2.1 Organisation Perspectives

Organisation requirements will differ according to the individual project. However, the involvement of all interested parties at an early stage is imperative. Working arrangements may be organised from two perspectives, as shown in Diagram 5-2:

#### **Macro** level.

This examines the main flows of traffic within a multinational airspace system unconstrained by existing FIR/UIR boundaries or elements of a political nature. The associated interface with terminal areas is then addressed to accommodate, as far as possible, the requirements of the overall system. The benefit of this arrangement is that consideration is given to the wider picture beyond the simulated area which may enable harmonisation of routes with those in adjoining areas.

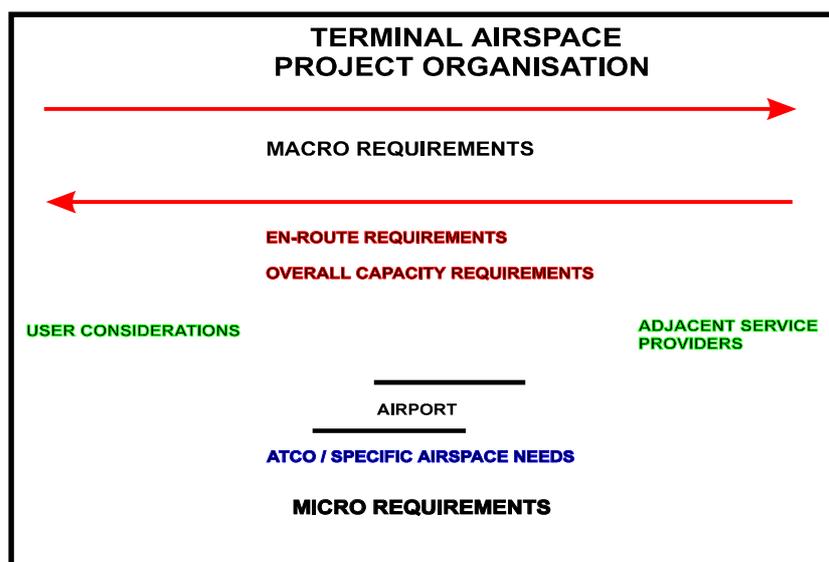
#### **Micro** level.

This requires input from those involved in the provision of the service, including air traffic controllers, airspace users etc.

The ultimate aim is to improve the structure of the individual area of terminal airspace concerned. This method is, in general, the most successful within the context of an individual area of airspace. However, if the development is taken in isolation, it is possible that it may be contrary to overall capacity enhancement. The principles of Zones of Interaction should also be taken fully into account, with broad consultation among all relevant interested parties.

Clearly, both perspectives have limitations if viewed in isolation, and requirements for en-route development may be unachievable for a particular terminal airspace due to any number of reasons. However, the development of a specific area of terminal airspace without the consideration of other factors may lead to a fragmented airspace structure. Therefore it is important that full *consultation* takes place during an early stage of planning.

Diagram 5-2



### 5.6.3 Stage 3 – Proposal development

Proposal development should be based upon quantified problem assessment and may cover a number of areas. These will vary from project to project and a similar problem may result in different solutions being adopted in different States due to local requirements.

The following list outlines some of the elements that should be taken into consideration when developing improvement proposals for terminal airspace:

#### Design of Airspace

Airspace is a valuable asset which requires efficient management. Improved aircraft performance both in flight profile and navigation areas will enable new design concepts to be examined. The basic principle is to minimise the requirement for airspace restrictions consistent with the need for safety, while providing sufficient capacity to match the existing and forecast demand.

#### Traffic flows

Traffic flows interfacing with the en-route environment should provide a seamless transition and, ideally, allow for uninterrupted climb and descent with minimum intervention from air traffic control.

Traffic flows should be designed so that the interface with the en-route environment is not dependent upon the runway in use at any given time. A 'mirror image' design may be the ultimate conceptual aim. However, in reality this is difficult to achieve due to the uneven directional traffic flow distribution at most locations.

#### Procedures

New procedures are being introduced in many locations in order to increase capacity at airports and in the surrounding airspace. A number of these are documented in the ECAC APATSI Manual on Mature Procedures. However it must be noted that these do not necessarily adhere to ICAO provisions. Note: Non-compliance with ICAO Standards and Recommended Practices should be filed as a difference with ICAO.

#### Airspace Management

The Flexible Use of Airspace (FUA) concept, endorsed by ECAC states, requires that airspace is considered as one continuum to be allocated for use to accommodate user requirements. This principle will result in more flexible structures being created to optimise the airspace design. This flexibility may be between civil and military users or between purely civil users when, for instance, airspace is allocated to a particular ATSU depending upon the direction of runway in use.

#### Flow control

Traffic demand and available capacity inevitably do not coincide during many periods. In order to balance demand with capacity during peak periods of the day, flow control measures may be introduced. In order to anticipate such a requirement, hourly forecasts must be analysed. A capacity assessment for airspace and associated airports is a prerequisite for the introduction of flow control measures.

#### Equipment

As the density of aircraft movements increases, the need to utilise advanced technology becomes more important. For example, in previous generations capacity within a low density area may have been adequate when controlled procedurally but as traffic increased the need for the introduction of radar became apparent. The introduction of new technology will require the development of complementary procedures.

#### Airspace users

The introduction of capacity enhancing measures within terminal airspace may require significant participation from the airspace users associated with the airspace concerned. In this case proposals may address the education of these users with regard to the flight techniques and operating procedures to be utilised within the airspace.

Other airspace users, e.g. State aircraft, will require handling which takes account of the capabilities of their aircraft.

#### Environmental and other restrictions

Airspace restrictions may occur for a number of reasons e.g. environmental considerations or the establishment of prohibited areas for national security reasons. Many of these restrictions cannot be removed and, therefore, innovative solutions must be found that will allow for optimal aircraft operations while adhering to the requirements imposed upon the airspace.

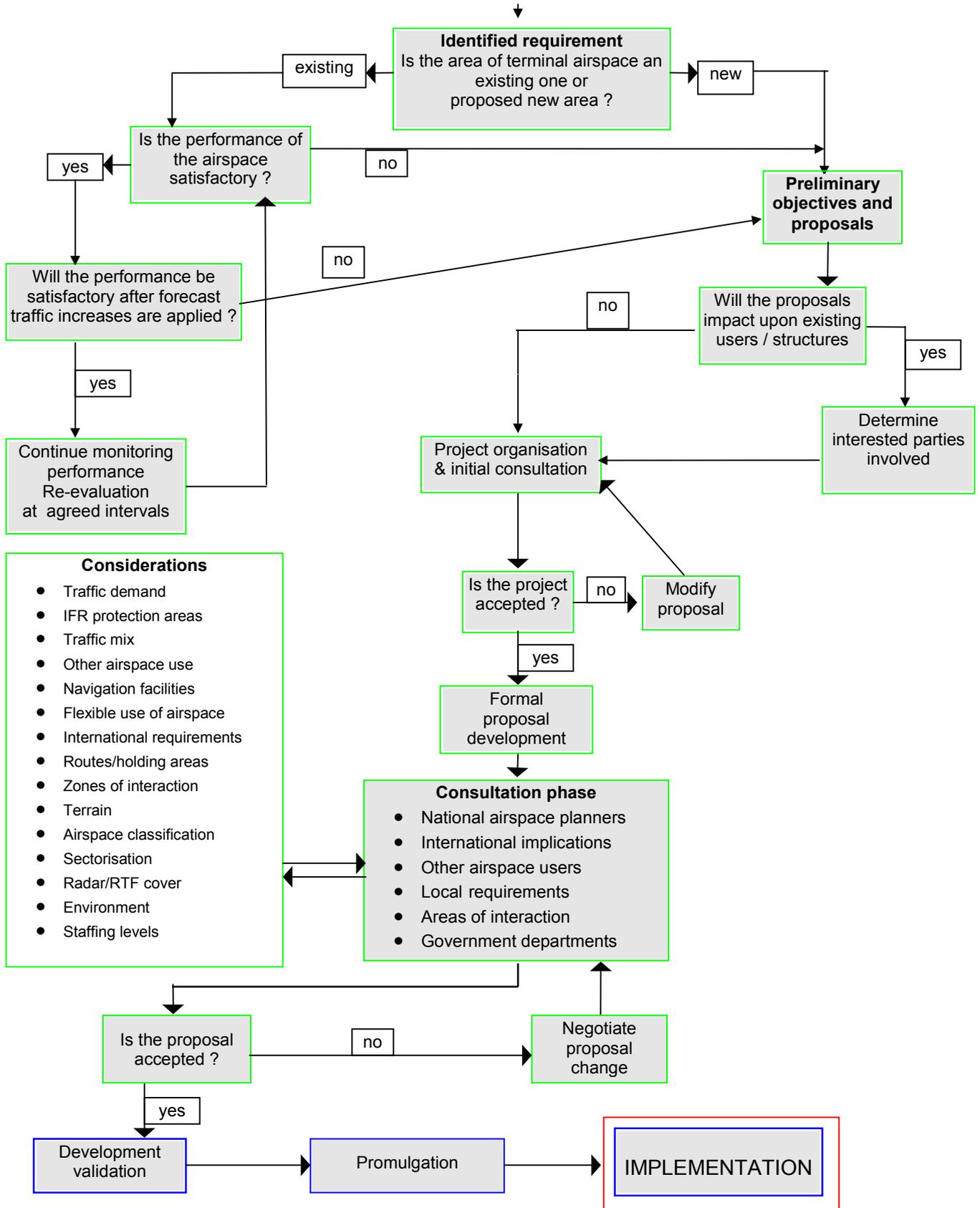
### 5.6.4 Stage 4 – Validation of proposals

*Validation* is usually required prior to implementation of proposals. Validation may be carried out by simulation (fast-time and/or real-time) or by analysis of trials and/or implementation at other locations. However, if proposals are considered as refinements of the existing structure or system, validation prior to introduction may not be considered necessary.

If simulation is chosen as the validation method, a *staged approach* is recommended. In general, the most successful validation arises from real-time simulation. However, the required resources for such a simulation are extensive. A high level analysis of a wide range of options may be available as an initial simulation level. Though lacking the use of in-depth information, these should enable options which are obviously not viable to be discounted at an early stage and therefore avoid the need for unnecessary additional resource-intensive simulation. In order to maximise available resources, a number of options may then be analysed by fast-time simulation and then preferred options selected prior to real-time simulation.

Staged approach	Validation facility
Refinement of existing structures or systems	If the proposal is considered as a refinement of an existing structure or system <i>it is possible that validation may be considered unnecessary.</i>
Existing procedures	Procedures in operation at another location. <i>Validation of procedures or concepts at another location may negate the requirement for a comprehensive simulation process.</i>
Initial evaluation of options	High level analysis tool utilising generic data or CFMU flight plan data. <i>Enables a number of options to be evaluated in order to discount those that do not have potential.</i>
Evaluation of viable options	Fast-time simulation utilising mathematical or analytical models. <i>e.g. SIMMOD, TAAM or RAMS.</i> <i>Enables analysis of potentially viable solutions in order to identify initial problems that may be encountered.</i>
Simulation of preferred options	Initiation of a real-time simulation. <i>This is resource-intensive and therefore should be used to evaluate only those options still considered viable.</i>
Site validation	Site validation may include flight trials of procedures or testing of structures that have been simulated or adopted from other locations.

5.6.5 A development process – Terminal airspace design concept



## 5.7 THE TERMINAL AIRSPACE CONCEPT

### 5.7.1 Overview of requirements

The needs of individual areas of terminal airspace within Europe are extremely diverse and, in consequence, a prescriptive terminal airspace concept cannot be applied. However, broad principles, based upon ICAO direction, may be established to serve as a platform on which an individual airspace structure may be designed. These principles have been discussed in preceding sections of this document.

### 5.7.2 ICAO Documentation

#### 5.7.2.1 ICAO Provisions

The starting point for any terminal airspace concept should be the provisions contained within relevant ICAO documentation. As indicated previously, four separate issues should be considered:

**a. Procedure design**

The design of terminal airspace structures is closely linked to the associated departure, arrival and holding procedures established for the location in question. Controlled terminal airspace structures are provided to protect IFR flights during the arrival and departure phase. Therefore it is necessary for an airspace planner to have a comprehensive knowledge of the existing, or proposed, arrival/departure procedures for the location that the airspace structure will serve.

**b. Airspace annotation**

The terminal airspace concept should not necessarily be determined with reference to the annotation of the airspace structure concerned. However, the overall aim should be to establish controlled airspace so that it corresponds to the flight profile requirements of IFR aircraft which are to be provided with an ATC service. ICAO gives a number of guidelines on relevant structures. These may be summarised as:

**Control Zones :** Control Zones should be kept as small as possible, consistent with the requirement to accommodate the flight paths of controlled IFR flights between the lower limits of a CTA and the aerodrome for which the control zone is established.

**Control Areas :** Control Areas may be formed in a number of different ways in order to accommodate the flight paths of controlled IFR aircraft. These structures should supplement the associated Control Zone while keeping its lateral limits to a minimum.

**c. Airspace function**

The function of the airspace is of increasing importance with regard to capacity. In consequence, the identification of the airspace in which an APP function is provided is imperative. It is sufficient to stress that this function may be carried out by an ACC unit or an APP unit. As traffic density increases there may be the requirement to progress from one 'function division' to another. This will be determined on a local basis.

ICAO requires that *significant points* for arrival and departure routes are established at which the division of the en-route phase of a flight and the approach phase of a flight is made. This will be site-specific and may not coincide with the transfer of responsibility from an APP unit to an ACC unit or vice versa. The *significant points* for arrival and departure routes may also not coincide.

**d. Airspace classification**

Issues relating to the classification of airspace arise from the potential mix of IFR and VFR aircraft within the same area of terminal airspace. As traffic density increases there may be a requirement to introduce specific provisions for VFR operations. As traffic density increases further still, additional tightening of ATS provisions, for example segregation of VFR flights from IFR arrivals and departures, may be required. This may entail airspace re-classification.

### 5.7.3 The concept development

#### 5.7.3.1 Concept of Operations

A number of steps must be taken in order to develop a concept of operations for a given area of terminal airspace. These steps will, in general, be similar for all locations. However, the final result may differ due to the local area requirements.

**STEP 1. Capacity assessment \***

Airspace planners should monitor the performance of the terminal airspace by establishing performance indicators. They should carry out a capacity assessment and apply forecasts in order to balance capacity with existing and forecast demand.

**STEP 2. Traffic flow analysis \***

Traffic flow analyses determine existing traffic flows and anticipated changes during the forecast period.

\* If the development is a new location the capacity assessment and traffic flow analysis should be based upon predicted requirements.

**STEP 3. Project development**

The organisational requirements for development should be considered and all interested parties should be involved in order to help create a co-operative environment.

**STEP 4. Airspace function and sectorisation**

The functionality method to be used should be determined within the context of the specific requirements of the airspace. This will influence the choice of sectorisation option.

**STEP 5. Airspace design**

The area of the approach control function and the potential transit traffic implications should be identified.

**STEP 6. Airspace operations**

The need for the establishment of SIDs and STARs should be assessed. The internal terminal airspace traffic flows should be researched to ensure that the interface with the en-route structure is as consistent as possible.

**STEP 7. Sectorisation requirements**

The requirement for sectorisation of the approach control area of responsibility should be considered in association with the determination of the approach control functionality. This will be influenced by the methods adopted at the specific location.

**STEP 8. Influencing factors**

The influencing factors associated with the specific terminal airspace and the impact upon the airspace requirements should be assessed.

**STEP 9. Establish connection with en-route**

The location of *significant points* should be established and areas where they overlap should be identified.

**STEP 10. Validation**

The appropriate method for validation should be applied dependent upon the extent of reorganisation or development of the project.

**STEP 11. Implementation and monitoring**

Once the project has been implemented, operations should be continually monitored to provide an early indication as to whether amendments are required.

**5.7.4 Conclusion**

It has been reiterated in this document that terminal airspace design cannot be definitive. Each individual area must be seen to be unique in its own way. This document is intended to provide an outline of principles involved in terminal airspace design upon which the development of national documentation may be based. This national documentation may, more readily, address the specific requirements of the State concerned.

Airspace structures have evolved with time. This evolution will continue and will need to take account of new generations of aircraft with improved performance ability. Advanced navigation systems also provide the basis for redevelopment of airspace and may allow for more efficient airspace structures and operating procedures to be introduced. Therefore it is necessary for continuous reassessment of existing airspace structures based upon future requirements and the development of aviation technology.

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## SECTION 5

<h1>GUIDELINES FOR TERMINAL AIRSPACE DESIGN</h1>
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## FINAL PAGE

### SUGGESTION - COMMENTS

To report any errors, or to propose a modification to the present Section 5 "Guidelines for Terminal Airspace Design", please contact:

Mrs Franca Pavlicevic  
EUROCONTROL  
Airspace / Flow Management & Navigation Business Division (AFN BD)  
Rue de la Fusée, 96  
B-1130 BRUSSELS  
(E-mail: [franca.pavlicevic@eurocontrol.int](mailto:franca.pavlicevic@eurocontrol.int))

### SECTION 5 - SPONSOR: ROUTE NETWORK DEVELOPMENT SUB-GROUP

Whenever material received, in accordance with the above procedure, makes it apparent that an amendment of the present Section 5 is required, such amendment will be first discussed within the Route Network Development Sub-Group (RNDSG) before its adoption by the Airspace & Navigation Team (ANT).

### PUBLICATION OF AMENDMENT

The agreed amendment will then be issued by EUROCONTROL in the form most convenient for its insertion in the Planning Manual.

## SECTION 6

# GUIDELINES FOR DELEGATION OF THE RESPONSIBILITY FOR THE PROVISION OF ATS

## 6.1 INTRODUCTION

### 6.1.1 Definition

- 6.1.1.1 As regards to the terminology describing the situation of one State delegating to another State the responsibility for the provision of ATS in a portion of the airspace above its territory, two different expressions seem to be currently used.
- 6.1.1.2 In several bilateral agreements and corresponding documents the notion "delegation of airspace" is used. This notion would seem to imply that a State would transfer all responsibilities associated to the provision of ATS, including the regulatory competence, to another State which is in effect not the case.
- 6.1.1.3 So, a clear distinction should be made between "Delegation of Airspace" and "Delegation of the responsibility for the provision of Air Traffic Services":
- "Delegation of Airspace" will refer to the delegation of jurisdiction in a portion of the airspace over a territory from one State to another State with the transfer of all responsibilities associated to the provision of ATS, including the regulatory competence which may necessitate changes to FIR boundaries and/or imply derogation of national sovereignty.
  - "Delegation of the responsibility for the provision of Air Traffic Services" will refer only to the delegation of the responsibility for the provision of ATS in a portion of the airspace over a territory from one State to another State.

### 6.1.2 Scope

- 6.1.2.1 The Delegation of Airspace is a very rare event requiring the approval of Governments concerned and ICAO, as it may involve changes to FIR boundaries. As ECAC States do not anticipate any such delegation in the foreseeable future, the Guidance Material in this Section 6 refers only to the Delegation of the responsibility for the provision of Air Traffic Services.

### 6.1.3 Process

- 6.1.3.1 The present Guidance Material is recommended to be used in conjunction with the Common Format, Cross-Border, Inter-Centre Letter of Agreement, Edition 2.0, REF: ASM.ET1.ST015, EUROCONTROL (hereinafter referred to as the **Common Format LoA**) for the purpose of describing the basic principles and operational aspects regarding the situation where one State delegates to another State the responsibility for the provision of ATS in a portion of the airspace above the territory of the former State.
- 6.1.3.2 The Guidance Material takes into consideration the provisions of the Model Agreement on the Delegation of Air Traffic Services developed by the Delegation of ATS Task Force, and approved by the EUROCONTROL Provisional Council. This type of Agreement between States, once implemented, takes precedence over any other lower level agreement, such as the Common Format LoA.

## 6.2 SOVEREIGNTY

- 6.2.1 According to the Convention on International Civil Aviation (Chicago Convention) “the contracting States recognise that every State has complete and exclusive sovereignty over the airspace above its territory. For the purposes of this Convention the territory of a State shall be deemed to be the land areas and territorial waters adjacent thereto under the sovereignty, suzerainty, protection or mandate of such State”.
- 6.2.2 Based on the principle of the territorial sovereignty, it will fall under the jurisdiction of a State to prescribe the rules and regulations for the airspace above its territory. However, through signing the Chicago Convention, the States have undertaken to maintain, to the extent possible, their national rules and regulations in conformity with ICAO international standards and procedures.
- 6.2.3 In the Chicago Convention it is further prescribed that “any State which finds it impracticable to comply in all respects with any such international standard or procedure, or to bring its own regulations or practices into full accord with any international standard or procedure after amendment of the latter, or which deems it necessary to adopt regulations or practices differing in any particular respect from those established by an international standard, shall give immediate notification to the International Civil Aviation Organisation of the differences between its own practice and that established by the international standard”.
- 6.2.4 As a principle of sovereignty, the rules and procedures of the Delegating State apply in its territory. It is, however, actual practice to apply the rules and procedures pertaining to the provision of ATS of the Providing State. In the interest of safety and for the sake of efficiency, it is necessary that the air traffic controller is able to apply only one set of rules and procedures – those of the Providing State.
- 6.2.5 The rules and procedures pertaining to the provision of ATS in the Providing State shall apply when providing ATS in a portion of the airspace of the Delegating State.
- 6.2.6 The ATS Unit/Authority of the Contracting States may agree, however, that certain rules and procedures of the Delegating State pertaining to the provision of ATS will remain applicable in the airspace concerned.

## 6.3 TERMINOLOGY

- 6.3.1 In accordance with para. 2.1.1 of Annex 11 to the Chicago Convention the full term prescribed is delegation of “the responsibility for establishing and providing air traffic services”. As this term indicates, the objective of the delegation is purely functional and will not imply any derogation of national sovereignty.
- 6.3.2 Thus, in the event of a State delegating to another State the responsibility for the provision of ATS in a portion of the airspace above its territory, the term delegation of the responsibility for the provision of ATS, as provided for in the Note under para. 2.1.1 of Annex 11 to the Chicago Convention, should be used by the States (instead of delegation of airspace) when drafting their delegation agreements.

## 6.4 AIR TRAFFIC SERVICES

### 6.4.1 General

- 6.4.1.1 In Annex 11 to the Chicago Convention it is expressed as a Recommendation that “the delineation of airspace wherein air traffic services are to be provided, should be related to the nature of the route structure and the need for efficient service rather than to national boundaries”.
- 6.4.1.2 According to Note 1. under the Recommendation above it is further expressed that, “conclusions of agreements to permit the delineation of airspace lying across national boundaries is advisable when such action will facilitate the provision of air traffic services”.

### 6.4.2 Delegation of the responsibility for the provision of ATS

- 6.4.2.1 Annex 11 to the Chicago Convention (para. 2.1.1) prescribes that “contracting States shall determine, in accordance with the provisions of this Annex, and for the territories over which they have jurisdiction, those portions of the airspace and those aerodromes where air traffic services will be provided. They shall thereafter arrange for such services to be established and provided in accordance with the provisions of this Annex, except that, by mutual agreement, a State may delegate to another State the responsibility for establishing and providing air traffic services in flight information regions, control areas or control zones extending over the territories of the former”.
- 6.4.2.2 In the Note. under para. 2.1.1 of Annex 11 to the Chicago Convention it is expressed that, “if one State delegates to another State the responsibility for the provision of air traffic services over its territory, it does so without derogation of its national sovereignty. Similarly, the providing State’s responsibility is limited to technical and operational considerations and does not extend beyond those pertaining to the safety and expedition of aircraft using the concerned airspace”.
- 6.4.2.3 “Furthermore, the providing State in providing air traffic services within the territory of the delegating State will do so in accordance with the requirements of the latter which is expected to establish such facilities and services for the use of the providing State as are jointly agreed to be necessary. It is further expected that the delegating State would not withdraw or modify such facilities or services without prior consultation with the providing State. Both the delegating and providing States may terminate the agreement between them at any time”.
- 6.4.2.4 The States shall describe the lateral and vertical limits of the portion of airspace within which the responsibility for the provision of ATS is delegated from one State to another State.
- 6.4.2.4.1 In the cases where a delegation of the responsibility for the provision of ATS is based on a technically required adjustment of the AoR boundaries caused by the inability of video displays to depict the exact FIR boundaries, it may be sufficient to identify the new AoR boundary(ies) through use of significant points and agree to a broad statement that the responsibility for the provision of ATS is delegated in all airspace north, east, south or west of the AoR boundary(ies).
- 6.4.2.5 Both the Delegating and Providing State shall keep each other advised of any changes in the operational status of their communication and/or navigational facilities which may have an influence on the provision of ATS in the portion of airspace within which the responsibility for the provision of ATS is delegated.

- 6.4.2.6 Moreover, the Common Format LoA provides that both Centres shall keep each other advised of any changes in the operational status of their facilities and navigational aids which may affect the procedures specified in the Letter of Agreement (LoA).
- 6.4.2.7 The States shall have established procedures pertaining to revisions and cancellation of the delegation agreement. According to the **Common Format LoA**, cancellation of the LoA by either State requires that the cancelling party declares its intention to cancel the LoA with a minimum pre-notification time as agreed and prescribed in the LoA. Should the Agreement on the Delegation of Air Traffic Services between the Contracting States be terminated, the LoA under it will, as a consequence, be cancelled with effect from the same date as that Agreement.

### **6.4.3 Authority responsible for the provision of ATS**

- 6.4.3.1 In Annex 11 to the Chicago Convention (para. 2.1.3) it is prescribed that “when it has been determined that air traffic services will be provided, the States concerned shall designate the authority responsible for providing such services”.
- 6.4.3.2 According to Note 1. under the paragraph mentioned above, “the authority for establishing and providing the services may be a State or a suitable Agency”.
- 6.4.3.3 Furthermore, in the situation where a State delegates to another State the responsibility for the provision of ATS in a portion of the airspace above its territory, “the State which designates the authority responsible for establishing and providing the air traffic services is: the State to whom responsibility for the establishment and provision of air traffic services has been delegated”.

### **6.4.4 Scope of the delegation of the responsibility for the provision of ATS**

- 6.4.4.1 The delegation of the responsibility for the provision of ATS should encompass air traffic control service, flight information service and alerting service.
- 6.4.4.2 Moreover, the delegation of the responsibility for the provision of ATS normally encompasses GAT traffic operating under IFR, unless otherwise specified.
- 6.4.4.3 Considering the fact that the Common Format LoA provides for, on an optional basis, the inclusion of co-ordination procedures for Operational Air Traffic and/or VFR traffic, the delegation may also include the responsibility for the provision of ATS to such Operational Air Traffic (OAT) and/or VFR traffic. Thus, in the event the Letter of Agreement encompasses co-ordination procedures for OAT and/or VFR traffic, and if the responsibility for the provision of ATS to OAT/VFR traffic is delegated, this shall be clearly specified also in the relevant paragraphs of the Letter of Agreement pertaining to delegation of the responsibility for the provision of ATS.
- 6.4.4.4 With respect to alerting service this is, according to ICAO definitions, “a service provided to notify appropriate organisations regarding aircraft in need of search and rescue aid, and assist such organisations as required”. The responsibility for the provision of alerting service will normally fall on the ATS unit responsible for the provision of ATS in the airspace concerned.
- 6.4.4.5 In the event of a State delegating to another State the responsibility for the provision of ATS in a portion of the airspace above its territory, the States should establish co-ordination procedures regarding the provision of search and rescue services for the territory connected with the airspace concerned.
- 6.4.4.6 According to the Common Format LoA, the Centre responsible for the provision of ATS, by virtue of delegation, shall provide alerting service and shall co-ordinate with the appropriate Rescue Co-ordination Centre as required.

### 6.4.5 Radar separation minima

6.4.5.1 In Annex 11 to the Chicago Convention it is prescribed that “the selection of separation minima for application within a given portion of airspace shall be as follows:

a) *the separation minima shall be selected from those prescribed by the provisions of the PANS-ATM and the Regional Supplementary Procedures as applicable under the prevailing circumstances except that, where types of aids are used or circumstances prevail which are not covered by current ICAO provisions, other separation minima shall be established as necessary by:*

b) *the appropriate ATS authority, following consultation with operators, for routes and portions of routes contained within the sovereign airspace of a State”.*

6.4.5.2 As regards to the radar separation minima it is prescribed in ICAO PANS-ATM (Doc 4444) Chapter 8 that “the radar separation minimum or minima to be applied shall be prescribed by the appropriate ATS authority according to the capability of the particular radar system or sensor to accurately identify the aircraft position in relation to the centre of an RPS, PSR blip or SSR response.....”.

6.4.5.3 The appropriate ATS authority is, according to Annex 11 to the Chicago Convention, defined as “the relevant authority designated by the State responsible for providing air traffic services in the airspace concerned”.

6.4.5.4 As a consequence, in the situation where a State delegates to another State the responsibility for the provision of ATS in a portion of the airspace above its territory, the appropriate ATS authority designated by the Providing State should be responsible for the selection of the separation minima to be applied in the portion of airspace concerned.

### 6.4.6 Special activities which will have an influence on the provision of ATS

6.4.6.1 In the situation where a State delegates to another State the responsibility for the provision of ATS in a portion of the airspace above its territory, the Providing State should be kept informed of all pertinent conditions regarding airspace restrictions (Prohibited, Restricted and Danger Areas) and airspace reservations located in the portion of airspace concerned.

6.4.6.2 Moreover, the Delegating State should keep the Providing State informed of all relevant aspects relating to the application of the EATCHIP Concept of the Flexible Use of Airspace (FUA), which will have an impact on the portion of airspace within which the responsibility for the provision of ATS has been delegated (ref. EUROCONTROL Handbook for Airspace Management, ASM-ET1-ST08.5000-HBK-02-00).

### 6.4.7 SSR code assignment

6.4.7.1 In the event of a State delegating to another State the responsibility for the provision of ATS in a portion of the airspace above its territory, the States should have established procedures for the allocation of SSR codes to the ATS units concerned.

### 6.4.8 Language

6.4.8.1 Regarding the language to be used it is in Volume II of Annex 10 to the Chicago Convention (para. 5.2.1.1.1) expressed as a Recommendation that “in general, the air-ground radiotelephony communications should be conducted in the language normally used by the station on the ground”. Furthermore, in accordance with the Note. under the same paragraph “the language normally used by the station on the ground may not necessarily be the language of the State in which it is located”.

6.4.8.2 In Volume II of Annex 10 to the Chicago Convention (para. 5.2.1.1.2) it is further expressed as a Recommendation that “pending the development and adoption of a more suitable form of speech for universal use in aeronautical radiotelephony communications, the English language should be used as such and should be available , on request from any aircraft station unable to comply with 5.2.1.1.1, at all stations on the ground serving designated airports and routes used by international air services”.

6.4.8.3 The language(s) to be used in the portion of airspace within which the responsibility for the provision of ATS is delegated from one State to another State should be specified.

#### **6.4.9 Promulgation**

6.4.9.1 In Annex 15 to the Chicago Convention it is prescribed that “an aeronautical information service shall collect, collate, edit and publish aeronautical information concerning the entire territory of the State as well as areas in which the State is responsible for air traffic services outside its territory”.

6.4.9.2 As a consequence, in the situation where a State delegates to another State the responsibility for the provision of ATS in a portion of the airspace above its territory, both the Delegating and Providing State shall agree upon the content of, and publish all relevant information regarding the portion of airspace concerned, in their Aeronautical Information Package as defined in ICAO Annex 15.

#### **6.4.10 Air Traffic Controller Licence**

6.4.10.1 With regard to air traffic controller licence, Annex 1 to the Chicago Convention prescribes that “before issuing an air traffic controller licence, a Contracting State shall require the applicant to meet the requirements of 4.4.1 (see ICAO Annex 1) and the requirements of at least one of the ratings set out in 4.5 (see ICAO Annex 1). Unlicensed State employees may operate as air traffic controllers on condition that they meet the same requirements”.

6.4.10.2 In Annex 1 to the Chicago Convention it is also prescribed that “a Contracting State having issued an air traffic controller licence shall not permit the holder thereof to carry out instruction in an operational environment unless such holder has received proper authorisation from such Contracting State”. Furthermore, “a Contracting State, having issued a licence, shall ensure that other Contracting States are enabled to be satisfied as to the validity of the licence”.

6.4.10.3 In the situation where a State delegates to another State the responsibility for the provision of ATS in the airspace above its territory, the validity of the air traffic controller licences relevant to the provision of ATS in the portion of airspace concerned, should have been ensured. The training of ATS personnel of one Contracting State, providing ATS in the portion of airspace of the other Contracting State, shall include the requirements pertaining to the airspace concerned.

6.4.10.4 Furthermore, in Annex 1 to the Chicago Convention it is stated that “before exercising the privileges indicated in 4.5.3.1 (see ICAO Annex 1), the licence holder shall be familiar with all pertinent and current information”.

6.4.10.5 Therefore, in the event of a State delegating to another State the responsibility for the provision of ATS in a portion of the airspace above its territory, the Providing State should be kept advised of all pertinent and current information regarding the portion of airspace concerned, in order to accomplish properly the requirements above.

### 6.4.11 Forwarding of meteorological information

- 6.4.11.1 According to ICAO PANS-ATM (Doc 4444) Chapter 4 “air traffic services units shall forward without delay to their associated meteorological offices, in accordance with local arrangements, meteorological information received from aircraft in flight”.
- 6.4.11.2 In the situation where a State delegates to another State the responsibility for the provision of ATS in a portion of the airspace above its territory, the States should establish procedures regarding the forwarding of meteorological information.

### 6.4.12 Contingency procedures

- 6.4.12.1 In the event the ATS unit of the Providing State is unable to continue the provision of ATS in the portion of airspace of the Delegating State, the appropriate procedures to be applied should be specified.

## 6.5 APPLICATION OF THE RULES OF THE AIR

- 6.5.1 In Annex 2 to the Chicago Convention it is prescribed that *“the rules of the air shall apply to aircraft bearing the nationality and registration marks of a Contracting State, wherever they may be, to the extent that they do not conflict with the rules published by the State having jurisdiction over the territory overflown”*.
- 6.5.2 As a consequence, in the portion of the airspace above the territory of a State where the responsibility for the provision of ATS is delegated to another State, the rules of the air published by the Delegating State shall apply. However, Article 12 of the Chicago Convention prescribes that *“each contracting State undertakes to keep its own regulations in these respects uniform, to the greatest possible extent, with those established from time to time under this Convention”*.

## 6.6 TERRITORIAL MATTERS

- 6.6.1 (1) State Aircraft, other than those of the Delegating State, may not enter that portion of the airspace where the responsibility for the provision of ATS has been delegated without prior Diplomatic Clearance or special permission from the Delegating State.
- (2) For State Aircraft operating as GAT the same rules and procedures are to be applied as for Civil Air Traffic, but where necessary, special procedures should be established to permit access to the airspace. OAT shall be subject to prior co-ordination between the military unit and the ATS Unit/Authority concerned.
- 6.6.2 If deemed necessary, the States should have established procedures authorising the Delegating State to temporarily suspend or limit the delegation of the responsibility for the provision of ATS (see the Common Format LoA, para. 2.2.5).

## **6.7 ATS AIRSPACE CLASSIFICATION**

- 6.7.1 In accordance with Annex 11 to the Chicago Convention “States shall select those airspace classes appropriate to their needs”.
- 6.7.2 However, in the situation where a State delegates to another State the responsibility for the provision of ATS in a portion of the airspace above its territory, the ATS airspace classifications as determined by the Delegating State apply in the airspace concerned.
- 6.7.3 Since the airspace classification is directly related to the level of ATS provided, States might, in the situation where a State delegates to another State the responsibility for the provision of ATS in a portion of the airspace above its territory, undertake to negotiate the ATS airspace classifications to be applied in the portion of airspace concerned, in order to better accomplish the level of air traffic services requested.

## **6.8 AIR TRAFFIC INCIDENT INVESTIGATION**

- 6.8.1 Regarding the applicability of Annex 13 to the Chicago Convention it is prescribed that “unless otherwise stated, the specifications in this Annex apply to activities following accidents and incidents wherever they occurred”.
- 6.8.2 In Annex 13 to the Chicago Convention it is prescribed that “the State of Occurrence shall institute an investigation into the circumstances of the accident”. Furthermore, in Annex 13 to the Chicago Convention it is expressed as a Recommendation that “the State of Occurrence should institute an investigation into the circumstances of a serious incident”.
- 6.8.3 In Annex 13 to the Chicago Convention the terms accident, serious incident and incident are defined. In the definition of a serious incident it is noted, that the difference between an accident and a serious incident lies only in the result. A list, however not exhaustive, of serious incidents is attached to Annex 13.
- 6.8.4 Annex 13 to the Chicago Convention further prescribes that “any State, the facilities or services of which have been, or would normally have been, used by an aircraft prior to an accident or an incident wherever it occurred, and which has information pertinent to the investigation, shall provide such information to the State conducting the investigation”.
- 6.8.5 Chapter 3 (Part II) of the ICAO Air Traffic Services Planning Manual (Doc 9426) is concerned with incidents specifically related to the provision of ATS and known as Air Traffic Incidents.
- 6.8.6 The term Air Traffic Incident is not defined, however described, according to ICAO PANS-ATM (Doc 4444), as incidents specifically related to the provision of air traffic services involving such occurrences as aircraft proximity (AIRPROX) or other serious difficulty resulting in a hazard to aircraft, caused by e.g. faulty procedures, non-compliance with procedures (PROCEDURE), or failure of ground facilities (FACILITY).

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- 6.8.7 Air Traffic Incident Reports, intended for use by pilots and air traffic controllers and any associated information should be recorded by the ATS unit concerned and forwarded to the appropriate investigation authority. All material relevant for the investigation should be secured.
- 6.8.8 The initial ATS investigation is normally carried out by the ATS unit to which the Air Traffic Incident has been reported or which noted it and should contain the following information:
- statements by personnel involved;
  - tape transcripts of relevant radio and telephone communications;
  - copies of flight progress strips and other relevant data, including recorded radar data, if available;
  - copies of the meteorological reports and forecasts relevant to the time of the incident;
  - technical statements concerning the operating status of equipment, if applicable;
  - unit findings and recommendations for corrective actions, if appropriate.
- 6.8.9 In the situation where a State delegates to another State the responsibility for the provision of ATS in a portion of the airspace above its territory, it normally falls within the responsibility of the ATS unit of the Providing State to accomplish the activities described in paras. 8.7 and 8.8. The further investigation is normally carried out by the relevant investigation authorities of the Delegating State.
- 6.8.10 In the situation where a State delegates to another State the responsibility for the provision of ATS in a portion of the airspace above its territory the following shall apply:
1. A Contracting State will institute an inquiry into the circumstances of accidents or serious incidents occurring in its territory.
  2. At its request, the Delegating State shall be provided with the necessary materials from the ATS Unit/Authority of the Providing State (e.g. radar data recordings, tape transcriptions, etc.) in order to enable it to conduct an enquiry into an accident or serious incident occurring in the Delegating State's territory.
  3. The Providing State shall be given the opportunity to appoint observers to be present at the inquiry and the Delegating State shall communicate the report and findings of the inquiry to that State.

## 6.9 CRITERIA FOR THE IDENTIFICATION OF AREAS WHERE DELEGATION OF ATS WOULD BE BENEFICIAL:

- 1) Geographical position of airports close to FIR boundaries;
- 2) Geographical position of major crossing points close to FIR boundaries;
- 3) Lateral protection of airways and/or predetermined routes close to FIR boundaries;
- 4) Optimising the use of available radar coverage;
- 5) Optimising the use of available radiotelephony coverage;
- 6) Optimising the use of available air traffic control capacity;
- 7) Rationalisation of airspace sectorisation, avoiding short sector crossing times;
- 8) Straightening of boundaries between ACCs to permit the transfer of control at clear operational boundaries;
- 9) Early transfer of control on unidirectional traffic flows;
- 10) On major traffic flows transfer of control where traffic is predominantly in level flight;
- 11) Avoiding multiple co-ordination between ACCs, where traffic penetrates one or several ACCs for short periods of time;
- 12) Ensuring operational continuity during climb and descent phases to avoid multiple co-ordination between ACCs;
- 13) Specific operations;
- 14) Optimising the ATS provided to reduce aircrew workload.

(Ref: *Final Report of the EATCHIP Task Force on Airspace Structure and Management*)

*[Editorial Note: The numbering above does not indicate a ranking of priorities]*

**Annex 6A**

# **MODEL AGREEMENT ON THE DELEGATION OF AIR TRAFFIC SERVICES**

EUROCONTROL

*The Model Agreement on the Delegation of Air Traffic Services aims at facilitating and harmonising the delegation of Air Traffic Services (ATS), and hence to contributing to the optimisation of airspace utilisation. The Model Agreement has been endorsed by the EUROCONTROL ATM/CNS Consultancy Group (ACG) and approved by the EUROCONTROL Provisional Council. Further to a decision of the ICAO European Air Navigation Planning Group (EANPG), the Model Agreement will also have been disseminated to interested parties in the whole ICAO EUR Region.*

*The Model Agreement addresses the legal and regulatory aspects of delegation of ATS, and allows the appropriate ATS Units/Authorities to negotiate and conclude Letters of Agreement containing the operational and technical aspects of delegation of ATS. It recognises the need for States to follow the EUROCONTROL Common Format, Cross-Border, Inter-Centre Letter of Agreement when concluding their operational Letters of Agreement (LoA).*

*Although this Model Agreement will have been distributed to States under separate cover, the Model Agreement is included here as background, informative material.*

Text	Explanatory Notes
<p style="text-align: center;"><b><u>Preamble</u></b></p> <p style="text-align: center;"><b>A g r e e m e n t</b></p> <p style="text-align: center;">between the Government of .....(State) and the Government of .....(State)</p> <p style="text-align: center;"><b><i>on the Delegation of Air Traffic Services</i></b></p>	
<p>The Government of .....(State) and the Government of.....(State) (hereinafter: “the Contracting States”)</p> <p>Desiring to facilitate the safe conduct of international flight operations across their common State boundaries in the interests of the airspace users and their passengers;</p> <p>For the purpose of promoting air traffic services relations between the Contracting States for their mutual benefit;</p> <p>Being Parties to the Convention on International Civil Aviation, opened for signature at Chicago on December 7, 1944 and desiring to conclude an agreement for the purpose of providing Air Traffic Services according to the international Standards and Recommended Practices set out in Annex 11 to the Chicago Convention, across and beyond their respective territories;</p> <p>Referring to the ECAC Institutional Strategy for ATM in Europe and the Protocol consolidating the EUROCONTROL International Convention relating to Co-operation for the Safety of Air Navigation, which was opened for signature on 27 June 1997 (the revised Convention);</p> <p>Recognising that the conclusion of an agreement between States regarding the delegation of ATS shall not prejudice the principle that every State has complete and exclusive sovereignty over the airspace above its territory or the capacity of every State to exercise its prerogatives with regard to security and defence in its national airspace;</p> <p>Recognising, that the aim of this agreement is to address legal and institutional aspects of the delegation of ATS and to allow lower level authorities involved to negotiate and conclude Letters of Agreement containing the specific operational and technical aspects related to these matters.</p> <p>Have agreed as follows:</p>	

## Article 1

### Definitions

For the purpose of this Agreement, unless otherwise stated, the term:

1. *“Agreement”* means this Agreement, its Appendices and any amendments thereto.
2. *“Air Traffic Service”* as a generic term includes flight information service, alerting service, air traffic advisory service, air traffic control service provided by the Contracting States.
3. *“Appropriate ATS authority”* means the relevant authority designated by the Contracting State responsible for providing air traffic services in the airspace concerned.
4. *“Chicago Convention”* means the Convention on International Civil Aviation, opened for signature at Chicago on December 7, 1944 and includes:
  - a) any amendment thereof that has been ratified by both Contracting States and has entered into force under Article 94a of the Convention, and
  - b) any Annex or any amendment thereto adopted under Article 90 of the Convention, insofar as the international Standards referred to in Article 37 of the Convention in such Annex or amendment are at any given time effective for both Contracting States.
5. *“Delegation of ATS”* means the delegation from one State (the Delegating State) to another State (the Providing State) of the responsibility for providing air traffic services in a portion of airspace extending over the territories of the former.
6. *“GAT” or General Air Traffic* means flights conducted in accordance with the rules and provisions of ICAO.
7. *“OAT” or Operational Air Traffic* means flights which do not comply with the provisions stated for GAT and for which rules and procedures have been specified by the appropriate authorities.
8. *“Territory”* in relation to a State, has the meaning specified in Article 2 of the Chicago Convention.

*In conformity with Annex 11 of the Chicago Convention.*

*Article 2 of the Chicago Convention: “Territory: For the purposes of this Convention the territory of a State shall be deemed to be the land areas and the territorial waters adjacent thereto under the sovereignty, suzerainty, protection or mandate of such State.”*

<p style="text-align: center;"><b><u>Article 2</u></b></p> <p style="text-align: center;">Authorisation to Lower Level Authorities (ATS Unit /ATS Authority)</p> <p>(1) The Contracting States agree that the responsibility for control of air traffic shall be transferred from an ATS unit of one State to another ATS unit in a neighbouring State, according to the provisions set forth in Annex 11 and under the terms of this Agreement.</p> <p>(2) The control information pertinent to the transfer shall be exchanged between the ATS units concerned having due regard to the national regulations in force and to the local circumstances.</p> <p>(3) The Contracting States agree that the appropriate ATS Unit/Authority of one State may provide air traffic services in a portion of the airspace of the other State, in accordance with the terms of this Agreement.</p> <p>(4) To that effect the Contracting States authorise their appropriate ATS Units/Authorities to conclude Letters of Agreement (LoA).</p> <p>(5) These Letters of Agreement (LoA) shall define the portion of airspace concerned and specify the rules and procedures to be applied in accordance with the provisions of this Agreement and shall follow the structure of the EUROCONTROL Common Format, Cross-Border, Inter-Centre Letter of Agreement (Hereinafter the <i>Common Format LoA</i>).</p>	<p><i>Based on the provisions of Annex 11 of the Chicago Convention and the conclusions of MATSE/5.</i></p> <p><i>Paragraph 4 refers solely to paragraph 3 of Article 2. Hence the words "To that effect".</i></p> <p><i>The present Common Format LoA of EUROCONTROL will serve as a guideline for States.</i></p>
<p style="text-align: center;"><b><u>Article 3</u></b></p> <p style="text-align: center;">Application of Rules and Procedures</p> <p>(1) The rules and procedures pertaining to the provision of ATS in the Providing State shall apply when providing ATS in a portion of the airspace of the Delegating State.</p> <p>(2) The ATS Unit/Authority of the Contracting States may agree, however, that certain rules and procedures of the Delegating State pertaining to the provision of ATS will remain applicable in the airspace concerned.</p>	<p><b><i>As a principle of sovereignty, the rules and procedures of the Delegating State apply in its territory. It is, however, actual practice to apply the rules and procedures pertaining to the provision of ATS of the Providing State. In the interest of safety and for the sake of efficiency, it is necessary that the air traffic controller is able to apply only one set of rules and procedures – those of the Providing State.</i></b></p>

<p style="text-align: center;"><b><u>Article 4</u></b></p> <p style="text-align: center;">Financial Arrangements</p> <p>(1) Each Contracting State shall bear the costs of any activity performed by it under this Agreement, unless otherwise agreed by the Contracting States.</p> <p>(2) The introduction of financial arrangements requires prior written agreement between the appropriate representatives of the Contracting States.</p>	<p><i>Generally, the delegation of ATS is in the interest of the service provider. The reason for delegation of ATS is in many cases lack of airspace to provide a proper service to the users.</i></p> <p><i>Activities involving inter alia cost-sharing or revenue sharing are subject to bilateral negotiations. Reasons for doing it could be manifold.</i></p>
<p style="text-align: center;"><b><u>Article 5</u></b></p> <p style="text-align: center;">Civil Liability</p> <p>(1) The Providing State shall be liable for the damage caused by its negligence, or that of its agents or of any other person acting on its behalf, under the provisions of this Agreement.</p> <p>(2) Claims against the Providing State, its agents or any other person acting on its behalf shall be made in the courts, and subject to the law of the Providing State.</p> <p>(3) The Delegating State may bring an action against the Providing State to recover any compensation or costs paid or incurred as a result of loss or damage caused by the negligence of the Providing State, its agents or any other person acting on its behalf, while applying the provisions of this Agreement. The action shall be brought in the courts, and subject to the law of the Providing State.</p>	<p><i>Provisions of this article are only applicable in the relationship between the Contracting States and do not constitute rights or obligations for third parties.</i></p>

<p style="text-align: center;"><b><u>Article 6</u></b></p> <p style="text-align: center;">Licensing and Training</p> <p>(1) The Contracting States agree that:</p> <ul style="list-style-type: none"> <li>(a) an air traffic controller licence issued by one Contracting State, or</li> <li>(b) an authorisation by a service provider, or</li> <li>(c) an authorisation to a unlicensed State employee to operate as an air traffic controller,</li> </ul> <p>is valid for the provision of air traffic services in the portion of the airspace of the other Contracting State within which the responsibility for the provision of ATS is delegated.</p> <p>(2) Training of ATS personnel of one Contracting State, providing ATS in the portion of airspace of the other Contracting State, shall include the requirements pertaining to the airspace concerned.</p>	<p><i>This is actual practice which is applied by several ATS Units/Authorities in the world.</i></p> <p><i>Different airspace classifications, restricted and reserved areas and/or special regulations in the neighbouring State including military procedures should be taken into account.</i></p>
<p style="text-align: center;"><b><u>Article 7</u></b></p> <p style="text-align: center;">State Aircraft</p> <p>(1) State Aircraft other than those of the Delegating State may not enter that portion of airspace where the responsibility for the provision of ATS has been delegated without prior Diplomatic Clearance or special permission from the Delegating State.</p> <p>(2) For State aircraft operating as <b>GAT</b> the same rules and procedures are to be applied as for Civil Air Traffic, but where necessary, special procedures should be established to permit their access to the airspace. <b>OAT</b> shall be subject to prior co-ordination between the military unit and the ATS Unit/Authority concerned.</p>	<p><i>Generally a distinction between GAT and OAT is made to reflect their different objectives. For GAT, the relevant ICAO regulations (transferred into national law) would be applicable.</i></p>

<p style="text-align: center;"><b><u>Article 8</u></b></p> <p style="text-align: center;">Co-ordination and Contingency Procedures for Military and Other Reasons</p> <p>(1) Letters of Agreement (LoA) shall be supplemented by co-ordination and contingency procedures established by the Units/Authorities concerned.</p> <p>(2) The ATS Unit/Authority of the Providing State shall provide the appropriate military Authorities/Units of the Delegating State with pertinent flight plans and other data concerning the flights in the airspace where the responsibility for the provision of ATS has been delegated.</p>	<p><i>The co-ordination and contingency procedures could include the following item, in accordance with Annex 11 and 2 of the Chicago Convention:</i></p> <p><i>service the aircraft in the event of an emergency</i></p> <p><i>steps to be taken in-flight contingencies</i></p> <p><i>steps to be taken to assist the strayed aircraft</i></p> <p><i>steps to be taken concerning the interception of ( civil ) aircraft / unlawful use of the airspace</i></p> <p><i>co-ordination between military authorities and air traffic services</i></p> <p><i>co-ordination of activities potentially hazardous to civil aircraft</i></p> <p><i>information exchange between the appropriate civil and military authorities / units</i></p> <p><i>requirements relating to the diplomatic clearances or for special permissions for State Aircraft of the other State</i></p>
<p style="text-align: center;"><b><u>Article 9</u></b></p> <p style="text-align: center;">Publication</p> <p>Contracting States shall agree upon the content of, and publish all relevant information regarding the portion of airspace, where the responsibility for the provision of ATS has been delegated, in their Aeronautical Information Package as defined in Annex 15 to the Chicago Convention.</p>	

<p style="text-align: center;"><b><u>Article 10</u></b></p> <p style="text-align: center;">Investigation of Accidents or Serious Incidents</p> <p>(1) A Contracting State will institute an inquiry into the circumstances of accidents or serious incidents occurring in its territory.</p> <p>(2) At its request, the Delegating State shall be provided with the necessary materials from the ATS Unit/Authority of the Providing State (e.g. radar data recordings, tape transcriptions, etc.) in order to enable it to conduct an inquiry into an accident or serious incident occurring in the Delegating State's territory.</p> <p>(3) The Providing State shall be given the opportunity to appoint observers to be present at the inquiry and the Delegating State shall communicate the report and findings of the inquiry to that State.</p>	<p><i>In conformity with Article 26 and Annex 13 of the Chicago Convention.</i></p> <p><i>In conformity with Directive 94/56 of the European Council.</i></p> <p><i>Co-ordination between the two States concerned is in most cases necessary.</i></p>
<p style="text-align: center;"><b><u>Article 11</u></b></p> <p style="text-align: center;">Dispute Resolution</p> <p>(1) If any dispute arises between the Contracting States regarding the interpretation or application of any provision of this Agreement, the Contracting States shall in the first place endeavour to settle it by negotiation.</p> <p>(2) If the Contracting States are unable to resolve any disagreement by negotiation, the dispute shall be submitted for final decision to a third party (arbitrator) designated by both Contracting States.</p> <p>(3) The costs of arbitration, including its fees and expenses, shall be shared equally by the Contracting States.</p>	<p><i>The possibility that the Contracting States could elect EUROCONTROL as their arbitrator was suggested by the members involved in the drafting of this Agreement.</i></p>

<p style="text-align: center;"><b><u>Article 12</u></b></p> <p style="text-align: center;">Termination/Suspension</p> <p>(1) This Agreement may be terminated by either Contracting State at any time by written notice to the other Contracting State. The termination shall become effective {12} months after the date of receipt of such notice by the other Contracting State.</p> <p>(2) In the event of war, during a period of emergency or in the interest of public safety, or in other exceptional circumstances, each Contracting State has the right to suspend or terminate the Agreement with immediate effect, and shall notify the other Contracting State accordingly.</p> <p>(3) The Letters of Agreement referred to in Article 2 (5) shall contain provisions regarding their suspension and termination.</p>	<p><i>See Article 9 of the Chicago Convention.</i></p> <p><i>This is to meet defence requirements. If this agreement (State level) is terminated, the LoA under it will, as a consequence, be cancelled with effect from the same date of termination.</i></p>
<p style="text-align: center;"><b><u>Article 13</u></b></p> <p style="text-align: center;">Entry into Force</p> <p>(1) This Agreement shall enter into force as soon as the Contracting States have notified each other in writing of the completion of their respective constitutional requirements.</p> <p>(2) This Agreement may be provisionally applied from the date of its signature.</p>	
<p style="text-align: center;"><b><u>Article 14</u></b></p> <p style="text-align: center;">Amendments</p> <p>(1) If a Contracting State considers it desirable to amend any provisions of this Agreement, it may request consultations with the other Contracting State. Any amendments agreed by the Contracting States shall come into force when they have been confirmed by an exchange of diplomatic notes.</p> <p>(2) Amendments to the Attached <i>Common Format LoA</i> may be jointly determined by direct Agreement between the appropriate ATS Units/Authorities of the Contracting States.</p>	

<p style="text-align: center;"><b><u>Article 15</u></b></p> <p style="text-align: center;">Transitional Measures for Agreements Already in Operation</p> <p>Agreements which are in operation on the date of entry into force of this Agreement shall be assessed for possible revision in accordance with the provisions set out in this Agreement.</p>	<p><i>“Agreements already in operation” refers to agreements on co-ordination procedures as well as agreements at the State level.</i></p>
<p style="text-align: center;"><b><u>Article 16</u></b></p> <p style="text-align: center;">ICAO Registration</p> <p>This Agreement shall be registered with the ICAO Council, in accordance with the provisions of Article 83 of the Chicago Convention.</p>	
<p>In witness whereof, the undersigned, being duly authorised by their respective Governments, have signed this Agreement.</p> <p>Done in duplicate at..... this.....day of 2000 in the English ( ) languages. In case of any divergence of interpretation of the text, the English one shall prevail.</p> <p>For the Government of</p> <p>For the Government of</p>	

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## **SECTION 6**

<h1><b>GUIDELINES FOR DELEGATION OF THE RESPONSIBILITY FOR THE PROVISION OF ATS</b></h1>
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## **FINAL PAGE**

### **SUGGESTION - COMMENTS**

To propose modifications, if so required, to the present Section 6 "Guidelines for Delegation of Air Traffic Services", please contact:

Mr Anders Hallgren  
EUROCONTROL  
Airspace / Flow Management and Navigation Business Division (AFN BD)  
Rue de la Fusée, 96  
B-1130 BRUSSELS  
(E-mail: anders.hallgren@eurocontrol.int)

### **SECTION 6 - SPONSOR: ATM PROCEDURES DEVELOPMENT SUB-GROUP**

Whenever material received, in accordance with the above procedure, makes it apparent that an amendment of the present Section 6 is required, such amendment will be first discussed within the ATM Procedures Development Sub-Group (APDSG) before its adoption by the Airspace & Navigation Team (ANT).

### **PUBLICATION OF AMENDMENT**

The agreed amendment will then be issued by EUROCONTROL in the form most convenient for its insertion in the Planning Manual.

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## **SECTION 7**

<h1><b><u>GUIDELINES FOR FREE ROUTE AIRSPACE DESIGN</u></b></h1>
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### **7.1 INTRODUCTION**

#### **7.1.1 TBD**

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UNDER THE AUSPICES OF FRAP**

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## SECTION 8

# TERMS AND REFERENCES

### 8.1 ACRONYMS AND ABBREVIATIONS

<b>A</b> CA	AUP/UUP Composition Application
ACAS	Airborne Collision Avoidance System
ACC	Area Control Centre
ACFT	Aircraft
AD	Air Defence
AFN	EUROCONTROL Airspace/Flow Management & Navigation Business Division
AGL	Above Ground Level
AIP	Aeronautical Information Publication
AIS	Aeronautical Information Service
AMC	Airspace Management Cell
AME	ATM Message Exchange
AMSL	Above Mean Sea Level
ANT	EATM Airspace & Navigation Team
AO	Aircraft Operator
AOM	Airspace Organisation & Management (one of EATM Programmes)
AOWIR	Aircraft Operator What-if Re-routing (CFMU Function)
APATSI	Airports/Air Traffic Services Interface
APD-SG	ATM Procedures Development Sub-Group of ANT
APP	Approach (Control)
APW	Airspace Penetration Warning
ARN	ATS Route Network
ARO	ATS Reporting Office
ASAS	Airborne Separation Assurance System
ASM	Airspace Management
ASM-SG	Airspace Management Sub-Group of ANT
ATC	Air Traffic Control
ATCC	Air Traffic Control Centre
ATCO	Air Traffic Control Officer
ATCU	Air Traffic Control Unit
ATFM	Air Traffic Flow Management
ATFCM	Air Traffic Flow & Capacity Management
ATM	Air Traffic Management (ATS+ASM+ATFM)
ATN	Aeronautical Telecommunications Network
ATS	Air Traffic Services
ATSU	Air Traffic Service Unit
ATZ	Aerodrome Traffic Zone
AUP	Airspace Use Plan
AW	Aerial Work
<b>B</b> -RNAV	Basic Area Navigation
<b>C</b> AA	Civil Aviation Authority
CADF	ECAC Centralised Airspace Data Function
CBA	Cross-Border Area
CDR	Conditional Route

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CDM	Collaborative Decision-Making
CFMU	EUROCONTROL Central Flow Management Unit
CIP	Convergence and Implementation Plan
CNS	Communication, Navigation and Surveillance
CODA	Central Office for Delay Analysis (EUROCONTROL)
COM	Communication
CPL	Current Flight Plan
CRAM	Conditional Route Availability Message
CRCO	Central Route Charges Office (EUROCONTROL)
CTA	Control Area
CTR	Control Zone
CVFR	Controlled VFR
<b>D</b>	
	Danger Area
DAA	Dynamic Airspace Allocation
DME	Distance Measuring System
<b>E</b>	
EAD	European AIS Database
EANPG	ICAO Regional European Air Navigation Planning Group
EATCHIP	European ATC Harmonisation and Integration Programme
EATM	European Air Traffic Management
EATMS	European Air Traffic Management System
EC	European Commission
ECAC	European Civil Aviation Conference
ECIP	European Convergence and Implementation Plan
eFDP	European Flight Data Processing (Programme)
ETFMS	Enhanced Tactical Flow Management System
EUR ANP	ICAO European Air Navigation Plan
EUROCAE	European Organisation for Civil Aviation Electronics
EUROCONTROL	European Organisation for the Safety of Air Navigation
<b>F</b>	
FDP	Flight Data Processing System
FIR	Flight Information Region
FIS	Flight Information Service
FFA	Free Flight Airspace
FFAS	Free Flight Airspace Regime
FL	Flight Level
FLIPCY	Flight Plan Consistency
FMP	Flow Management Position
FMS	Flight Management System
FPL	Filed Flight Plan
FRA	Free Route Airspace
FRAP	Free Route Airspace Project
FUA	Flexible Use of Airspace
<b>G</b>	
GA	General Aviation
GAT	General Air Traffic
GND	Ground (Level)
GPS	Global Positioning System

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<b>I</b>	
IATA	International Air Transport Association
IACA	International Air Carriers Association
IAOPA	International Council of Aircraft Owner and Pilot Associations
ICAO	International Civil Aviation Organisation
IFATCA	International Federation of Air Traffic Controllers' Associations
IFPS	Integrated Initial Flight Plan Processing System
IFR	Instrument Flight Rules
IM	Information Management
IMC	Instrument Meteorological Conditions
<b>J</b>	
JAA	Joint Aviation Authorities
<b>K</b>	
K	Know Traffic Environment
(k)m	(kilo)metres
<b>L</b>	
LCIP	Local Convergence and Implementation Plan
LoA	Letter of Agreement
<b>M</b>	
MASPS	Minimum Aircraft System Performance Specification (ICAO)
MOD	Ministry of Defence
Mode S	Selective Co-operation Secondary Surveillance System
MOPS	Minimum Operational Performance Standards (Specifications) / FAA
MOT	Ministry of Transport
MSAW	Minimum Safe Altitude Warning
MSSR	Mono pulse Secondary Surveillance Radar
MTCDC	Medium Term Conflict Detection
<b>N</b>	
N	Intended Traffic Environment
NATO	North Atlantic Treaty Organisation
NAV	Navigation
NBD	Non-Directional Beacon
NM	Nautical Miles
NOTAM	Notice to Airmen
NSG	Navigation Sub-Group of ANT
<b>O</b>	
OAT	Operational Air Traffic
OCD	Operational Concept Document
OLDI	On-Line Data Interchange
<b>P</b>	
P	Prohibited Area
PANS	Procedures for Air Navigation Services (ICAO)
PCA	Prior Co-ordination Airspace
PIB	Pre-flight Information Bulletin
PMP	Programme/Project Management Plan
PPD	Pilot Preferences Downlink (data link)
P-RNAV	Precision Area Navigation
PSR	Primary Surveillance Radar
<b>R</b>	
R	Restricted Area
RAP	Recognised Air Picture
RCA	Reduced Co-ordination Airspace

RDPS	Radar Data Processing System
RIA	Regulatory Impact Assessment
RNAV	Area Navigation
RND-SG	Route Network Development Sub-Group of ANT
RNP	Required Navigation Performance
RPV	Remotely Piloted Vehicle
RTF	Radio Telephony Frequency
RVSM	Reduced Vertical Separation Minimum
RWY	Runway
R&D	Research and Development
<b>S</b>	
SA	Separation Assurance
SARPS	Standards and Recommended Practices (ICAO)
SID	Standard Instrument Departure (Route)
SLoA	Stakeholder Line of Action (ECIP, LCIP)
SRA	Special Rules Area
SRS	Standard Routeing Scheme
SRZ	Special Rules Zone
SSR	Secondary Surveillance Radar
STAR	Standard (Instrument) Arrival Route
STCA	Short Term Conflict Area
SUR	Surveillance
SWIM	System-Wide Information Management
<b>T</b>	
TAA	Temporary Airspace Allocation
TACT	CFMU Tactical System
TIA	Traffic Information Area
TIZ	Traffic Information Zone
TMA	Terminal Control Area
TPIAS	Transition Plan for the Implementation of the Airspace Strategy
TRA	Temporary Reserved Airspace
TSA	Temporary Segregated Area
TWR	Tower
<b>U</b>	
U	Unknown Traffic Environment
UAC	Upper Area Control Centre
UAV	Uninhabited Aerial Vehicle
UCAS	Uncontrolled Airspace
UHF	Ultra High Frequency (300 to 3000Mhz)
UIFR	Uncontrolled IFR
UIR	Upper Information Region
UMAS	Unmanaged Airspace
UN	United Nations
UTA	Upper Control Area
UTC	Co-ordinated Universal Time
UUP	Updated Airspace Use Plan
<b>V</b>	
VFR	Visual Flight Rules
VHF	Very High Frequency (30 to 300Mhz)
VMC	Visual Meteorological Conditions
VOR	VHF (Very High Frequency) Omni-Range
<b>W</b>	
WEU	Western European Union
WGS	World Geodetic Survey

## 8.2 EXPLANATION OF TERMS

The terms used in the EUROCONTROL Manual for Airspace Planning have the following meanings.

The ICAO definitions are identified with an **(I)** at the end of the text.

*Some terms have an explanatory note in italics.*

### A

**Aerial Work** is an aircraft operation in which an aircraft is used for specialised services such as agriculture, construction, photography, surveying, observation and patrol, search and rescue, aerial advertisement, etc. **(I)**

**Aeronautical Information Publication (AIP)** is a publication issued by or with the authority of a State containing aeronautical information of a lasting character essential to air navigation. **(I)**

**Aeronautical Information Service (AIS)** A service established within the defined area of coverage responsible for the provision of aeronautical information/data necessary for the safety, regularity and efficiency of air navigation.

*Such information includes the availability of air navigation facilities and services and the procedures associated with them, and must be provided to flight operations personnel and services responsible for flight information service.*

**Aircraft Operating Agencies (AOs)** are the person, organisation or enterprise engaged in, or offering to engage in, an aircraft operation. **(I)**

*In the context of the FUA Concept, "AOs" encompass all aircraft operations other than aerial work operations, that is to say commercial air transport operations and general aviation operations.*

**Airspace Management (ASM)** is a planning function with the primary objective of maximising the utilisation of available airspace by dynamic time-sharing and, at times, the segregation of airspace among various categories of users based on short-term needs. In future systems, airspace management will also have a strategic function associated with infrastructure planning. **(I)**

*In the context of the FUA Concept, airspace management is a generic term covering any management activity at the three Strategic, Pre-tactical and Tactical Levels, provided for the purpose of achieving the most efficient use of airspace based on actual needs and, where possible, avoiding permanent airspace segregation.*

**Airspace Management Cell (AMC)** is a joint civil/military cell responsible for the day-to-day management and temporary allocation of national or sub-regional airspace under the jurisdiction of one or more ECAC state(s).

**Airspace Reservation** is a defined volume of airspace normally under the jurisdiction of one aviation authority and temporarily reserved, by common agreement, for exclusive use by another aviation authority. **(I)**

*In the context of the FUA Concept, airspace reservation include "Temporary Reserved Area" (TRA) and "Temporary Segregated Area" (TSA).*

**Airspace Structures** are specific portions of airspace designed to accommodate the safe operation of aircraft.

*In the context of the present document, "Airspace Structures" include Controlled Airspace, ATS Route, ATC Sectors, Danger Area (D), Restricted Area (R), Prohibited Area (P), Temporary Segregated Area (TSA), Temporary Reserved Area (TRA), Cross-Border Area (CBA),.....*

**Airspace Use Plan (AUP)** is an ASM message of NOTAM status notifying the daily decision of an Airspace Management Cell on the temporary allocation of the airspace within its jurisdiction for a specific time period, by means of a standard message format.

**Air Traffic** encompasses all aircraft in flight or operating on the manoeuvring area of an aerodrome. **(I)**

**Air Traffic Control Clearance** is an authorisation for an aircraft to proceed under conditions specified by an Air Traffic Control unit. **(I)**

*For convenience, the term "Air Traffic Control Clearance" is frequently abbreviated to "ATC Clearance" or "Clearance" when used in appropriate contexts.*

*The abbreviated term "Clearance" may be prefixed by the words "taxi", "take-off", "departure", "en-route", "approach" or "landing" to indicate the particular portion of flight to which the Air Traffic Control Clearance relates. (I)*

**Air Traffic Control Service (ATC)** is a service provided for the purpose of:

- a) preventing collisions:
  - 1) between aircraft, and
  - 2) on the manoeuvring area between aircraft and obstructions, and
- b) expediting and maintaining an orderly flow of air traffic. **(I)**

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

**Air Traffic Flow Management Notification Message (ANM)** is the official medium for the notification of ATFM measures. It is produced by the CFMU the day before the day of operation to provide a summary of planned ATFM measures and to promulgate any specific instructions or communications requirements associated with those measures.

**Air Traffic Management (ATM)** is the aggregation of the airborne functions and ground-based functions (air traffic services, airspace management and air traffic flow management) required to ensure the safe and efficient movement of aircraft during all phases of operations. **(I)**

*The general objective of ATM is to enable aircraft operators to meet their planned departure and arrival times and to adhere to their preferred flight profiles with the minimum constraints, without compromising agreed levels of safety.*

**Air Traffic Services (ATS)** is a generic term meaning variously, Flight Information Service (FIS), Alerting Service, Air Traffic Advisory Service, Air Traffic Control (ATC) Service (Area Control Service, Approach Control Service or Aerodrome Control Service). **(I)**

**Air Traffic Services Unit (ATSU)** is a generic term meaning variously, air traffic control unit, flight information centre or air traffic services reporting office. **(I)**

**Airway (AWY)** is a control area or portion thereof established in the form of a corridor. **(I)**

**AMC-Manageable Area** is an area subject to management and allocation by an AMC at Level 2.

*Under the Temporary Airspace Allocation Process, these manageable areas are either formal structures entitled "TSAs or TRAs" or R and D Areas that are manageable at Level 2 in the same way as TSA/TRAs.*

**Approved Agencies (AAs)** are units, which are authorised by a State to deal with an Airspace Management Cell for airspace allocation and utilisation matters.

**Area Control Centre (ACC)** is a unit established to provide air traffic control service to controlled flights in control areas under its jurisdiction. **(I)**

**Area Navigation (RNAV)** is a method of navigation which permits aircraft operation on any desired flight path within the coverage of station-referenced navigation aids or within the limits of the capability of self-contained aids, or a combination of these. **(I)**

**ATC Clearance** (see Air Traffic Control Clearance)

**ATC Co-ordination** is the process of communication between ATC units, or controllers within such units, of the necessary flight plan data, radar data and control information with a view to reaching an agreed course of action as the controlled flight(s) progress(es).

**ATC Instructions** are directives issued by air traffic control for the purpose of requiring a pilot to take a specific action. **(I)**

**ATC Unit** is a generic term meaning variously, area control centre (ACC), approach control office or aerodrome control tower. **(I)**

**ATS Airspace (Class A to G)** are airspaces of defined dimensions, alphabetically designated, within which specific types of flights may operate and for which air traffic services and rules of operation are specified. **(I)**

*ATS airspaces are classified as Class A to G (I).*

**ATS Environment Data Base** is a specific part of the CFMU Data Base containing all environment data concerning airspace organisation and structure, ACC operational organisation and ATC capacities. The ATS Environment Data Base is used by the CFMU systems for the calculation of flight profiles taking account of all the airspace constraints.

**ATS Reporting Office (ARO)** is a unit established for the purpose of receiving reports concerning air traffic services and flight plans submitted before departure. **(I)**

**ATS Route** is a specified part of the airspace structure designed for channelling the flow of traffic as necessary for the provision of air traffic services. **(I)**

*In the context of the FUA Concept, the term "ATS route" is used to mean variously Upper Air Route, Airway, Advisory Route, Standard Instrument Departure or Standard Arrival Route, RNAV Route, Permanent Route and Conditional Route.*

## C

**Central Flow Management Unit (CFMU)** is an EUROCONTROL Directorate established in accordance with the ICAO Centralised ATFM Organisation to provide the ATFM Service, on behalf of the participant States, in a specified part of the EUR Region.

*The CFMU comprises the Flow Management Division (FMD) and the Flight Data Operations Division with the Integrated Initial Flight Plan Processing System (IFPS). For ASM purposes, the CFMU is also entrusted with the Centralised Airspace Data Function (CADF).*

**Centralised Airspace Data Function (CADF)** is an ASM function entrusted to the CFMU by the ECAC States for extracting Conditional Route (CDR) information contained in the various national AUPs. The CADF compiles it into a single coherent list, the Conditional Route Availability Message (CRAM).

**Civil/Military Co-ordination** is the communication between civil and military elements (human and/or technical) necessary to ensure safe, efficient and harmonious use of the airspace.

**Clearance** (see Air Traffic Control Clearance) **(I)**

**Cleared Flight Level (CFL)** is the flight level at or to which an aircraft is authorised to proceed under conditions specified by an ATC unit.

**Conditional Route (CDR)** is an ATS route or a portion thereof which can be planned and used under certain specified conditions.

*CDRs can be divided into different categories according to their flight-planning possibilities and the expected level of activity of the possible associated TSAs/TRAs. A CDR can be established in one or more of the three following categories:*

- a) Category One - Permanently Plannable CDR,*
- b) Category Two - Non-Permanently Plannable CDR, and*
- c) Category Three - Not Plannable CDR.*

**Conditional Route Availability Message (CRAM)** is a special consolidated ASM message issued daily by the CADF to promulgate in one message, on behalf of ECAC States, the AMC decisions on Conditional Routes (CDRs) availability notified by the AUPs for all the ECAC area. The CRAM is used by Aircraft Operators for flight planning purposes.

**Control Area (CTA)** is a controlled airspace extending upwards from a specified limit above the earth. **(I)**

**Control Zone (CTR)** is a controlled airspace extending upwards from the surface of the earth to a specified upper limit. **(I)**

**Controlled Airspace** is an airspace of defined dimensions within which air traffic control services are provided to IFR flights and to VFR flights in accordance with the airspace classification. **(I)**

*Controlled Airspace is a generic term, which covers ATS airspace classes A, B, C, D & E*

*Controlled Airspace includes Control Area (CTA), Terminal Control Area (TMA), Airway (AWY) and Control Zone (CTR). **(I)***

**Controlled Flight** is any flight, which is subject to an ATC clearance. **(I)**

**Controller's Intentions** are updated flight data, which shall be exchanged, as laid down in LoAs, either simultaneously with or before, the corresponding ATC clearance is issued.

**Cross-Border Area (CBA)** is a Temporary Segregated Area established over international boundaries for specific operational requirements.

**Current Flight Plan (CPL)** is the flight plan, including changes, if any, brought about by subsequent clearances. **(I)**

*When the word "message" is used as a suffix to this term, it denotes the content and format of the current flight plan data sent from one unit to another. **(I)***

## D

**Danger Area (D)** is an airspace of defined dimensions within which activities dangerous to the flight of aircraft may exist at specified times. **(I)**

*In the context of the FUA Concept, some Danger Areas subject to management and allocation at Level 2 are established at Level 1 as "AMC-manageable areas" and identified as such in AIP.*

## E

**En-Route Phase** is that part of the flight from the end of the take-off and initial climb phase to the commencement of the approach and landing phase or more generally the portion of a flight excluding the airport phases. **(I)**

## F

**Filed Flight Plan (FPL)** is the flight plan as filed with an ATS unit by the pilot or a designated representative, without any subsequent changes. **(I)**

*When the word "message" is used as a suffix to this term, it denotes the content and format of the filed flight plan data as transmitted. **(I)***

**Flexible Use of Airspace (FUA) Concept** is based on the fundamental principle that airspace should not be designated as either pure civil or military airspace, but rather be considered as one continuum in which all user requirements have to be accommodated to the extent possible.

**Flight Information Region (FIR)** is an airspace of defined dimensions within which flight information service and alerting service are provided. **(I)**

**Flight Management System (FMS)** is an integrated system, consisting of airborne sensor, receiver and computer with both navigation and aircraft performance data bases, which provides performance and RNAV guidance to a display and automatic flight control system.

**Flight Plan** contains specified information provided to air traffic services units, relative to an intended flight or portion of a flight of an aircraft. **(I)**

**Flow Management Division (FMD)** is the CFMU unit responsible for the planning, co-ordination and execution of the Strategic, Pre-Tactical and Tactical Air Traffic Flow Management.

**Flow Management Position (FMP)** is a working position established within an ACC to ensure the necessary interface with the CEU on matters concerning the provision of the ATFM Service and the interface with national AMCs on matters concerning the ASM Service.

## G

**General Air Traffic (GAT)** encompasses all flights conducted in accordance with the rules and procedures of ICAO and/or the national civil aviation regulations and legislation.

*GAT can include military flights for which ICAO rules and procedures satisfy entirely their operational requirements.*

**General Aviation** encompasses all civil aviation operations other than scheduled air services and non-scheduled air transport operations for remuneration or hire. **(I)**

## I

**Integrated Initial Flight Plan Processing System (IFPS)** is the CFMU system in charge of receiving and processing the GAT IFR flight plan data and associated update messages for the area covered by the participating States. It subsequently distributes these messages in a format, which can be received and processed automatically by ATC Flight Plan Processing Systems (FPPS) and the CEU (West) without further intervention. The IFPS is installed in two geographical sites.

## K

**Known Traffic Environment (KTE)** is the environment within which all traffic is known to ATS.

## L

**Level 1 - Strategic ASM** is the act of defining and reviewing, as required, the national airspace policy taking into account national and international airspace requirements.

**Level 2 - Pre-Tactical ASM** is the act of conducting operational management within the framework of pre-determined existing ATM structure and procedures defined in Level 1 and of reaching specific agreement between civil and military authorities involved.

**Level 3 - Tactical ASM** is the act, on the day of operation, of activating, de-activating or real-time reallocating of airspace allocated in Level 2 and of solving specific airspace problems and/or of individual OAT/GAT traffic situations in real-time between civil and military ATS units and/or controllers, as appropriate. This co-ordination can take place either in active or passive mode with or without action by the controller.

## M

**Manoeuvring Area** is that part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons. **(I)**

## N

**Notice to Airmen (NOTAM)** is a notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations. **(I)**

## O

**Off-Route Traffic** encompasses all GAT flying outside the published ATS Routes Network.

**On-Route Traffic** encompasses all GAT flying along the published ATS Routes Network.

**Operational Air Traffic (OAT)** encompasses all flights which do not comply with the provisions stated for GAT and for which rules and procedures have been specified by appropriate national authorities.

*OAT can include civil flights such as test-flights, which require some deviation from ICAO rules to satisfy their operational requirements.*

## P

**Permanent ATS Route** is a permanently designated ATS route which is not subject to daily management at Level 2 by AMCs.

**Pre-Tactical Civil/Military Co-ordination** (see definition of Level 2 - Pre-Tactical ASM).

**Prior Co-ordination Airspace (PCA)** is a portion of airspace of defined dimensions within which individual GAT is permitted to fly "off-route" only after prior co-ordination initiated by GAT controllers with OAT controllers.

**Prohibited Area (P)** is an airspace of defined dimensions, above the land area or territorial waters of a State, within which the flight of aircraft is prohibited. **(I)**

## R

**Real-Time Civil/Military Co-ordination** (see definition of Level 3 - Tactical ASM).

**Reduced Co-ordination Airspace (RCA)** is a portion of airspace of defined dimensions within which GAT is permitted to fly "off-route" without requiring GAT controllers to initiate co-ordination with OAT controllers.

**Restricted Area (R)** is an airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is restricted in accordance with specific conditions. **(I)**

*In the context of the FUA Concept, some Restricted Areas are subject to management and allocation at Level 2 are established at Level 1 as "AMC-manageable areas" and identified as such in AIP.*

**Route Availability Document (RAD)** is a strategically planned routing system for the CFMU area agreed at the annual ICAO Stratplan meeting. The RAD is designed as a part of the CFMU ATFM operation to make the most effective use of ATC capacity while allowing aircraft operators flight planning flexibility. The RAD enables ATC to maximise capacity by defining routings that provide an organised system of major traffic flows through congested areas and reduce the crossing of major flows at critical points.

## S

**Standard Arrival Route (STAR)** is a standard ATS route identified in an approach procedure by which aircraft should proceed from the en-route phase to an initial approach fix.

**Standard Instrument Departure Route (SID)** is a standard ATS route identified in an instrument departure procedure by which aircraft should proceed from take-off phase to the en-route phase.

**Strategic Civil/Military Co-ordination** (see definition of Level 1 - Strategic ASM).

## T

**Tactical Civil/Military Co-ordination** (see definition of Level 3 - Tactical ASM).

**Temporary Airspace Allocation Process** consists in the allocation process of an airspace of defined dimensions assigned for the temporary reservation (TRA/TSA) or restriction (D/R) and identified more generally as an "AMC-manageable" area. (See Section 3).

**Temporary Reserved Area (TRA)** is a defined volume of airspace normally under the jurisdiction of one aviation authority and **temporarily reserved**, by common agreement, for the specific use by another aviation authority and through which other traffic may be allowed to transit, under ATC clearance.

**Temporary Segregated Area (TSA)** is a defined volume of airspace normally under the jurisdiction of one aviation authority and **temporarily segregated**, by common agreement, for the exclusive use by another aviation authority and through which other traffic will not be allowed to transit.

*In the context of the FUA Concept, all TRAs and TSAs are airspace reservations subject to management and allocation at Level 2.*

**Note:** Pending results from consultation with ICAO on above definitions, the current TSA definition is maintained i.e. :

***“Temporary Segregated Area (TSA)** is an airspace of defined dimensions within which activities require the reservation of airspace for the exclusive use of specific users during a determined period of time”.*

**Terminal Airspace** is a generic term encompassing Terminal Control Area (TMA), Control Area (CTA), Control Zone (CTR), Special Rules Zone (SRZ), Aerodrome Traffic Zone (ATZ), or any other nomenclature, such as Traffic Information Area (TIA) or Traffic Information Zone (TIZ) and Airspace Classification, used to describe the airspace around an airport.

**Terminal Control Area (TMA)** is a control area normally established at the confluence of ATS routes in the vicinity of one or more major aerodromes. **(I)**

## U

**Unknown Traffic Environment (UTE)** is the environment within which not all traffic is known to ATS.

**Updated Airspace Use Plan (UUP)** is an ASM message of NOTAM status issued by an AMC on the day of operation to update AUP information.

## 8.3 REFERENCES AND SOURCE DOCUMENTS

### EUROCONTROL Documentation

Final Report of the Task Force on Airspace Structure and Management.  
(EUROCONTROL Doc 92.10.13 - July 1992)

Report on the Organisational Structures and Procedures Required for the Application of the Concept of the Flexible Use of Airspace.  
(EUROCONTROL Doc 94.70.08 - March 1994)

Report on Route Network Development and Associated Sectorisation Improvements in the ECAC Area.

(EUROCONTROL Doc 95.70.05 - January 1995)

Functional Specifications for System Support for Airspace Management and Civil/Military Coordination.

(EUROCONTROL Document DPS.ET1.ST10.2000-FS-01-00 - 15 May 1996)

Guidance Document for the Implementation of the Flexible Use of Airspace Concept.  
(EUROCONTROL Document ASM.ET1.ST08.5000-GUI-02-00 – 18 August 2003)

ATS Data Exchange Presentation (ADEXP)  
(EUROCONTROL Standard Document DPS-ET1-ST09-STD-01-00)

EUROCONTROL Airspace Strategy for the ECAC States  
(EUROCONTROL Document ASM.ET1.ST03.4000-EAS-01-00 – 18 January 2001) .

Transition Plan for the Implementation of the EUROCONTROL Airspace Strategy for the ECAC States (EUROCONTROL Document ASM.ET1.ST03.4000-TPIAS-01-01 – 19 April 2002)

EUROCONTROL Handbook for Airspace Management  
(EUROCONTROL Document ASM.ET1.ST08.5000.HBK-02-00 – 22 October 2003)

### ICAO Documentation

Annex 2	Rules of the Air
Annex 11	Air Traffic Services
Annex 15	Aeronautical Information Services
Doc. 4444	PANS – ATM/501
Doc. 7754	EUR Air Navigation Plan
Doc. 8126	Aeronautical Information Services Manual
Doc. 8168	PANS – OPS/611
Doc. 9426	Air Traffic Services Planning Manual
Doc. 9554	Manual Concerning Safety Measures Relating to Military Activities Potentially Hazardous to Civil Aircraft Operations
EUR Doc 001	Guidance Material Relating to the Implementation of Area Navigation (RNAV) in the EUR Region

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