Doc 4444
ATM/501

**Procedures for**
**Air Navigation Services**

# Air Traffic Management

This edition incorporates all amendments approved by the Council prior to 2 June 2007 and supersedes, on 22 November 2007, all previous editions of Doc 4444.

Fifteenth Edition — 2007

**International Civil Aviation Organization**

# AMENDMENTS

The issue of amendments is announced regularly in the *ICAO Journal* and in the supplements to the *Catalogue of ICAO Publications and Audio-visual Training Aids*, which holders of this publication should consult. The space below is provided to keep a record of such amendments.

## RECORD OF AMENDMENTS AND CORRIGENDA

| AMENDMENTS | | | |
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# FOREWORD

## 1. Historical background

1.1 The *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM) are the result of the progressive evolution of the *Procedures for Air Navigation Services — Air Traffic Control* (PANS-ATC) prepared by the Air Traffic Control Committee of the International Conference on North Atlantic Route Service Organization (Dublin, March 1946).

1.2 A second version of the PANS-ATC was issued in the same year, following review of the original procedures by the International Conference on European-Mediterranean Route Service Organization (Paris, April–May 1946).

1.3 The Third Edition of the PANS-ATC was prepared in 1947 by the Rules of the Air and Air Traffic Control (RAC) Division at its Second Session (Montreal, December 1946–January 1947).

1.4 Originally applicable on a regional basis, the PANS-ATC became applicable on a worldwide basis on 1 February 1950.

1.5 The Fourth Edition (1951) was given the title *Procedures for Air Navigation Services — Rules of the Air and Air Traffic Services* (PANS-RAC) on the recommendation of the Fourth Session of the Rules of the Air and Air Traffic Control (RAC) Division (Montreal, November–December 1950). This title reflected the fact that certain procedures applicable to pilots and a number of procedures relating to the provision of flight information and alerting service were included therein, in addition to the operation of the air traffic control service.

1.6 Further editions were issued periodically. The origin of each edition issued since 1946 and subsequent amendments thereto are shown in Table A, together with a list of the principal subjects involved, the dates on which the amendments were approved by the Council and the dates on which they became applicable.

1.7 This edition, re-titled *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM), provides for a comprehensive update of the procedures as well as a major reorganization of the contents. The new title reflects that provisions and procedures relating to safety management of air traffic services and to air traffic flow management are included.

## 2. Scope and purpose

2.1 The *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM) are complementary to the Standards and Recommended Practices contained in Annex 2 — *Rules of the Air* and in Annex 11 — *Air Traffic Services*. They are supplemented when necessary by regional procedures contained in the *Regional Supplementary Procedures* (Doc 7030).

*Note 1.— Although these procedures are mainly directed to air traffic services personnel, flight crews should be familiar with the procedures contained in the following chapters of the document:*

*Chapters 3, 4 through 9, 12 through 14, Sections 16.3 and 16.4 of Chapter 16, and Appendices 1, 2, 4 and 5.*

*Note 2.— The objectives of the air traffic control service as prescribed in Annex 11 do not include prevention of*

*collision with terrain. The procedures prescribed in this document do not relieve pilots of their responsibility to ensure that any clearances issued by air traffic control units are safe in this respect. When an IFR flight is vectored or is given a direct routing which takes the aircraft off an ATS route, the procedures in Chapter 8, 8.6.5.2 apply.*

2.2 The *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM) specify, in greater detail than in the Standards and Recommended Practices, the actual procedures to be applied by air traffic services units in providing the various air traffic services to air traffic.

## 3. Status

3.1 The Procedures for Air Navigation Services (PANS) do not have the same status as the Standards and Recommended Practices. While the latter are *adopted* by Council in pursuance of Article 37 of the Convention on International Civil Aviation, subject to the full procedure of Article 90, the PANS are *approved* by the Council and recommended to Contracting States for worldwide application.

3.2 While the PANS may contain material which may eventually become Standards or Recommended Practices (SARPs) when it has reached the maturity and stability necessary for adoption as such, they may also comprise material prepared as an amplification of the basic principles in the corresponding SARPs, and designed particularly to assist the user in the application of those SARPs.

## 4. Implementation

The implementation of procedures is the responsibility of Contracting States; they are applied in actual operations only after, and in so far as, States have enforced them. However, with a view to facilitating their processing towards implementation by States, they have been prepared in language which will permit direct use by air traffic services personnel and others associated with the provision of air traffic services to international air navigation.

## 5. Publication of differences

5.1 The PANS do not carry the status afforded to Standards adopted by the Council as Annexes to the Convention and, therefore, do not come within the obligation imposed by Article 38 of the Convention to notify differences in the event of non-implementation.

5.2 However, attention of States is drawn to the provision of Annex 15 related to the publication in their Aeronautical Information Publications of lists of significant differences between their procedures and the related ICAO procedures.

## 6. Promulgation of information

Information relating to the establishment and withdrawal of and changes to facilities, services and procedures affecting aircraft operations provided according to the Procedures specified in this document should be notified and take effect in accordance with Annex 15.

## 7. Contents of the document

Chapter 1 contains definitions.

Chapter 2 contains provisions and procedures regarding safety management of the air traffic services.

Chapter 3 contains provisions and procedures applicable to air traffic flow management.

Chapter 4 contains general provisions and procedures applicable to the air traffic services.

Chapter 5 contains provisions and procedures applicable to the separation of aircraft.

Chapter 6 contains provisions and procedures applicable to departing and arriving aircraft.

Chapter 7 contains provisions and procedures applicable by air traffic control units providing aerodrome control service.

*Note.— The procedures for operating aeronautical ground lights have been included in Chapter 7 (Section 7.15) since they concern mostly aerodromes. It should be noted that all aeronautical ground lights are included whether or not they are on or in the vicinity of an aerodrome, and that the whole of Section 7.15 applies to all aerodromes, whether or not aerodrome control service is provided.*

Chapter 8 contains procedures applicable by air traffic services units using radar in the performance of their functions.

Chapter 9 contains procedures applicable by air traffic services units providing flight information service and alerting service.

Chapter 10 contains procedures regarding the coordination to be effected between air traffic services units, between control positions within such units, and between such units and associated aeronautical telecommunication stations.

Chapter 11 contains procedures relating to the air traffic services messages which are necessary for the effective operation of air traffic services.

Chapter 12 contains typical phraseologies to be used in the provision of air traffic services, arranged in groups to relate to the particular phase of air traffic services with which they are generally employed.

Chapter 13 contains procedures regarding automatic dependent surveillance — contract (ADS-C) services.

Chapter 14 contains procedures concerning controller-pilot data link communications (CPDLC). The associated CPDLC message set is contained in Appendix 5.

Chapter 15 contains procedures related to emergencies, communication failure and contingencies.

Chapter 16 contains procedures applicable to special air operations, to incident reporting and to repetitive flight plans.

## Table A. Amendments to the PANS-ATM

| *Amendment* | *Source(s)* | *Subject(s)* | *Approved Applicable* |
|---|---|---|---|
| 1st Edition (1946) | North Atlantic Route Conference (1946) | *Procedures for Air Navigation Services — Air Traffic Control* (PANS-ATC). | Implemented on a regional basis on various dates and applicable from 1 February 1950 on a worldwide basis. |
| 2nd Edition (1946) | Conference on European-Mediterranean Route Service Organization (1946) | Revision of the original procedures. | |
| 3rd Edition (1947) | Rules of the Air and Air Traffic Control (RAC) Division, Second Session (1946/1947) | Revision of the second edition. | |
| 4th Edition | Rules of the Air and Air Traffic Control (RAC) Division, Fourth Session (1950) | *Procedures for Air Navigation Services — Rules of the Air and Air Traffic Services* (PANS-RAC). Inclusion of procedures applicable to pilots and of procedures regarding the provision of flight information and alerting service; change of title to reflect these inclusions. | 28 November 1951<br>1 September 1952 |
| 5th Edition | First Air Navigation Conference (1953); AGA Division, Fifth Session (1952) | Position reporting procedures; holding procedures phraseology; radar approach control procedures and phraseology; operation of aeronautical ground lights; air-ground communications failure; air-reports; flight plan AIREP and POMAR forms. | 8 December 1953<br>1 September 1954 |
| 6th Edition | Second Air Navigation Conference (1955) | Separation minima; VFR on-top; coordination between adjacent area control centres; objectives and functions of air traffic advisory service; alerting service and search and rescue service; POMAR form. | 11 May 1956<br>1 December 1956 |
| 7th Edition | Rules of the Air, Air Traffic Services and Search and Rescue (RAC/SAR) Division (1958) | Introduction of a new flight plan form; major revision of the provisions relating to flight plans and the issuance of clearances based thereon; revision of flight plan messages; standardized content for messages relating to emergency phases; changes to the separation minima requirements; contents of position reports; restrictions in the issuance of clearances to fly maintaining VMC; transfer of responsibility for control from one ATC unit to another; procedures for approach control service; objectives and functions of the air traffic advisory service; phraseologies for ATS; consolidation of all provisions regarding flight plans, the flight plan form and instructions for completion of same. | 18 February 1960<br>1 August 1960 |
| Amendment 1 to the 7th Edition | Panel for Coordinating Procedures respecting the Supply of Information for Aircraft Information, First Meeting (1959); Meteorology Division, Fifth Session (1959) | Transmission of meteorological information to aircraft in flight; revision of the Air-report and AIREP form. | 2 December 1960<br>1 July 1961 |
| Amendment 2 to the 7th Edition | Air Navigation Commission | Altimeter setting procedures. | 26 June 1961<br>1 October 1961 |
| Amendment 3 to the 7th Edition | Air Navigation Commission | Change to flight plan form to cater for flights through intermediate stops. | 15 December 1961<br>1 July 1962 |

| *Amendment* | *Source(s)* | *Subject(s)* | *Approved*<br>*Applicable* |
|---|---|---|---|
| Amendment 4 to the 7th Edition | Air Navigation Commission | Additional provisions relating to alerting service. | 13 April 1962<br>1 November 1962 |
| Amendment 5 to the 7th Edition | Air Navigation Commission | Changes and additions to the provisions relating to the operation of aeronautical ground lights. | 12 December 1962<br>1 March 1963 |
| Amendment 6 to the 7th Edition | Air Navigation Commission | Definition for "D-value". | 8 April 1963<br>1 November 1963 |
| Amendment 7 to the 7th Edition | Meteorological and Operations (MET/OPS) Divisional Meeting (1964) | Aircraft meteorological observations and reports. | 31 May 1965<br>10 March 1966 |
| 8th Edition | Rules of the Air and Air Traffic Services/Operations (RAC/OPS) Divisional Meeting (1963); Air Traffic Control Automation Panel (ATCAP), Fourth Meeting (1964) | New separation criteria and minima; control of VFR flights; essential traffic information; air traffic services coordination; phraseology including radar phraseology. | 29 November 1965<br>25 August 1966 |
| Amendment 1 to the 8th Edition | Air Navigation Commission | Introduction of a new part on the use of radar in air traffic services and consequential changes to other parts. Expression of vertical position. | 20 February 1967<br>24 August 1967 |
| 9th Edition | Air Traffic Control Automation Panel (ATCAP), Fifth Meeting (1966) | Changes to the provisions concerning air traffic services data to facilitate the application of automation in air traffic control; guidance material on ATC automation and flow control. | 7 June 1967<br>8 February 1968 |
| Amendment 1 to the 9th Edition | Fifth Air Navigation Conference (1967) | Changes to all parts to improve the safety and efficiency of international air operations in the approach, landing and take-off phases. | 23 January 1969<br>18 September 1969 |
| 10th Edition | Sixth Air Navigation Conference (1969) | Position reporting and reporting of operational and meteorological information; types of flights to be provided with separation; VMC clearances; Mach number technique; use of SSR in the air traffic services; application of separation minima; clearances; addressing of ATS messages; flight information service and alerting service; guidance material on the application of the Mach number technique on the use of secondary surveillance radar in the air traffic services and on a standard form and attendant procedures for the reporting of air traffic incidents. | 1 June 1970<br>4 February 1971 |
| Amendment 1 to the 10th Edition | Sixth Air Navigation Conference (1969); LIM EUM (RAC/COM) RAN Meeting (1969) | Changes to the format and data conventions for air-report messages. Estimated time of departure/arrival in ATS messages. | 24 March 1972<br>7 December 1972 |
| Amendment 2 to the 10th Edition | Air Navigation Commission | Authority over aircraft operating over the high seas. | 15 November 1972<br>16 August 1973 |
| Amendment 3 to the 10th Edition | Air Navigation Commission | Guidance material on repetitive flight plans. | 13 December 1972<br>16 August 1973 |
| Amendment 4 to the 10th Edition | Seventh Air Navigation Conference (1972) | Area navigation practices; position reports; SSR radiotelephony phraseology; guidance material on the use of SSR. | 23 March 1973<br>23 May 1974 |

| *Amendment* | *Source(s)* | *Subject(s)* | *Approved*<br>*Applicable* |
|---|---|---|---|
| Amendment 5 to the 10th Edition | Council action in pursuance of Assembly Resolutions A17-10 and A18-10 | ATS practices in the event an aircraft is being subjected to unlawful interference. | 7 December 1973<br>23 May 1974 |
| Amendment 6 to the 10th Edition | Various sources including Sixth EUM/RAN Meeting, a proposal by the United Kingdom, various actions of the Council and the Air Navigation Commission | Altimeter setting; radar identification and transfer; automatic terminal information service (ATIS); communication failure procedures. | 8 April 1974<br>27 February 1975 |
| Amendment 7 to the 10th Edition | Technical Panel on Supersonic Transport Operations; Air Navigation Commission; Council | Supersonic aircraft operations; interception of aircraft; definition of "emergency phase". | 4 February 1975<br>9 October 1975 |
| Amendment 8 to the 10th Edition | Air Navigation Commission; Amendments to Annexes 3 and 10 | SSR Code 7500; information to aircraft and air-reporting by aircraft; frequencies for survival radio equipment. | 12 December 1975<br>30 December 1976 |
| Amendment 9 to the 10th Edition | Technical Panel on Supersonic Transport Operations; Air Navigation Commission; Amendment to Annex 14 | Supersonic aircraft operations; unlawful interference. | 7 April 1976<br>30 December 1976 |
| 11th Edition | Ninth Air Navigation Conference (1976); Air Navigation Commission; Amendments to Annexes 3 and 14 | Definitions; ATS flight plans and messages; guidance material regarding repetitive flight plans; separation between aircraft; guidance material regarding wake turbulence and related separation minima; use of information derived from secondary surveillance radar; guidance material concerning radar separation based on computer-processed radar data; operation of aeronautical ground lights. | 9 December 1977<br>10 August 1978 |
| Amendment 1 to the 11th Edition | Air Navigation Commission | Designation of standard departure and arrival routes. | 3 December 1979<br>27 November 1980 |
| Amendment 2 to the 11th Edition | Air Navigation Commission | Definitions; coordination of activities which constitute a potential hazard to flights of civil aircraft; unmanned free balloons. | 4 March 1981<br>26 November 1981 |
| Amendment 3 to the 11th Edition | Air Navigation Commission | Action to be taken by an ATS unit when it becomes aware that an aircraft has deviated from its intended track or reports that it is lost. | 1 April 1981<br>26 November 1981 |
| Amendment 4 to the 11th Edition | Amendment 29 to Annex 11 | Automatic terminal information service (ATIS); transferred to Annex 11. | 2 April 1982<br>25 November 1982 |
| Amendment 5 to the 11th Edition | AGA Divisional Meeting (1981); ATS Data Acquisition, Processing and Transfer Panel, Third Meeting (1981); Air Navigation Commission | Definitions; wind shear; surface movement guidance and control; message priority; radiotelephony phraseologies; communications requirements; units of measurement. | 13 May 1983<br>7 June 1984 |
| 12th Edition | ATS Data Acquisition, Processing and Transfer Panel, Third Meeting (1981); Air Navigation Commission | Definitions; contents of flight plans; repetitive flight plans; ATS data interchange; Coordinated Universal Time (UTC). | 26 June 1984<br>21 November 1985 |
| Amendment 1 to the 12th Edition | Council; Air Navigation Commission | Strayed or unidentified aircraft; interception of civil aircraft; provision of flight plan and flight progress information; use of radar. | 14 March 1986<br>20 November 1986 |

| *Amendment* | *Source(s)* | *Subject(s)* | *Approved*<br>*Applicable* |
|---|---|---|---|
| Amendment 2 to the 12th Edition | Air Navigation Commission | Definitions; position and air-reporting; change of aircraft call signs during flight; airborne SSR Mode S capability; reporting of volcanic activity; introduction of three-letter designators; transmission of numbers on radiotelephony; inclusion of English language phraseology in the French, Russian and Spanish editions; deletion of all attachments. | 27 March 1987<br>22 October 1987 |
| Amendment 3 to the 12th Edition | Secretariat; Visual Flight Rules Operations Panel (VFOP), Third Meeting (1986); Air Navigation Commission; amendments consequential to adoption of amendments to Annex 6 | Operation of aircraft in mixed VFR/IFR environments; surface movement guidance and control; simultaneous operations on parallel or near-parallel instrument runways; acts of unlawful interference; wake turbulence categories and separation minima. | 19 March 1990<br>14 November 1991 |
| Amendment 4 to the 12th Edition | Secondary Surveillance Radar Improvements and Collision Avoidance Systems Panel, Fourth Meeting (SICASP/4) (1989) | Definitions; provision of air traffic services irrespective of airborne collision avoidance system (ACAS) operation. | 26 February 1993<br>11 November 1993 |
| Amendment 5 to the 12th Edition | Review of the General Concept of Separation Panel (RGCSP), Seventh Meeting (1990), Eighth Meeting (1993); Automatic Dependent Surveillance Panel (ADSP), Second Meeting (1992); All Weather Operations Panel (AWOP), Twelfth Meeting (1987); SSR Improvements and Collision Avoidance Systems Panel (SICASP), Fourth Meeting (1989); Obstacle Clearance Panel (OCP), Ninth Meeting (1990); Limited North Atlantic (COM/MET/RAC) Regional Air Navigation Meeting (1992); COM/MET/OPS Divisional Meeting (1990); Air Navigation Commission | Definitions; reduced vertical separation minimum of 300 m (1 000 ft) above FL 290; area navigation (RNAV) criteria; required navigation performance; automatic dependent surveillance; identification of medical aircraft; integration of helicopter traffic with conventional aeroplane traffic; inclusion of en-route alternates on the flight plan; surface movement radar; air traffic incident reporting; air-reporting procedures; transmission of information to aircraft on radioactive material and toxic chemical "clouds"; meteorological information in ATS messages; identification of runway visual range (RVR) reporting position; ATS aspects of MLS operations; use of SSR alone for separation purposes; ground proximity warning systems (GPWS). | 18 March 1994<br>10 November 1994 |
| Amendment 6 to the 12th Edition | Air Navigation Commission | Simultaneous operations on parallel or near-parallel instrument runways. | 13 March 1995<br>9 November 1995 |
| 13th Edition | Secretariat; SSR Improvements and Collision Avoidance Systems Panel (SICASP), Fifth Meeting (1993); All Weather Operations Panel | Use of radar in air traffic services; airborne collision avoidance systems (ACAS); approach instructions for microwave landing system (MLS)/area navigation (RNAV) procedures. | 21 March 1996<br>7 November 1996 |
| Amendment 1 to the 13th Edition | Air Navigation Commission | Definitions; AIREP formats and automated air-reporting; forwarding of meteorological information; separation between aircraft; adequacy of distress and urgency communication procedures; and communication failure procedures. | 5 March 1997<br>6 November 1997 |
| Amendment 2 to the 13th Edition | Automatic Dependent Surveillance Panel, Fourth Meeting (1996); Review of the General Concept of Separation Panel, Ninth Meeting (1996) | Automatic dependent surveillance; data interchange between automatic ATS systems; ATS applications for air-ground data links; separation between aircraft; required navigation performance; and required navigation performance and area navigation for en-route operations. | 19 March 1998<br>5 November 1998 |

| *Amendment* | *Source(s)* | *Subject(s)* | *Approved*<br>*Applicable* |
|---|---|---|---|
| Amendment 3 to the 13th Edition | Air Navigation Commission; Visual Aids Panel, Thirteenth Meeting (1997) | ATS airspace classifications; visual meteorological conditions clearance; and runway-holding position. | 10 March 1999<br>4 November 1999 |
| 14th Edition | Air Navigation; Secretariat; fifth meeting of the Automatic Dependent Surveillance Panel (ADSP/5); Multi- Agency Air Traffic Services Procedures Coordination Group (MAPCOG); thirty-ninth meeting of the European Air Navigation Planning Group (EANPG/39); eleventh and twelfth meetings of the Obstacle Clearance Panel (OCP/11 and OCP/12); Amendment 72 to Annex 3 — *Meteorological Service for International Air Navigation*; Amendments 25, 20 and 7 to Annex 6 — *Operation of Aircraft*, Parts I, II and III; Amendments 26, 21 and 8 to Annex 6, Parts I, II and III | Renaming of document to *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM); Chapter 1 — Definitions. New and revised definitions; New Chapter 2 — ATS Safety Management. Introduction of new provisions relating to ATS safety management; New Chapter 3 — ATS System Capacity and Air Traffic Flow Management. Introduction of new provisions relating to ATFM procedures and capacity management; Chapter 4 — General Provisions for Air Traffic Services. Restructuring of the material, changes to readback requirements, and expansion of the provisions relating to speed control; Chapter 5 — Separation Methods and Minima. Restructuring, and editorial changes to improve clarity; Chapter 6 — Separation in the Vicinity of Aerodromes. Restructuring, introduction of new provisions relating to standard clearances for arriving and departing aircraft; Chapter 7 — Procedures for Aerodrome Control Service. Restructuring, introduction of new provisions relating to low visibility operations; Chapter 8 — Radar Services. Restructuring and editorial changes; Chapter 9 — Flight Information Service and Alerting Service. Renumbering of paragraphs only; Chapter 10 — Coordination. Introduction of new general provisions relating to ATS coordination, renumbering of existing paragraphs and editorial changes; Chapter 11 — Air Traffic Services Messages. Renumbering of paragraphs only; editorial amendments. Chapter 12 — Phraseologies. Amended procedures aimed at harmonizing radiotelephony speech and improving the use of standard phraseology; Chapter 14 — Controller-Pilot Data Link Communications (CPDLC). Amended and new procedures to facilitate implementation of the available technology in relation to CPDLC and data link — flight information services (D-FIS); New Chapter 15 — Procedures related to Emergencies, Communication Failure and Contingencies. Contains relocated and new provisions dealing with emergency situations; Chapter 16 — Miscellaneous Procedures. Relocated provisions dealing with military traffic, unmanned free balloons, air traffic incident reports and use of repetitive flight plans; and miscellaneous editorial amendments. | 29 June 2001<br>1 November 2001 |
| Amendment 1 to the 14th Edition | Fifth meeting of the Automatic Dependent Surveillance Panel (ADSP/5); tenth meeting of the Review of the General Concept of Separation Panel (RGCSP/10) | Automatic dependent surveillance; lateral separation on intersecting tracks for RNAV operations where RNP is specified; 55.5 km (30 NM) longitudinal separation and the requirement for ADS to implement this separation minimum. | 28 May 2002<br>28 November 2002 |

| *Amendment* | *Source(s)* | *Subject(s)* | *Approved*<br>*Applicable* |
|---|---|---|---|
| 2 | Separation and Airspace Safety Panel; and Secretariat and the Proficiency Requirements in Common English Study Group | Tolerance values to be used by controllers for verification of the accuracy of the level information reported by Mode C; language proficiency requirements; and editorial amendment to Appendix 1. | 26 March 2003<br>27 November 2003 |
| 3 | Secretariat/Air Navigation Commission; Meteorology Divisional Meeting (2002); Recommendation 3/3 of the fourth meeting of the Global Navigation Satellite System Panel (GNSSP/4). | Runway incursions; phraseologies concerning 8.33 kHz channel spacing, RVSM and GNSS; special air-reports and other meteorological information; and amendment of definitions. | 29 June 2004<br>25 November 2004 |
| 4 | Secretariat | Definitions; meteorological information; special procedures for in-flight contingencies in oceanic airspace; reduced runway separation minima; air-ground communications failure procedures; phraseologies for use on and in the vicinity of the aerodrome. | 31 March 2005<br>24 November 2005 |
| 15th Edition | Secretariat/Air Navigation Commission; Separation and Airspace Safety Panel (SASP); Operational Data Link Panel (OPLINKP); Surveillance and Conflict Resolution Systems Panel (SCRSP); Operations Panel (OPSP); International Airways Volcano Watch Operations Group (IAVWOPSG) | Definitions; procedures for ADS-B, ADS-C, AIDC, CPDLC and RCP; pilot procedures in the event of unlawful interference; coordination procedures between ATS and other entities; name-code designators; criteria for the selection of preferential runways; procedures and phraseologies relating to ACAS; procedures related to volcanic ash. | 1 June 2007<br>22 November 2007 |

# Chapter 1

# DEFINITIONS

*Note 1.— Throughout the text of this document the term "service" is used as an abstract noun to designate functions, or service rendered; the term "unit" is used to designate a collective body performing a service.*

*Note 2.— All references to "Radio Regulations" are to the Radio Regulations published by the International Telecommunication Union (ITU). Radio Regulations are amended from time to time by the decisions embodied in the Final Acts of World Radiocommunication Conferences held normally every two to three years. Further information on the ITU processes as they relate to aeronautical radio system frequency use is contained in the* Handbook on Radio Frequency Spectrum Requirements for Civil Aviation including statement of approved ICAO policies *(Doc 9718).*

When the following terms are used in the present document they have the following meanings:

***Accepting unit/controller.*** Air traffic control unit/air traffic controller next to take control of an aircraft.

*Note.— See definition of "transferring unit/controller".*

***ADS-C agreement.*** A reporting plan which establishes the conditions of ADS-C data reporting (i.e. data required by the air traffic services unit and frequency of ADS-C reports which have to be agreed to prior to using ADS-C in the provision of air traffic services).

*Note.— The terms of the agreement will be exchanged between the ground system and the aircraft by means of a contract, or a series of contracts.*

***Advisory airspace.*** An airspace of defined dimensions, or designated route, within which air traffic advisory service is available.

***Advisory route.*** A designated route along which air traffic advisory service is available.

*Note.— Air traffic control service provides a much more complete service than air traffic advisory service; advisory areas and routes are therefore not established within controlled airspace, but air traffic advisory service may be provided below and above control areas.*

***Aerodrome.*** A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.

*Note.— The term "aerodrome" where used in the provisions relating to flight plans and ATS messages is intended to cover also sites other than aerodromes which may be used by certain types of aircraft, e.g. helicopters or balloons.*

***Aerodrome control service.*** Air traffic control service for aerodrome traffic.

***Aerodrome control tower.*** A unit established to provide air traffic control service to aerodrome traffic.

***Aerodrome elevation.*** The elevation of the highest point of the landing area.

***Aerodrome traffic.*** All traffic on the manoeuvring area of an aerodrome and all aircraft flying in the vicinity of an aerodrome.

*Note.— An aircraft is in the vicinity of an aerodrome when it is in, entering or leaving an aerodrome traffic circuit.*

***Aerodrome traffic circuit.*** The specified path to be flown by aircraft operating in the vicinity of an aerodrome.

***Aeronautical fixed service (AFS).*** A telecommunication service between specified fixed points provided primarily for the safety of air navigation and for the regular, efficient and economical operation of air services.

***Aeronautical fixed station.*** A station in the aeronautical fixed service.

***Aeronautical ground light.*** Any light specially provided as an aid to air navigation, other than a light displayed on an aircraft.

***Aeronautical Information Publication (AIP).*** A publication issued by or with the authority of a State and containing aeronautical information of a lasting character essential to air navigation.

***Aeronautical mobile service (RR S1.32).*** A mobile service between aeronautical stations and aircraft stations, or between aircraft stations, in which survival craft stations may participate; emergency position-indicating radio beacon stations may also participate in this service on designated distress and emergency frequencies.

***Aeronautical station (RR S1.81).*** A land station in the aeronautical mobile service. In certain instances, an aeronautical station may be located, for example, on board ship or on a platform at sea.

***Aeronautical telecommunication station.*** A station in the aeronautical telecommunication service.

***Airborne collision avoidance system (ACAS).*** An aircraft system based on secondary surveillance radar (SSR) transponder signals which operates independently of ground-based equipment to provide advice to the pilot on potential conflicting aircraft that are equipped with SSR transponders.

***Aircraft.*** Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

***Aircraft address.*** A unique combination of 24 bits available for assignment to an aircraft for the purpose of air-ground communications, navigation and surveillance.

***Aircraft identification.*** A group of letters, figures or a combination thereof which is either identical to, or the coded equivalent of, the aircraft call sign to be used in air-ground communications, and which is used to identify the aircraft in ground-ground air traffic services communications.

***Aircraft observation.*** The evaluation of one or more meteorological elements made from an aircraft in flight.

***Aircraft proximity.*** A situation in which, in the opinion of a pilot or air traffic services personnel, the distance between aircraft as well as their relative positions and speed have been such that the safety of the aircraft involved may have been compromised. An aircraft proximity is classified as follows:

*Risk of collision.* The risk classification of an aircraft proximity in which serious risk of collision has existed.

*Safety not assured.* The risk classification of an aircraft proximity in which the safety of the aircraft may have been compromised.

*No risk of collision.* The risk classification of an aircraft proximity in which no risk of collision has existed.

*Risk not determined.* The risk classification of an aircraft proximity in which insufficient information was available to determine the risk involved, or inconclusive or conflicting evidence precluded such determination.

***Air-ground communication.*** Two-way communication between aircraft and stations or locations on the surface of the earth.

***AIRMET information.*** Information issued by a meteorological watch office concerning the occurrence or expected occurrence of specified en-route weather phenomena which may affect the safety of low-level aircraft operations and which was not already included in the forecast issued for low-level flights in the flight information region concerned or sub-area thereof.

***AIRPROX.*** The code word used in an air traffic incident report to designate aircraft proximity.

***Air-report.*** A report from an aircraft in flight prepared in conformity with requirements for position, and operational and/or meteorological reporting.

***Air-taxiing.*** Movement of a helicopter/VTOL above the surface of an aerodrome, normally in ground effect and at a ground speed normally less than 37 km/h (20 kt).

*Note.— The actual height may vary, and some helicopters may require air-taxiing above 8 m (25 ft) AGL to reduce ground effect turbulence or provide clearance for cargo slingloads.*

***Air-to-ground communication.*** One-way communication from aircraft to stations or locations on the surface of the earth.

***Air traffic.*** All aircraft in flight or operating on the manoeuvring area of an aerodrome.

***Air traffic advisory service.*** A service provided within advisory airspace to ensure separation, in so far as practical, between aircraft which are operating on IFR flight plans.

***Air traffic control clearance.*** Authorization for an aircraft to proceed under conditions specified by an air traffic control unit.

*Note 1.— For convenience, the term "air traffic control clearance" is frequently abbreviated to "clearance" when used in appropriate contexts.*

*Note 2.— 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.*

***Air traffic control instruction.*** Directives issued by air traffic control for the purpose of requiring a pilot to take a specific action.

***Air traffic control service.*** 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.

***Air traffic control unit.*** A generic term meaning variously, area control centre, approach control unit or aerodrome control tower.

***Air traffic flow management (ATFM).*** A service established with the objective of contributing to a safe, orderly and expeditious flow of air traffic by ensuring that ATC capacity is utilized to the maximum extent possible, and that the traffic volume is compatible with the capacities declared by the appropriate ATS authority.

***Air traffic management (ATM).*** The dynamic, integrated management of air traffic and airspace including air traffic services, airspace management and air traffic flow management — safely, economically and efficiently — through the provision of facilities and seamless services in collaboration with all parties and involving airborne and ground-based functions.

***Air traffic management system.*** A system that provides the collaborative integration of humans, information, technology, facilities and services, supported by ground- and/or space-based communications, navigation and surveillance.

***Air traffic service (ATS).*** A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service (area control service, approach control service or aerodrome control service).

***Air traffic services airspaces.*** 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.

*Note.— ATS airspaces are classified as Class A to G as shown in Annex 11, Appendix 4.*

***Air traffic services reporting office.*** A unit established for the purpose of receiving reports concerning air traffic services and flight plans submitted before departure.

*Note.— An air traffic services reporting office may be established as a separate unit or combined with an existing unit, such as another air traffic services unit, or a unit of the aeronautical information service.*

***Air traffic services unit.*** A generic term meaning variously, air traffic control unit, flight information centre or air traffic services reporting office.

***Airway.*** A control area or portion thereof established in the form of a corridor.

***ALERFA.*** The code word used to designate an alert phase.

***Alerting service.*** A service provided to notify appropriate organizations regarding aircraft in need of search and rescue aid, and assist such organizations as required.

***Alert phase.*** A situation wherein apprehension exists as to the safety of an aircraft and its occupants.

***Allocation, allocate.*** Distribution of frequencies, SSR codes, etc. to a State, unit or service. Distribution of 24-bit aircraft addresses to a State or common mark registering authority.

***Alphanumeric characters (alphanumerics).*** A collective term for letters and figures (digits).

***Alternate aerodrome.*** An aerodrome to which an aircraft may proceed when it becomes either impossible or inadvisable to proceed to or to land at the aerodrome of intended landing. Alternate aerodromes include the following:

*Take-off alternate.* An alternate aerodrome at which an aircraft can land should this become necessary shortly after take-off and it is not possible to use the aerodrome of departure.

*En-route alternate.* An aerodrome at which an aircraft would be able to land after experiencing an abnormal or emergency condition while en route.

*Destination alternate.* An alternate aerodrome to which an aircraft may proceed should it become either impossible or inadvisable to land at the aerodrome of intended landing.

*Note.— The aerodrome from which a flight departs may also be an en-route or a destination alternate aerodrome for that flight.*

***Altitude.*** The vertical distance of a level, a point or an object considered as a point, measured from mean sea level (MSL).

***Approach control service.*** Air traffic control service for arriving or departing controlled flights.

***Approach control unit.*** A unit established to provide air traffic control service to controlled flights arriving at, or departing from, one or more aerodromes.

***Approach sequence.*** The order in which two or more aircraft are cleared to approach to land at the aerodrome.

***Appropriate ATS authority.*** The relevant authority designated by the State responsible for providing air traffic services in the airspace concerned.

***Appropriate authority.***

a) Regarding flight over the high seas: The relevant authority of the State of Registry.

b) Regarding flight other than over the high seas: The relevant authority of the State having sovereignty over the territory being overflown.

***Apron.*** A defined area, on a land aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers, mail or cargo, fuelling, parking or maintenance.

***Area control centre (ACC).*** A unit established to provide air traffic control service to controlled flights in control areas under its jurisdiction.

***Area control service.*** Air traffic control service for controlled flights in control areas.

***Area navigation (RNAV).*** 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.

***Area navigation route.*** An ATS route established for the use of aircraft capable of employing area navigation.

***Assignment, assign.*** Distribution of frequencies to stations. Distribution of SSR codes or 24-bit aircraft addresses to aircraft.

***ATIS.*** The symbol used to designate automatic terminal information service.

***ATS route.*** A specified route designed for channelling the flow of traffic as necessary for the provision of air traffic services.

*Note 1.— The term "ATS route" is used to mean variously, airway, advisory route, controlled or uncontrolled route, arrival or departure route, etc.*

*Note 2.— An ATS route is defined by route specifications which include an ATS route designator, the track to or from significant points (waypoints), distance between significant points, reporting requirements and, as determined by the appropriate ATS authority, the lowest safe altitude.*

***ATS surveillance service.*** A term used to indicate a service provided directly by means of an ATS surveillance system.

***ATS surveillance system.*** A generic term meaning variously, ADS-B, PSR, SSR or any comparable ground-based system that enables the identification of aircraft.

*Note.— A comparable ground-based system is one that has been demonstrated, by comparative assessment or other methodology, to have a level of safety and performance equal to or better than monopulse SSR.*

***Automatic dependent surveillance — broadcast (ADS-B).*** A means by which aircraft, aerodrome vehicles and other objects can automatically transmit and/or receive data such as identification, position and additional data, as appropriate, in a broadcast mode via a data link.

***Automatic dependent surveillance — contract (ADS-C).*** A means by which the terms of an ADS-C agreement will be exchanged between the ground system and the aircraft, via a data link, specifying under what conditions ADS-C reports would be initiated, and what data would be contained in the reports.

*Note.— The abbreviated term "ADS contract" is commonly used to refer to ADS event contract, ADS demand contract, ADS periodic contract or an emergency mode.*

***Automatic terminal information service (ATIS).*** The automatic provision of current, routine information to arriving and departing aircraft throughout 24 hours or a specified portion thereof:

*Data link-automatic terminal information service (D-ATIS).* The provision of ATIS via data link.

*Voice-automatic terminal information service (Voice-ATIS).* The provision of ATIS by means of continuous and repetitive voice broadcasts.

***Base turn.*** A turn executed by the aircraft during the initial approach between the end of the outbound track and the beginning of the intermediate or final approach track. The tracks are not reciprocal.

*Note.— Base turns may be designated as being made either in level flight or while descending, according to the circumstances of each individual procedure.*

***Blind transmission.*** A transmission from one station to another station in circumstances where two-way communication cannot be established but where it is believed that the called station is able to receive the transmission.

***Broadcast.*** A transmission of information relating to air navigation that is not addressed to a specific station or stations.

***Ceiling.*** The height above the ground or water of the base of the lowest layer of cloud below 6 000 m (20 000 ft) covering more than half the sky.

***Clearance limit.*** The point to which an aircraft is granted an air traffic control clearance.

***Code (SSR).*** The number assigned to a particular multiple pulse reply signal transmitted by a transponder in Mode A or Mode C.

***Common point.*** A point on the surface of the earth common to the paths of two aircraft, used as a basis for describing longitudinal separation minima (e.g. significant point, waypoint, navigation aid, fix).

*Note.— Common point is not used for operational purposes or in pilot-controller communications.*

***Computer.*** A device which performs sequences of arithmetical and logical steps upon data without human intervention.

*Note.— When the word "computer" is used in this document it may denote a computer complex, which includes one or more computers and peripheral equipment.*

***Control area.*** A controlled airspace extending upwards from a specified limit above the earth.

***Controlled aerodrome.*** An aerodrome at which air traffic control service is provided to aerodrome traffic.

*Note.— The term "controlled aerodrome" indicates that air traffic control service is provided to aerodrome traffic but does not necessarily imply that a control zone exists.*

***Controlled airspace.*** An airspace of defined dimensions within which air traffic control service is provided in accordance with the airspace classification.

*Note.— Controlled airspace is a generic term which covers ATS airspace Classes A, B, C, D and E as described in Annex 11, 2.6.*

***Controlled flight.*** Any flight which is subject to an air traffic control clearance.

***Controller-pilot data link communications (CPDLC).*** A means of communication between controller and pilot, using data link for ATC communications.

***Control zone.*** A controlled airspace extending upwards from the surface of the earth to a specified upper limit.

***Cruise climb.*** An aeroplane cruising technique resulting in a net increase in altitude as the aeroplane mass decreases.

***Cruising level.*** A level maintained during a significant portion of a flight.

***Current data authority.*** The designated ground system through which a CPDLC dialogue between a pilot and a controller currently responsible for the flight is permitted to take place.

***Current flight plan (CPL).*** The flight plan, including changes, if any, brought about by subsequent clearances.

*Note.— 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.*

***Data convention.*** An agreed set of rules governing the manner or sequence in which a set of data may be combined into a meaningful communication.

***Data link initiation capability (DLIC).*** A data link application that provides the ability to exchange addresses, names and version numbers necessary to initiate data link applications.

***Data processing.*** A systematic sequence of operations performed on data.

*Note.— Examples of operations are the merging, sorting, computing or any other transformation or rearrangement with the object of extracting or revising information, or of altering the representation of information.*

***Decision altitude (DA) or decision height (DH).*** A specified altitude or height in the precision approach or approach with vertical guidance at which a missed approach must be initiated if the required visual reference to continue the approach has not been established.

*Note 1.— Decision altitude (DA) is referenced to mean sea level and decision height (DH) is referenced to the threshold elevation.*

*Note 2.— The required visual reference means that section of the visual aids or of the approach area which should have been in view for sufficient time for the pilot to have made an assessment of the aircraft position and rate of change of position, in relation to the desired flight path. In Category III operations with a decision height the required visual reference is that specified for the particular procedure and operation.*

*Note 3.— For convenience where both expressions are used they may be written in the form "decision altitude/ height" and abbreviated "DA/H".*

***Dependent parallel approaches.*** Simultaneous approaches to parallel or near-parallel instrument runways where radar separation minima between aircraft on adjacent extended runway centre lines are prescribed.

***DETRESFA.*** The code word used to designate a distress phase.

***Discrete code.*** A four-digit SSR code with the last two digits not being "00".

***Distress phase.*** A situation wherein there is reasonable certainty that an aircraft and its occupants are threatened by grave and imminent danger or require immediate assistance.

***Downstream data authority.*** A designated ground system, different from the current data authority through which the pilot can contact an appropriate ATC unit for the purposes of receiving a downstream clearance.

***Elevation.*** The vertical distance of a point or a level, on or affixed to the surface of the earth, measured from mean sea level.

***Emergency phase.*** A generic term meaning, as the case may be, uncertainty phase, alert phase or distress phase.

***Estimated elapsed time.*** The estimated time required to proceed from one significant point to another.

***Estimated off-block time.*** The estimated time at which the aircraft will commence movement associated with departure.

***Estimated time of arrival.*** For IFR flights, the time at which it is estimated that the aircraft will arrive over that designated point, defined by reference to navigation aids, from which it is intended that an instrument approach procedure will be commenced, or, if no navigation aid is associated with the aerodrome, the time at which the aircraft will arrive over the aerodrome. For VFR flights, the time at which it is estimated that the aircraft will arrive over the aerodrome.

***Expected approach time.*** The time at which ATC expects that an arriving aircraft, following a delay, will leave the holding fix to complete its approach for a landing.

*Note.— The actual time of leaving the holding fix will depend upon the approach clearance.*

***Filed flight plan (FPL).*** The flight plan as filed with an ATS unit by the pilot or a designated representative, without any subsequent changes.

*Note.— 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.*

***Final approach.*** That part of an instrument approach procedure which commences at the specified final approach fix or point, or where such a fix or point is not specified,

a) at the end of the last procedure turn, base turn or inbound turn of a racetrack procedure, if specified; or

b) at the point of interception of the last track specified in the approach procedure; and

ends at a point in the vicinity of an aerodrome from which:

1) a landing can be made; or

2) a missed approach procedure is initiated.

***Flight crew member.*** A licensed crew member charged with duties essential to the operation of an aircraft during a flight duty period.

***Flight information centre.*** A unit established to provide flight information service and alerting service.

***Flight information region (FIR).*** An airspace of defined dimensions within which flight information service and alerting service are provided.

***Flight information service.*** A service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights.

***Flight level.*** A surface of constant atmospheric pressure which is related to a specific pressure datum, 1 013.2 hectopascals (hPa), and is separated from other such surfaces by specific pressure intervals.

*Note 1.— A pressure type altimeter calibrated in accordance with the Standard Atmosphere:*

*a) when set to a QNH altimeter setting, will indicate altitude;*

*b) when set to QFE altimeter setting, will indicate height above the QFE reference datum;*

*c) when set to a pressure of 1 013.2 hPa, may be used to indicate flight levels.*

*Note 2.— The terms "height" and "altitude", used in Note 1 above, indicate altimetric rather than geometric heights and altitudes.*

***Flight path monitoring.*** The use of ATS surveillance systems for the purpose of providing aircraft with information and advice relative to significant deviations from nominal flight path, including deviations from the terms of their air traffic control clearances.

*Note.— Some applications may require a specific technology, e.g. radar, to support the function of flight path monitoring.*

***Flight plan.*** Specified information provided to air traffic services units, relative to an intended flight or portion of a flight of an aircraft.

*Note.— Specifications for flight plans are contained in Annex 2. A Model Flight Plan Form is contained in Appendix 2 to this document.*

***Flight visibility.*** The visibility forward from the cockpit of an aircraft in flight.

***Flow control.*** Measures designed to adjust the flow of traffic into a given airspace, along a given route, or bound for a given aerodrome, so as to ensure the most effective utilization of the airspace.

***Forecast.*** A statement of expected meteorological conditions for a specified time or period, and for a specified area or portion of airspace.

***Glide path.*** A descent profile determined for vertical guidance during a final approach.

***Ground effect.*** A condition of improved performance (lift) due to the interference of the surface with the airflow pattern of the rotor system when a helicopter or other VTOL aircraft is operating near the ground.

*Note.— Rotor efficiency is increased by ground effect to a height of about one rotor diameter for most helicopters.*

***Ground visibility.*** The visibility at an aerodrome, as reported by an accredited observer or by automatic systems.

***Heading.*** The direction in which the longitudinal axis of an aircraft is pointed, usually expressed in degrees from North (true, magnetic, compass or grid).

***Height.*** The vertical distance of a level, a point or an object considered as a point, measured from a specified datum.

***Holding fix.*** A geographical location that serves as a reference for a holding procedure.

***Holding procedure.*** A predetermined manoeuvre which keeps an aircraft within a specified airspace while awaiting further clearance.

***Hot spot.*** A location on an aerodrome movement area with a history or potential risk of collision or runway incursion, and where heightened attention by pilots/drivers is necessary.

***Human Factors principles.*** Principles which apply to aeronautical design, certification, training, operations and maintenance and which seek safe interface between the human and other system components by proper consideration to human performance.

***Human performance.*** Human capabilities and limitations which have an impact on the safety and efficiency of aeronautical operations.

***Identification.*** The situation which exists when the position indication of a particular aircraft is seen on a situation display and positively identified.

***IFR.*** The symbol used to designate the instrument flight rules.

***IFR flight.*** A flight conducted in accordance with the instrument flight rules.

***IMC.*** The symbol used to designate instrument meteorological conditions.

***INCERFA.*** The code word used to designate an uncertainty phase.

***Incident.*** An occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation.

*Note.— The type of incidents which are of main interest to the International Civil Aviation Organization for accident prevention studies can be found at http://www.icao.int/anb/aig.*

***Independent parallel approaches.*** Simultaneous approaches to parallel or near-parallel instrument runways where radar separation minima between aircraft on adjacent extended runway centre lines are not prescribed.

***Independent parallel departures.*** Simultaneous departures from parallel or near-parallel instrument runways.

***Initial approach segment.*** That segment of an instrument approach procedure between the initial approach fix and the intermediate approach fix or, where applicable, the final approach fix or point.

***Instrument approach procedure (IAP).*** A series of predetermined manoeuvres by reference to flight instruments with specified protection from obstacles from the initial approach fix, or where applicable, from the beginning of a defined arrival route to a point from which a landing can be completed and thereafter, if a landing is not completed, to a position at which holding or en-route obstacle clearance criteria apply. Instrument approach procedures are classified as follows:

*Non-precision approach (NPA) procedure.* An instrument approach procedure which utilizes lateral guidance but does not utilize vertical guidance.

*Approach procedure with vertical guidance (APV).* An instrument procedure which utilizes lateral and vertical guidance but does not meet the requirements established for precision approach and landing operations.

*Precision approach (PA) procedure.* An instrument approach procedure using precision lateral and vertical guidance with minima as determined by the category of operation.

*Note.— Lateral and vertical guidance refers to the guidance provided either by:*

*a) a ground-based navigation aid; or*

*b) computer-generated navigation data.*

***Instrument meteorological conditions (IMC).*** Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling, less than the minima specified for visual meteorological conditions.

*Note 1.— The specified minima for visual meteorological conditions are contained in Chapter 3 of Annex 2.*

*Note 2.— In a control zone, a VFR flight may proceed under instrument meteorological conditions if and as authorized by air traffic control.*

***Landing area.*** That part of a movement area intended for the landing or take-off of aircraft.

***Level.*** A generic term relating to the vertical position of an aircraft in flight and meaning variously, height, altitude or flight level.

***Location indicator.*** A four-letter code group formulated in accordance with rules prescribed by ICAO and assigned to the location of an aeronautical fixed station.

***Manoeuvring area.*** That part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons.

***Meteorological information.*** Meteorological report, analysis, forecast, and any other statement relating to existing or expected meteorological conditions.

***Meteorological office.*** An office designated to provide meteorological service for international air navigation.

***Meteorological report.*** A statement of observed meteorological conditions related to a specified time and location.

***Minimum fuel.*** The term used to describe a situation in which an aircraft's fuel supply has reached a state where little or no delay can be accepted.

*Note.— This is not an emergency situation but merely indicates that an emergency situation is possible, should any undue delay occur.*

***Missed approach procedure.*** The procedure to be followed if the approach cannot be continued.

***Mode (SSR).*** The conventional identifier related to specific functions of the interrogation signals transmitted by an SSR interrogator. There are four modes specified in Annex 10: A, C, S and intermode.

***Movement area.*** That part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, consisting of the manoeuvring area and the apron(s).

***Near-parallel runways.*** Non-intersecting runways whose extended centre lines have an angle of convergence/divergence of 15 degrees or less.

***Next data authority.*** The ground system so designated by the current data authority through which an onward transfer of communications and control can take place.

***Normal operating zone (NOZ).*** Airspace of defined dimensions extending to either side of an ILS localizer course and/or MLS final approach track. Only the inner half of the normal operating zone is taken into account in independent parallel approaches.

***NOTAM.*** 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.

***No transgression zone (NTZ).*** In the context of independent parallel approaches, a corridor of airspace of defined dimensions located centrally between the two extended runway centre lines, where a penetration by an aircraft requires a controller intervention to manoeuvre any threatened aircraft on the adjacent approach.

***Obstacle clearance altitude (OCA) or obstacle clearance height (OCH).*** The lowest altitude or the lowest height above the elevation of the relevant runway threshold or the aerodrome elevation as applicable, used in establishing compliance with appropriate obstacle clearance criteria.

*Note 1.— Obstacle clearance altitude is referenced to mean sea level and obstacle clearance height is referenced to the threshold elevation or in the case of non-precision approaches to the aerodrome elevation or the threshold elevation if that is more than 2 m (7 ft) below the aerodrome elevation. An obstacle clearance height for a circling approach is referenced to the aerodrome elevation.*

*Note 2.— For convenience when both expressions are used they may be written in the form "obstacle clearance altitude/height" and abbreviated "OCA/H".*

***Operational control.*** The exercise of authority over the initiation, continuation, diversion or termination of a flight in the interest of the safety of the aircraft and the regularity and efficiency of the flight.

***Operator.*** A person, organization or enterprise engaged in or offering to engage in an aircraft operation.

***Pilot-in-command.*** The pilot designated by the operator, or in the case of general aviation, the owner, as being in command and charged with the safe conduct of a flight.

***Position indication.*** The visual indication, in non-symbolic and/or symbolic form, on a situation display, of the position of an aircraft, aerodrome vehicle or other object.

***Position symbol.*** The visual indication in symbolic form, on a situation display, of the position of an aircraft, aerodrome vehicle or other object, obtained after automatic processing of positional data derived from any source.

***Precision approach radar (PAR).*** Primary radar equipment used to determine the position of an aircraft during final approach, in terms of lateral and vertical deviations relative to a nominal approach path, and in range relative to touchdown.

*Note.— Precision approach radars are designated to enable pilots of aircraft to be given guidance by radiocommunication during the final stages of the approach to land.*

***Pressure-altitude.*** An atmospheric pressure expressed in terms of altitude which corresponds to that pressure in the Standard Atmosphere.*

* As defined in Annex 8.

***Primary radar.*** A radar system which uses reflected radio signals.

***Primary surveillance radar (PSR).*** A surveillance radar system which uses reflected radio signals.

***Procedural control.*** Term used to indicate that information derived from an ATS surveillance system is not required for the provision of air traffic control service.

***Procedural separation.*** The separation used when providing procedural control.

***Procedure turn.*** A manoeuvre in which a turn is made away from a designated track followed by a turn in the opposite direction to permit the aircraft to intercept and proceed along the reciprocal of the designated track.

*Note 1.— Procedure turns are designated "left" or "right" according to the direction of the initial turn.*

*Note 2.— Procedure turns may be designated as being made either in level flight or while descending, according to the circumstances of each individual procedure.*

***Profile.*** The orthogonal projection of a flight path or portion thereof on the vertical surface containing the nominal track.

***PSR blip.*** The visual indication, in non-symbolic form, on a situation display of the position of an aircraft obtained by primary radar.

***Radar.*** A radio detection device which provides information on range, azimuth and/or elevation of objects.

***Radar approach.*** An approach in which the final approach phase is executed under the direction of a controller using radar.

***Radar clutter.*** The visual indication on a situation display of unwanted signals.

***Radar contact.*** The situation which exists when the radar position of a particular aircraft is seen and identified on a situation display.

***Radar separation.*** The separation used when aircraft position information is derived from radar sources.

***RCP type.*** A label (e.g. RCP 240) that represents the values assigned to RCP parameters for communication transaction time, continuity, availability and integrity.

***Receiving unit/controller.*** Air traffic services unit/air traffic controller to which a message is sent.

*Note.— See definition of "sending unit/controller".*

***Repetitive flight plan (RPL).*** A flight plan related to a series of frequently recurring, regularly operated individual flights with identical basic features, submitted by an operator for retention and repetitive use by ATS units.

***Reporting point.*** A specified geographical location in relation to which the position of an aircraft can be reported.

***Required communication performance (RCP).*** A statement of the performance requirements for operational communication in support of specific ATM functions.

***Required navigation performance (RNP).*** A statement of the navigation performance necessary for operation within a defined airspace.

*Note.— Navigation performance and requirements are defined for a particular RNP type and/or application.*

***Rescue coordination centre.*** A unit responsible for promoting efficient organization of search and rescue services and for coordinating the conduct of search and rescue operations within a search and rescue region.

***Rescue unit.*** A unit composed of trained personnel and provided with equipment suitable for the expeditious conduct of search and rescue.

***RNP type.*** A containment value expressed as a distance in nautical miles from the intended position within which flights would be for at least 95 per cent of the total flying time.

Example.— RNP 4 represents a navigation accuracy of plus or minus 7.4 km (4 NM) on a 95 per cent containment basis.

***Runway.*** A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.

***Runway-holding position.*** A designated position intended to protect a runway, an obstacle limitation surface, or an ILS/MLS critical/sensitive area at which taxiing aircraft and vehicles shall stop and hold, unless otherwise authorized by the aerodrome control tower.

*Note.— In radiotelephony phraseologies, the expression "holding point" is used to designate the runway-holding position.*

***Runway incursion.*** Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft.

***Runway visual range (RVR).*** The range over which the pilot of an aircraft on the centre line of a runway can see the runway surface markings or the lights delineating the runway or identifying its centre line.

***Safety management system (SMS).*** A systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures.

***Secondary radar.*** A radar system wherein a radio signal transmitted from the radar station initiates the transmission of a radio signal from another station.

***Secondary surveillance radar (SSR).*** A surveillance radar system which uses transmitters/receivers (interrogators) and transponders.

***Segregated parallel operations.*** Simultaneous operations on parallel or near-parallel instrument runways in which one runway is used exclusively for approaches and the other runway is used exclusively for departures.

***Sending unit/controller.*** Air traffic services unit/air traffic controller transmitting a message.

*Note.— See definition of "receiving unit/controller".*

***Shoreline.*** A line following the general contour of the shore, except that in cases of inlets or bays less than 30 nautical miles in width, the line shall pass directly across the inlet or bay to intersect the general contour on the opposite side.

***SIGMET information.*** Information issued by a meteorological watch office concerning the occurrence or expected occurrence of specified en-route weather phenomena which may affect the safety of aircraft operations.

***Significant point.*** A specified geographical location used in defining an ATS route or the flight path of an aircraft and for other navigation and ATS purposes.

***Situation display.*** An electronic display depicting the position and movement of aircraft and other information as required.

***Slush.*** Water-saturated snow which with a heel-and-toe slap-down motion against the ground will be displaced with a splatter; specific gravity: 0.5 up to 0.8.

*Note.— Combinations of ice, snow and/or standing water may, especially when rain, rain and snow, or snow is falling, produce substances with specific gravities in excess of 0.8. These substances, due to their high water/ice content, will have a transparent rather than a cloudy appearance and, at the higher specific gravities, will be readily distinguishable from slush.*

***Snow (on the ground).***

a) *Dry snow.* Snow which can be blown if loose or, if compacted by hand, will fall apart upon release; specific gravity: up to but not including 0.35.

b) *Wet snow.* Snow which, if compacted by hand, will stick together and tend to or form a snowball; specific gravity: 0.35 up to but not including 0.5.

c) *Compacted snow.* Snow which has been compressed into a solid mass that resists further compression and will hold together or break up into lumps if picked up; specific gravity: 0.5 and over.

***Special VFR flight.*** A VFR flight cleared by air traffic control to operate within a control zone in meteorological conditions below VMC.

***SSR response.*** The visual indication, in non-symbolic form, on a situation display, of a response from an SSR transponder in reply to an interrogation.

***Standard instrument arrival (STAR).*** A designated instrument flight rule (IFR) arrival route linking a significant point, normally on an ATS route, with a point from which a published instrument approach procedure can be commenced.

***Standard instrument departure (SID).*** A designated instrument flight rule (IFR) departure route linking the aerodrome or a specified runway of the aerodrome with a specified significant point, normally on a designated ATS route, at which the en-route phase of a flight commences.

***Stopway.*** A defined rectangular area on the ground at the end of take-off run available prepared as a suitable area in which an aircraft can be stopped in the case of an abandoned take-off.

***Surveillance radar.*** Radar equipment used to determine the position of an aircraft in range and azimuth.

***Taxiing.*** Movement of an aircraft on the surface of an aerodrome under its own power, excluding take-off and landing.

***Taxiway.*** A defined path on a land aerodrome established for the taxiing of aircraft and intended to provide a link between one part of the aerodrome and another, including:

a) *Aircraft stand taxilane.* A portion of an apron designated as a taxiway and intended to provide access to aircraft stands only.

b) *Apron taxiway.* A portion of a taxiway system located on an apron and intended to provide a through taxi route across the apron.

c) *Rapid exit taxiway.* A taxiway connected to a runway at an acute angle and designed to allow landing aeroplanes to turn off at higher speeds than are achieved on other exit taxiways thereby minimizing runway occupancy times.

***Terminal control area (TMA).*** A control area normally established at the confluence of ATS routes in the vicinity of one or more major aerodromes.

***Threshold.*** The beginning of that portion of the runway usable for landing.

***Total estimated elapsed time.*** For IFR flights, the estimated time required from take-off to arrive over that designated point, defined by reference to navigation aids, from which it is intended that an instrument approach procedure will be commenced, or, if no navigation aid is associated with the destination aerodrome, to arrive over the destination aerodrome. For VFR flights, the estimated time required from take-off to arrive over the destination aerodrome.

***Touchdown.*** The point where the nominal glide path intercepts the runway.

*Note.— "Touchdown" as defined above is only a datum and is not necessarily the actual point at which the aircraft will touch the runway.*

***Track.*** The projection on the earth's surface of the path of an aircraft, the direction of which path at any point is usually expressed in degrees from North (true, magnetic or grid).

***Traffic avoidance advice.*** Advice provided by an air traffic services unit specifying manoeuvres to assist a pilot to avoid a collision.

***Traffic information.*** Information issued by an air traffic services unit to alert a pilot to other known or observed air traffic which may be in proximity to the position or intended route of flight and to help the pilot avoid a collision.

***Transfer of control point.*** A defined point located along the flight path of an aircraft, at which the responsibility for providing air traffic control service to the aircraft is transferred from one control unit or control position to the next.

***Transferring unit/controller.*** Air traffic control unit/air traffic controller in the process of transferring the responsibility for providing air traffic control service to an aircraft to the next air traffic control unit/air traffic controller along the route of flight.

*Note.— See definition of "accepting unit/controller".*

***Transition altitude.*** The altitude at or below which the vertical position of an aircraft is controlled by reference to altitudes.

***Transition layer.*** The airspace between the transition altitude and the transition level.

***Transition level.*** The lowest flight level available for use above the transition altitude.

***Uncertainty phase.*** A situation wherein uncertainty exists as to the safety of an aircraft and its occupants.

***Unmanned free balloon.*** A non-power-driven, unmanned, lighter-than-air aircraft in free flight.

*Note.— Unmanned free balloons are classified as heavy, medium or light in accordance with specifications contained in Annex 2, Appendix 4.*

***Vectoring.*** Provision of navigational guidance to aircraft in the form of specific headings, based on the use of an ATS surveillance system.

***VFR.*** The symbol used to designate the visual flight rules.

***VFR flight.*** A flight conducted in accordance with the visual flight rules.

***Visibility.*** Visibility for aeronautical purposes is the greater of:

a) the greatest distance at which a black object of suitable dimensions, situated near the ground, can be seen and recognized when observed against a bright background;

b) the greatest distance at which lights in the vicinity of 1 000 candelas can be seen and identified against an unlit background.

*Note 1.— The two distances have different values in air of a given extinction coefficient, and the latter b) varies with the background illumination. The former a) is represented by the meteorological optical range (MOR).*

*Note 2.— The definition applies to the observations of visibility in local routine and special reports, to the observations of prevailing and minimum visibility reported in METAR and SPECI and to the observations of ground visibility.*

***Visual approach.*** An approach by an IFR flight when either part or all of an instrument approach procedure is not completed and the approach is executed in visual reference to terrain.

***Visual meteorological conditions.*** Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling, equal to or better than specified minima.

*Note.— The specified minima are contained in Annex 2, Chapter 4.*

***VMC.*** The symbol used to designate visual meteorological conditions.

***Waypoint.*** A specified geographical location used to define an area navigation route or the flight path of an aircraft employing area navigation. Waypoints are identified as either:

*Fly-by waypoint.* A waypoint which requires turn anticipation to allow tangential interception of the next segment of a route or procedure, or

*Flyover waypoint.* A waypoint at which a turn is initiated in order to join the next segment of a route or procedure.

# Chapter 2

# ATS SAFETY MANAGEMENT

## 2.1 GENERAL

2.1.1 States shall ensure that the level of air traffic services (ATS) and communications, navigation and surveillance, as well as the ATS procedures applicable to the airspace or aerodrome concerned, are appropriate and adequate for maintaining an acceptable level of safety in the provision of ATS.

2.1.2 The requirements in respect of services, systems and procedures applicable to airspaces and aerodromes should be established on the basis of a regional air navigation agreement in order to facilitate the harmonization of ATS in adjacent airspaces.

2.1.3 To ensure that safety in the provision of ATS is maintained, the appropriate ATS authority shall implement safety management systems (SMS) for the air traffic services under its jurisdiction. Where appropriate, ATS SMS should be established on the basis of a regional air navigation agreement.

## 2.2 OBJECTIVES

The objectives of ATS safety management are to ensure that:

a) the established level of safety applicable to the provision of ATS within an airspace or at an aerodrome is met; and

b) safety-related enhancements are implemented whenever necessary.

## 2.3 ATS SAFETY MANAGEMENT ACTIVITIES

2.3.1 An ATS SMS should include, *inter alia*, the following with respect to the provision of air traffic services:

a) monitoring of overall safety levels and detection of any adverse trend;

b) safety reviews of ATS units;

c) safety assessments in respect of the planned implementation of airspace reorganizations, the introduction of new equipment systems or facilities, and new or changed ATS procedures; and

d) a mechanism for identifying the need for safety enhancing measures.

2.3.2 All activities undertaken in an ATS SMS shall be fully documented. All documentation shall be retained for such period of time as is specified by the appropriate authority.

## 2.4 MONITORING OF SAFETY LEVELS

### 2.4.1 Collection and evaluation of safety-related data

2.4.1.1 Data for use in safety monitoring programmes should be collected from as wide a range of sources as possible, as the safety-related consequences of particular procedures or systems may not be realized until after an incident has occurred.

2.4.1.2 The appropriate ATS authority should establish a formal incident reporting system for ATS personnel to facilitate the collection of information on actual or potential safety hazards or deficiencies related to the provision of ATS, including route structures, procedures, communications, navigation and surveillance systems and other safety significant systems and equipment as well as controller workloads.

*Note.— Guidance related to both mandatory and voluntary State incident reporting systems is contained in the* Safety Management Manual (SMM) (*Doc 9859*).

### 2.4.2 Review of incident and other safety-related reports

2.4.2.1 Safety-related reports concerning the operation of air traffic services, including air traffic incident reports, shall be systematically reviewed by the appropriate ATS authority in order to detect any adverse trend in the number and types of incidents which occur.

2.4.2.2 Reports concerning the serviceability of ATS facilities and systems, such as failures and degradations of communications, surveillance and other safety significant systems and equipment, shall be systematically reviewed by the appropriate ATS authority in order to detect any trend in the operation of such systems which may have an adverse effect on safety.

## 2.5 SAFETY REVIEWS

### 2.5.1 General requirements

Safety reviews of ATS units shall be conducted on a regular and systematic basis by personnel qualified through training, experience and expertise and having a full understanding of relevant Standards and Recommended Practices (SARPs), Procedures for Air Navigation Services (PANS), safe operating practices and Human Factors principles.

### 2.5.2 Scope

The scope of ATS unit safety reviews should include at least the following issues:

*Regulatory issues* to ensure that:

a) ATS operations manuals, ATS unit instructions and air traffic control (ATC) coordination procedures are complete, concise and up-to-date;

b) the ATS route structure, where applicable, provides for:

   1) adequate route spacing; and

2) crossing points for ATS routes located so as to reduce the need for controller intervention and for inter- and intra-unit coordination;

c) the separation minima used in the airspace or at the aerodrome are appropriate and all the provisions applicable to those minima are being complied with;

d) where applicable, provision is made for adequate observation of the manoeuvring area, and procedures and measures aimed at minimizing the potential for inadvertent runway incursions are in place. This observation may be performed visually or by means of an ATS surveillance system;

e) appropriate procedures for low visibility aerodrome operations are in place;

f) traffic volumes and associated controller workloads do not exceed defined, safe levels and that procedures are in place for regulating traffic volumes whenever necessary;

g) procedures to be applied in the event of failures or degradations of ATS systems, including communications, navigation and surveillance systems, are practicable and will provide for an acceptable level of safety; and

h) procedures for the reporting of incidents and other safety-related occurrences are implemented, that the reporting of incidents is encouraged and that such reports are reviewed to identify the need for any remedial action.

*Operational and technical issues* to ensure that:

a) the environmental working conditions meet established levels for temperature, humidity, ventilation, noise and ambient lighting, and do not adversely affect controller performance;

b) automation systems generate and display flight plan, control and coordination data in a timely, accurate and easily recognizable manner and in accordance with Human Factors principles;

c) equipment, including input/output devices for automation systems, are designed and positioned in the working position in accordance with ergonomic principles;

d) communications, navigation, surveillance and other safety significant systems and equipment:

1) are tested for normal operations on a routine basis;

2) meet the required level of reliability and availability as defined by the appropriate authority;

3) provide for the timely and appropriate detection and warning of system failures and degradations;

4) include documentation on the consequences of system, subsystem and equipment failures and degradations;

5) include measures to control the probability of failures and degradations; and

6) include adequate backup facilities and/or procedures in the event of a system failure or degradation; and

e) detailed records of systems and equipment serviceability are kept and periodically reviewed.

*Note.— In the context above, the terms reliability and availability have the following meanings:*

*1) Reliability. The probability that a device or system will function without failure over a specified time period or amount of usage; and*

*2) Availability. The ratio of percentage of the time that a system is operating correctly to the total time in that period.*

*Licensing and training issues* to ensure that:

a) controllers are adequately trained and properly licensed with valid ratings;

b) controller competency is maintained by adequate and appropriate refresher training, including the handling of aircraft emergencies and operations under conditions with failed and degraded facilities and systems;

c) controllers, where the ATC unit/control sector is staffed by teams, are provided relevant and adequate training in order to ensure efficient teamwork;

d) the implementation of new or amended procedures, and new or updated communications, surveillance and other safety significant systems and equipment is preceded by appropriate training and instruction;

e) controller competency in the English language is satisfactory in relation to providing ATS to international air traffic; and

f) standard phraseology is used.

## 2.6 SAFETY ASSESSMENTS

### 2.6.1 Need for safety assessments

2.6.1.1 A safety assessment shall be carried out in respect of proposals for significant airspace reorganizations, for significant changes in the provision of ATS procedures applicable to an airspace or an aerodrome, and for the introduction of new equipment, systems or facilities, such as:

a) a reduced separation minimum to be applied within an airspace or at an aerodrome;

b) a new operating procedure, including departure and arrival procedures, to be applied within an airspace or at an aerodrome;

c) a reorganization of the ATS route structure;

d) a resectorization of an airspace;

e) physical changes to the layout of runways and/or taxiways at an aerodrome; and

f) implementation of new communications, surveillance or other safety-significant systems and equipment, including those providing new functionality and/or capabilities.

*Note 1.— A reduced separation minimum may refer to the reduction of a horizontal separation minimum, including a minimum based on required navigation performance (RNP), a reduced vertical separation minimum of 300 m (1 000 ft) between FL 290 and FL 410 inclusive (RVSM), the reduction of a separation minimum based on the use of an ATS surveillance system or a wake turbulence separation minimum or reduction of minima between landing and/or departing aircraft.*

*Note 2.— When, due to the nature of the change, the acceptable level of safety cannot be expressed in quantitative terms, the safety assessments may rely on operational judgement.*

2.6.1.2 Proposals shall be implemented only when the assessment has shown that an acceptable level of safety will be met.

### 2.6.2 Safety-significant factors

The safety assessment shall consider relevant all factors determined to be safety-significant, including:

a) types of aircraft and their performance characteristics, including aircraft navigation capabilities and navigation performance;

b) traffic density and distribution;

c) airspace complexity, ATS route structure and classification of the airspace;

d) aerodrome layout, including runway configurations, runway lengths and taxiway configurations;

e) type of air-ground communications and time parameters for communication dialogues, including controller intervention capability;

f) type and capabilities of surveillance system, and the availability of systems providing controller support and alert functions. Where ADS-B implementation envisages reliance upon a common source for surveillance and/or navigation, the safety assessment shall take account of adequate contingency measures to mitigate the risk of either degradation or loss of this common source (i.e. common mode failure); and

g) any significant local or regional weather phenomena.

*Note 1.— See also Chapter 5, Section 5.11, concerning reductions in separation minima.*

*Note 2.— Guidance material on methods of expressing and assessing a safety level and on safety monitoring programmes is contained in Annex 11, Attachment B, the* Air Traffic Services Planning Manual *(Doc 9426), the* Manual on Implementation of a 300 m (1 000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive *(Doc 9574), the* Performance-based Navigation Manual *(Doc 9613) and the* Manual on Airspace Planning Methodology for the Determination of Separation Minima *(Doc 9689).*

## 2.7 SAFETY-ENHANCING MEASURES

2.7.1 Any actual or potential hazard related to the provision of ATS within an airspace or at an aerodrome, whether identified through an ATS safety management activity or by any other means, shall be assessed and classified by the appropriate ATS authority for its risk acceptability.

2.7.2 Except when the risk can be classified as acceptable, the ATS authority concerned shall, as a matter of priority and as far as practicable, implement appropriate measures to eliminate the risk or reduce the risk to a level that is acceptable.

2.7.3 If it becomes apparent that the level of safety applicable to an airspace or an aerodrome is not, or may not be achieved, the appropriate ATS authority shall, as a matter of priority and as far as practicable, implement appropriate remedial measures.

2.7.4 Implementation of any remedial measure shall be followed by an evaluation of the effectiveness of the measure in eliminating or mitigating a risk.

# Chapter 3

# ATS SYSTEM CAPACITY AND AIR TRAFFIC FLOW MANAGEMENT

## 3.1 CAPACITY MANAGEMENT

### 3.1.1 General

3.1.1.1 The capacity of an ATS system depends on many factors, including the ATS route structure, the navigation accuracy of the aircraft using the airspace, weather-related factors, and controller workload. Every effort should be made to provide sufficient capacity to cater to both normal and peak traffic levels; however, in implementing any measures to increase capacity, the responsible ATS authority shall ensure, in accordance with the procedures specified in Chapter 2, that safety levels are not jeopardized.

3.1.1.2 The number of aircraft provided with an ATC service shall not exceed that which can be safely handled by the ATC unit concerned under the prevailing circumstances. In order to define the maximum number of flights which can be safely accommodated, the appropriate ATS authority should assess and declare the ATC capacity for control areas, for control sectors within a control area and for aerodromes.

3.1.1.3 ATC capacity should be expressed as the maximum number of aircraft which can be accepted over a given period of time within the airspace or at the aerodrome concerned.

*Note.— The most appropriate measure of capacity is likely to be the sustainable hourly traffic flow. Such hourly capacities can, for example, be converted into daily, monthly or annual values.*

### 3.1.2 Capacity assessment

In assessing capacity values, factors to be taken into account should include, *inter alia*:

a) the level and type of ATS provided;

b) the structural complexity of the control area, the control sector or the aerodrome concerned;

c) controller workload, including control and coordination tasks to be performed;

d) the types of communications, navigation and surveillance systems in use, their degree of technical reliability and availability as well as the availability of backup systems and/or procedures;

e) availability of ATC systems providing controller support and alert functions; and

f) any other factor or element deemed relevant to controller workload.

*Note.— Summaries of techniques which may be used to estimate control sector/position capacities are contained in the* Air Traffic Services Planning Manual *(Doc 9426).*

### 3.1.3 Regulation of ATC capacity and traffic volumes

3.1.3.1 Where traffic demand varies significantly on a daily or periodic basis, facilities and procedures should be implemented to vary the number of operational sectors or working positions to meet the prevailing and anticipated demand. Applicable procedures should be contained in local instructions.

3.1.3.2 In case of particular events which have a negative impact on the declared capacity of an airspace or aerodrome, the capacity of the airspace or aerodrome concerned shall be reduced accordingly for the required time period. Whenever possible, the capacity pertaining to such events should be predetermined.

3.1.3.3 To ensure that safety is not compromised whenever the traffic demand in an airspace or at an aerodrome is forecast to exceed the available ATC capacity, measures shall be implemented to regulate traffic volumes accordingly.

### 3.1.4 Enhancement of ATC capacity

3.1.4.1 The appropriate ATS authority should:

a) periodically review ATS capacities in relation to traffic demand; and

b) provide for flexible use of airspace in order to improve the efficiency of operations and increase capacity.

3.1.4.2 In the event that traffic demand regularly exceeds ATC capacity, resulting in continuing and frequent traffic delays, or it becomes apparent that forecast traffic demand will exceed capacity values, the appropriate ATS authority should, as far as practicable:

a) implement steps aimed at maximizing the use of the existing system capacity; and

b) develop plans to increase capacity to meet the actual or forecast demand.

### 3.1.5 Flexible use of airspace

3.1.5.1 The appropriate authorities should, through the establishment of agreements and procedures, make provision for the flexible use of all airspace in order to increase airspace capacity and to improve the efficiency and flexibility of aircraft operations. When applicable, such agreements and procedures should be established on the basis of a regional air navigation agreement.

3.1.5.2 Agreements and procedures providing for a flexible use of airspace should specify, *inter alia*:

a) the horizontal and vertical limits of the airspace concerned;

b) the classification of any airspace made available for use by civil air traffic;

c) units or authorities responsible for transfer of the airspace;

d) conditions for transfer of the airspace to the ATC unit concerned;

e) conditions for transfer of the airspace from the ATC unit concerned;

f) periods of availability of the airspace;

g) any limitations on the use of the airspace concerned; and

h) any other relevant procedures or information.

## 3.2 AIR TRAFFIC FLOW MANAGEMENT

### 3.2.1 General

3.2.1.1 An air traffic flow management (ATFM) service shall be implemented for airspace where traffic demand at times exceeds the defined ATC capacity.

3.2.1.2 ATFM should be implemented on the basis of a regional air navigation agreement or, when appropriate, as a multilateral agreement.

3.2.1.3 The ATFM service within a region or other defined area, should be developed and implemented as a centralized ATFM organization, supported by flow management positions established at each area control centre (ACC) within the region or area of applicability.

3.2.1.4 Certain flights may be exempt from ATFM measures, or be given priority over other flights.

3.2.1.5 Detailed procedures governing the provision of the ATFM measures, and service within a region or area should be prescribed in a regional ATFM manual or handbook.

### 3.2.2 Flow management procedures

ATFM should be carried out in three phases:

a) *strategic planning*, if the action is carried out more than one day before the day on which it will take effect. Strategic planning is normally carried out well in advance, typically two to six months ahead;

b) *pre-tactical planning*, if the action is to be taken on the day before the day on which it will take effect;

c) *tactical operations*, if the action is taken on the day on which it will take effect.

### 3.2.3 Strategic planning

3.2.3.1 Strategic planning should be carried out in conjunction with ATC and the aircraft operators. It should consist of examining the demand for the forthcoming season, assessing where and when demand is likely to exceed the available ATC capacity and taking steps to resolve the imbalance by:

a) arranging with the ATC authority to provide adequate capacity at the required place and time;

b) re-routing certain traffic flows (traffic orientation);

c) scheduling or rescheduling flights as appropriate; and

d) identifying the need for tactical ATFM measures.

3.2.3.2 Where a traffic orientation scheme (TOS) is to be introduced, the routes should, as far as practicable, minimize the time and distance penalties for the flights concerned, and allow some degree of flexibility in the choice of routes, particularly for long-range flights.

3.2.3.3 When a TOS has been agreed, details should be published by all States concerned in a common format.

### 3.2.4 Pre-tactical planning

Pre-tactical planning should entail fine-tuning of the strategic plan in the light of updated demand data. During this phase:

a) certain traffic flows may be re-routed;

b) off-load routes may be coordinated;

c) tactical measures will be decided upon; and

d) details for the ATFM plan for the following day should be published and made available to all concerned.

### 3.2.5 Tactical operations

3.2.5.1 Tactical ATFM operations should consist of:

a) executing the agreed tactical measures in order to provide a reduced and even flow of traffic where demand would otherwise have exceeded capacity;

b) monitoring the evolution of the air traffic situation to ensure that the ATFM measures applied are having the desired effect and to take or initiate remedial action when long delays are reported, including re-routing of traffic and flight level allocation, in order to utilize the available ATC capacity to the maximum extent.

3.2.5.2 When the traffic demand exceeds, or is foreseen to exceed, the capacity of a particular sector or aerodrome, the responsible ATC unit shall advise the responsible ATFM unit, where such a unit is established, and other ATC units concerned. Flight crews of aircraft planned to fly in the affected area and operators should be advised, as soon as practicable, of the delays expected or the restrictions which will be applied.

*Note.— Operators known or believed to be concerned will normally be advised by the regional air traffic flow management service, when established.*

### 3.2.6 Liaison

During all phases of ATFM the responsible units should liaise closely with ATC and the aircraft operators in order to ensure an effective and equitable service.

*Note.— Attention is drawn to the guidance material contained in the* Air Traffic Services Planning Manual *(Doc 9426) regarding flow control as well as to procedures contained in* the Regional Supplementary Procedures *(Doc 7030) and regional ATFM Handbooks.*

# Chapter 4

# GENERAL PROVISIONS FOR AIR TRAFFIC SERVICES

## 4.1 RESPONSIBILITY FOR THE PROVISION OF AIR TRAFFIC CONTROL SERVICE

### 4.1.1 Area control service

Area control service shall be provided:

a) by an area control centre (ACC); or

b) 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, when no ACC is established.

### 4.1.2 Approach control service

Approach control service shall be provided:

a) by an aerodrome control tower or an ACC, when it is necessary or desirable to combine under the responsibility of one unit the functions of the approach control service and those of the aerodrome control service or the area control service; or

b) by an approach control unit, when it is necessary or desirable to establish a separate unit.

*Note.— Approach control service may be provided by a unit collocated with an ACC, or by a control sector within an ACC.*

### 4.1.3 Aerodrome control service

Aerodrome control service shall be provided by an aerodrome control tower.

## 4.2 RESPONSIBILITY FOR THE PROVISION OF FLIGHT INFORMATION SERVICE AND ALERTING SERVICE

Flight information service and alerting service shall be provided as follows:

a) *within a flight information region (FIR):* by a flight information centre, unless the responsibility for providing such services is assigned to an air traffic control unit having adequate facilities for the exercise of such responsibilities;

b) *within controlled airspace and at controlled aerodromes:* by the relevant air traffic control units.

## 4.3 DIVISION OF RESPONSIBILITY FOR CONTROL BETWEEN AIR TRAFFIC CONTROL UNITS

### 4.3.1 General

The appropriate ATS authority shall designate the area of responsibility for each air traffic control (ATC) unit and, when applicable, for individual control sectors within an ATC unit. Where there is more than one ATC working position within a unit or sector, the duties and responsibilities of the individual working positions shall be defined.

### 4.3.2 Between a unit providing aerodrome control service and a unit providing approach control service

4.3.2.1 Except for flights which are provided aerodrome control service only, the control of arriving and departing controlled flights shall be divided between units providing aerodrome control service and units providing approach control service as follows:

4.3.2.1.1 *Arriving aircraft.* Control of an arriving aircraft shall be transferred from the unit providing approach control service to the unit providing aerodrome control service when the aircraft:

a) is in the vicinity of the aerodrome, and

1) it is considered that approach and landing will be completed in visual reference to the ground, or

2) has reached uninterrupted visual meteorological conditions, or

b) is at a prescribed point or level, or

c) has landed,

as specified in letters of agreement or ATS unit instructions.

4.3.2.1.2 Transfer of communications to the aerodrome controller should be effected at such a point, level or time that clearance to land or alternative instructions, as well as information on essential local traffic, can be issued in a timely manner.

*Note.— Even though there is an approach control unit, control of certain flights may be transferred directly from an ACC to an aerodrome control tower and vice versa, by prior arrangement between the units concerned for the relevant part of approach control service to be provided by the ACC or the aerodrome control tower, as applicable.*

4.3.2.1.3 *Departing aircraft.* Control of a departing aircraft shall be transferred from the unit providing aerodrome control service to the unit providing approach control service:

a) when visual meteorological conditions prevail in the vicinity of the aerodrome:

1) prior to the time the aircraft leaves the vicinity of the aerodrome,

2) prior to the aircraft entering instrument meteorological conditions, or

3) when the aircraft is at a prescribed point or level,

as specified in letters of agreement or ATS unit instructions;

b) when instrument meteorological conditions prevail at the aerodrome:

1) immediately after the aircraft is airborne, or

2) when the aircraft is at a prescribed point or level,

as specified in letters of agreement or local instructions.

*Note.— See Note following 4.3.2.1.2.*

### 4.3.3 Between a unit providing approach control service and a unit providing area control service

4.3.3.1 When area control service and approach control service are not provided by the same air traffic control unit, responsibility for controlled flights shall rest with the unit providing area control service except that a unit providing approach control service shall be responsible for the control of:

a) arriving aircraft that have been released to it by the ACC;

b) departing aircraft until such aircraft are released to the ACC.

4.3.3.2 A unit providing approach control service shall assume control of arriving aircraft, provided such aircraft have been released to it, upon arrival of the aircraft at the point, level or time agreed for transfer of control, and shall maintain control during approach to the aerodrome.

### 4.3.4 Between two units providing area control service

The responsibility for the control of an aircraft shall be transferred from a unit providing area control service in a control area to the unit providing area control service in an adjacent control area at the time of crossing the common control area boundary as estimated by the ACC having control of the aircraft or at such other point, level or time as has been agreed between the two units.

### 4.3.5 Between control sectors/positions within the same air traffic control unit

The responsibility for the control of an aircraft shall be transferred from one control sector/position to another control sector/position within the same ATC unit at a point, level or time, as specified in local instructions.

## 4.4 FLIGHT PLAN

### 4.4.1 Flight plan form

*Note.— Procedures for the use of repetitive flight plans are contained in Chapter 16, Section 16.4.*

4.4.1.1 A flight plan form based on the model in Appendix 2 should be provided and should be used by operators and air traffic services units for the purpose of completing flight plans.

*Note.— A different form may be provided for use in completing repetitive flight plan listings.*

4.4.1.2 The flight plan form should be printed and should include an English text in addition to the language(s) of the State concerned.

*Note.— The Model Flight Plan Form in Appendix 2 is printed in English and one other of the languages of the Organization for illustration purposes.*

4.4.1.3 Operators and air traffic services units should comply with the instructions for completion of the flight plan form and the repetitive flight plan listing form given in Appendix 2.

*Note.— The instructions for completing the flight plan form given in Appendix 2 may be conveniently printed on the inside cover of flight plan form pads, or posted in briefing rooms.*

4.4.1.4 An operator shall, prior to departure:

a) ensure that, where the flight is intended to operate on a route or in an area where an RNP type is prescribed, the aircraft has an appropriate RNP approval, and that all conditions applying to that approval will be satisfied;

b) ensure that, where operation in reduced vertical separation minimum (RVSM) airspace is planned, the aircraft has the required RVSM approval; and

c) ensure that, where the flight is intended to operate where an RCP type is prescribed, the aircraft has an appropriate RCP approval, and that all conditions applying to that approval will be satisfied.

### 4.4.2 Submission of a flight plan

#### 4.4.2.1 PRIOR TO DEPARTURE

4.4.2.1.1 Except when other arrangements have been made for submission of repetitive flight plans, a flight plan submitted prior to departure should be submitted to the air traffic services reporting office at the departure aerodrome. If no such unit exists at the departure aerodrome, the flight plan should be submitted to the unit serving or designated to serve the departure aerodrome.

4.4.2.1.2 In the event of a delay of 30 minutes in excess of the estimated off-block time for a controlled flight or a delay of one hour for an uncontrolled flight for which a flight plan has been submitted, the flight plan should be amended or a new flight plan submitted and the old flight plan cancelled, whichever is applicable.

#### 4.4.2.2 DURING FLIGHT

4.4.2.2.1 A flight plan to be submitted during flight should normally be transmitted to the ATS unit in charge of the FIR, control area, advisory area or advisory route in or on which the aircraft is flying, or in or through which the aircraft wishes to fly or to the aeronautical telecommunication station serving the air traffic services unit concerned. When this is not practicable, it should be transmitted to another ATS unit or aeronautical telecommunication station for retransmission as required to the appropriate air traffic services unit.

4.4.2.2.2 Where relevant, such as in respect of ATC units serving high- or medium-density airspace, the appropriate ATS authority should prescribe conditions and/or limitations with respect to the submission of flight plans during flight to ATC units.

*Note.— If the flight plan is submitted for the purpose of obtaining air traffic control service, the aircraft is required to wait for an air traffic control clearance prior to proceeding under the conditions requiring compliance with air traffic control procedures. If the flight plan is submitted for the purpose of obtaining air traffic advisory service, the aircraft is required to wait for acknowledgment of receipt by the unit providing the service.*

### 4.4.3 Acceptance of a flight plan

The first ATS unit receiving a flight plan, or change thereto, shall:

a) check it for compliance with the format and data conventions;

b) check it for completeness and, to the extent possible, for accuracy;

c) take action, if necessary, to make it acceptable to the air traffic services; and

d) indicate acceptance of the flight plan or change thereto, to the originator.

## 4.5 AIR TRAFFIC CONTROL CLEARANCES

### 4.5.1 Scope and purpose

4.5.1.1 Clearances are issued solely for expediting and separating air traffic and are based on known traffic conditions which affect safety in aircraft operation. Such traffic conditions include not only aircraft in the air and on the manoeuvring area over which control is being exercised, but also any vehicular traffic or other obstructions not permanently installed on the manoeuvring area in use.

4.5.1.2 If an air traffic control clearance is not suitable to the pilot-in-command of an aircraft, the flight crew may request and, if practicable, obtain an amended clearance.

4.5.1.3 The issuance of air traffic control clearances by air traffic control units constitutes authority for an aircraft to proceed only in so far as known air traffic is concerned. ATC clearances do not constitute authority to violate any applicable regulations for promoting the safety of flight operations or for any other purpose; neither do clearances relieve a pilot-in-command of any responsibility whatsoever in connection with a possible violation of applicable rules and regulations.

4.5.1.4 ATC units shall issue such ATC clearances as are necessary to prevent collisions and to expedite and maintain an orderly flow of air traffic.

4.5.1.5 ATC clearances must be issued early enough to ensure that they are transmitted to the aircraft in sufficient time for it to comply with them.

### 4.5.2 Aircraft subject to ATC for part of flight

4.5.2.1 When a flight plan specifies that the initial portion of a flight will be uncontrolled, and that the subsequent portion of the flight will be subject to ATC, the aircraft shall be advised to obtain its clearance from the ATC unit in whose area controlled flight will be commenced.

4.5.2.2 When a flight plan specifies that the first portion of a flight will be subject to ATC, and that the subsequent portion will be uncontrolled, the aircraft shall normally be cleared to the point at which the controlled flight terminates.

### 4.5.3 Flights through intermediate stops

4.5.3.1 When an aircraft files, at the departure aerodrome, flight plans for the various stages of flight through intermediate stops, the initial clearance limit will be the first destination aerodrome and new clearances shall be issued for each subsequent portion of flight.

4.5.3.2 The flight plan for the second stage, and each subsequent stage, of a flight through intermediate stops will become active for ATS and search and rescue (SAR) purposes only when the appropriate ATS unit has received notification that the aircraft has departed from the relevant departure aerodrome, except as provided for in 4.5.3.3.

4.5.3.3 By prior arrangement between ATC units and the operators, aircraft operating on an established schedule may, if the proposed route of flight is through more than one control area, be cleared through intermediate stops within other control areas but only after coordination between the ACCs concerned.

### 4.5.4 Contents of clearances

4.5.4.1 Clearances shall contain positive and concise data and shall, as far as practicable, be phrased in a standard manner.

4.5.4.2 Clearances shall, except as provided for in Chapter 6, Section 6.3.2, concerning standard departure clearances, contain the items specified in Chapter 11, 11.4.2.6.2.1.

### 4.5.5 Departing aircraft

ACCs shall, except where procedures providing for the use of standard departure clearances have been implemented, forward a clearance to approach control units or aerodrome control towers with the least possible delay after receipt of request made by these units, or prior to such request if practicable.

### 4.5.6 En-route aircraft

#### 4.5.6.1 GENERAL

4.5.6.1.1 An ATC unit may request an adjacent ATC unit to clear aircraft to a specified point during a specified period.

4.5.6.1.2 After the initial clearance has been issued to an aircraft at the point of departure, it will be the responsibility of the appropriate ATC unit to issue an amended clearance whenever necessary and to issue traffic information, if required.

4.5.6.1.3 When so requested by the flight crew, an aircraft shall be cleared for cruise climb whenever traffic conditions and coordination procedures permit. Such clearance shall be for cruise climb either above a specified level or between specified levels.

#### 4.5.6.2 CLEARANCES RELATING TO SUPERSONIC FLIGHT

4.5.6.2.1 Aircraft intending supersonic flight shall, whenever practicable, be cleared for the transonic acceleration phase prior to departure.

4.5.6.2.2 During the transonic and supersonic phases of a flight, amendments to the clearance should be kept to a minimum and must take due account of the operational limitations of the aircraft in these flight phases.

## 4.5.7 Description of air traffic control clearances

### 4.5.7.1 CLEARANCE LIMIT

4.5.7.1.1 A clearance limit shall be described by specifying the name of the appropriate significant point, or aerodrome, or controlled airspace boundary.

4.5.7.1.2 When prior coordination has been effected with units under whose control the aircraft will subsequently come, or if there is reasonable assurance that it can be effected a reasonable time prior to their assumption of control, the clearance limit shall be the destination aerodrome or, if not practicable, an appropriate intermediate point, and coordination shall be expedited so that a clearance to the destination aerodrome may be issued as soon as possible.

4.5.7.1.3 If an aircraft has been cleared to an intermediate point in adjacent controlled airspace, the appropriate ATC unit will then be responsible for issuing, as soon as practicable, an amended clearance to the destination aerodrome.

4.5.7.1.4 When the destination aerodrome is outside controlled airspace, the ATC unit responsible for the last controlled airspace through which an aircraft will pass shall issue the appropriate clearance for flight to the limit of that controlled airspace.

### 4.5.7.2 ROUTE OF FLIGHT

4.5.7.2.1 The route of flight shall be detailed in each clearance when deemed necessary. The phrase "cleared via flight planned route" may be used to describe any route or portion thereof, provided the route or portion thereof is identical to that filed in the flight plan and sufficient routing details are given to definitely establish the aircraft on its route. The phrases "cleared via (designation) departure" or "cleared via (designation) arrival" may be used when standard departure or arrival routes have been established by the appropriate ATS authority and published in Aeronautical Information Publications (AIPs).

4.5.7.2.2 The phrase "cleared via flight planned route" shall not be used when granting a re-clearance.

4.5.7.2.3 Subject to airspace constraints, ATC workload and traffic density, and provided coordination can be effected in a timely manner, an aircraft should whenever possible be offered the most direct routing.

### 4.5.7.3 LEVELS

Except as provided for in Chapter 6, 6.3.2 and 6.5.1.5, use of standard departure and arrival clearances, instructions included in clearances relating to levels shall consist of the items specified in Chapter 11, 11.4.2.6.2.2.

### 4.5.7.4 CLEARANCE OF A REQUESTED CHANGE IN FLIGHT PLAN

4.5.7.4.1 When issuing a clearance covering a requested change in route or level, the exact nature of the change shall be included in the clearance.

4.5.7.4.2 When traffic conditions will not permit clearance of a requested change, the word "UNABLE" shall be used. When warranted by circumstances, an alternative route or level should be offered.

4.5.7.4.3 When an alternative route is offered and accepted by the flight crew under the procedures described in 4.5.7.4.2, the amended clearance issued shall describe the route to the point where it joins the previously cleared route, or, if the aircraft will not re-join the previous route, to the destination.

#### 4.5.7.5 READBACK OF CLEARANCES

4.5.7.5.1 The flight crew shall read back to the air traffic controller safety-related parts of ATC clearances and instructions which are transmitted by voice. The following items shall always be read back:

a) ATC route clearances;

b) clearances and instructions to enter, land on, take off from, hold short of, cross, taxi and backtrack on any runway; and

c) runway-in-use, altimeter settings, SSR codes, level instructions, heading and speed instructions and, whether issued by the controller or contained in automatic terminal information service (ATIS) broadcasts, transition levels.

*Note.— If the level of an aircraft is reported in relation to standard pressure 1 013.2 hPa, the words "FLIGHT LEVEL" precede the level figures. If the level of the aircraft is reported in relation to QNH/QFE, the figures are followed by the word "METRES" or "FEET", as appropriate.*

4.5.7.5.1.1 Other clearances or instructions, including conditional clearances, shall be read back or acknowledged in a manner to clearly indicate that they have been understood and will be complied with.

4.5.7.5.2 The controller shall listen to the readback to ascertain that the clearance or instruction has been correctly acknowledged by the flight crew and shall take immediate action to correct any discrepancies revealed by the readback.

4.5.7.5.2.1 Unless specified by the appropriate ATS authority, voice readback of controller-pilot data link communications (CPDLC) messages shall not be required.

*Note.— The procedures and provisions relating to the exchange and acknowledgement of CPDLC messages are contained in Annex 10, Volume II and the PANS-ATM, Chapter 14.*

## 4.6 HORIZONTAL SPEED CONTROL INSTRUCTIONS

### 4.6.1 General

4.6.1.1 In order to facilitate a safe and orderly flow of traffic, aircraft may, subject to conditions specified by the appropriate authority, be instructed to adjust speed in a specified manner. Flight crews should be given adequate notice of planned speed control.

*Note 1.— Application of speed control over a long period of time may affect aircraft fuel reserves.*

*Note 2.— Provisions concerning longitudinal separation using the Mach number technique are contained in Chapter 5, Separation Methods and Minima.*

4.6.1.2 Speed control shall not be applied to aircraft entering or established in a holding pattern.

4.6.1.3 Speed adjustments should be limited to those necessary to establish and/or maintain a desired separation minimum or spacing. Instructions involving frequent changes of speed, including alternate speed increases and decreases, should be avoided.

4.6.1.4 The flight crew shall inform the ATC unit concerned if at any time they are unable to comply with a speed instruction. In such cases, the controller shall apply an alternative method to achieve the desired spacing between the aircraft concerned.

4.6.1.5 At levels at or above 7 600 m (FL 250), speed adjustments should be expressed in multiples of 0.01 Mach; at levels below 7 600 m (FL 250), speed adjustments should be expressed in multiples of 20 km/h (10 kt) based on indicated airspeed (IAS).

*Note 1.— Mach 0.01 equals approximately 11 km/h (6 kt) IAS at higher flight levels.*

*Note 2.— When an aircraft is heavily loaded and at a high level, its ability to change speed may, in cases, be very limited.*

4.6.1.6 Aircraft shall be advised when a speed control restriction is no longer required.

### 4.6.2 Methods of application

4.6.2.1 In order to establish a desired spacing between two or more successive aircraft, the controller should first either reduce the speed of the last aircraft, or increase the speed of the lead aircraft, then adjust the speed(s) of the other aircraft in order.

4.6.2.2 In order to maintain a desired spacing using speed control techniques, specific speeds need to be assigned to all the aircraft concerned.

*Note 1.— The true airspeed (TAS) of an aircraft will decrease during descent when maintaining a constant IAS. When two descending aircraft maintain the same IAS, and the leading aircraft is at the lower level, the TAS of the leading aircraft will be lower than that of the following aircraft. The distance between the two aircraft will thus be reduced, unless a sufficient speed differential is applied. For the purpose of calculating a desired speed differential between two succeeding aircraft, 11 km/h (6 kt) IAS per 300 m (1 000 ft) height difference may be used as a general rule. At levels below 2 450 m (FL 80) the difference between IAS and TAS is negligible for speed control purposes.*

*Note 2.— Time and distance required to achieve a desired spacing will increase with higher levels, higher speeds, and when the aircraft is in a clean configuration.*

### 4.6.3 Descending and arriving aircraft

4.6.3.1 An aircraft should, when practicable, be authorized to absorb a period of notified terminal delay by cruising at a reduced speed for the latter portion of its flight.

4.6.3.2 An arriving aircraft may be instructed to maintain its "maximum speed", "minimum clean speed", "minimum speed", or a specified speed.

*Note.— "Minimum clean speed" signifies the minimum speed at which an aircraft can be flown in a clean configuration, i.e. without deployment of lift-augmentation devices, speed brakes or landing gear.*

4.6.3.3 Speed reductions to less than 460 km/h (250 kt) IAS for turbojet aircraft during initial descent from cruising level should be applied only with the concurrence of the flight crew.

4.6.3.4 Instructions for an aircraft to simultaneously maintain a high rate of descent and reduce its speed should be avoided as such manoeuvres are normally not compatible. Any significant speed reduction during descent may require the aircraft to temporarily level off to reduce speed before continuing descent.

4.6.3.5 Arriving aircraft should be permitted to operate in a clean configuration for as long as possible. Below 4 550 m (FL 150), speed reductions for turbojet aircraft to not less than 410 km/h (220 kt) IAS, which will normally be very close to the minimum speed of turbojet aircraft in a clean configuration, may be used.

4.6.3.6 Only minor speed reductions not exceeding plus/minus 40 km/h (20 kt) IAS should be used for aircraft on intermediate and final approach.

4.6.3.7 Speed control should not be applied to aircraft after passing a point 7 km (4 NM) from the threshold on final approach.

## 4.7 VERTICAL SPEED CONTROL INSTRUCTIONS

### 4.7.1 General

4.7.1.1 In order to facilitate a safe and orderly flow of traffic, aircraft may be instructed to adjust rate of climb or rate of descent. Vertical speed control may be applied between two climbing aircraft or two descending aircraft in order to establish or maintain a specific vertical separation minimum.

4.7.1.2 Vertical speed adjustments should be limited to those necessary to establish and/or maintain a desired separation minimum. Instructions involving frequent changes of climb/descent rates should be avoided.

4.7.1.3 The flight crew shall inform the ATC unit concerned if unable, at any time, to comply with a specified rate of climb or descent. In such cases, the controller shall apply an alternative method to achieve an appropriate separation minimum between aircraft, without delay.

4.7.1.4 Aircraft shall be advised when a rate of climb/descent restriction is no longer required.

### 4.7.2 Methods of application

4.7.2.1 An aircraft may be instructed to expedite climb or descent as appropriate to or through a specified level, or may be instructed to reduce its rate of climb or rate of descent.

4.7.2.2 Climbing aircraft may be instructed to maintain a specified rate of climb, a rate of climb equal to or greater than a specified value or a rate of climb equal to or less than a specified value.

4.7.2.3 Descending aircraft may be instructed to maintain a specified rate of descent, a rate of descent equal to or greater than a specified value or a rate of descent equal to or less than a specified value.

4.7.2.4 In applying vertical speed control, the controller should ascertain to which level(s) climbing aircraft can sustain a specified rate of climb or, in the case of descending aircraft, the specified rate of descent which can be sustained, and shall ensure that alternative methods of maintaining separation can be applied in a timely manner, if required.

*Note.— Controllers need to be aware of aircraft performance characteristics and limitations in relation to a simultaneous application of horizontal and vertical speed limitations.*

## 4.8 CHANGE FROM IFR TO VFR FLIGHT

4.8.1 Change from instrument flight rules (IFR) flight to visual flight rules (VFR) flight is only acceptable when a message initiated by the pilot-in-command containing the specific expression "CANCELLING MY IFR FLIGHT",

together with the changes, if any, to be made to the current flight plan, is received by an air traffic services unit. No invitation to change from IFR flight to VFR flight is to be made either directly or by inference.

4.8.2 No reply, other than the acknowledgment "IFR FLIGHT CANCELLED AT ... (time)", should normally be made by an air traffic services unit.

4.8.3 When an ATS unit is in possession of information that instrument meteorological conditions are likely to be encountered along the route of flight, a pilot changing from IFR flight to VFR flight should, if practicable, be so advised.

*Note.— See Chapter 11, 11.4.3.2.1.*

4.8.4 An ATC unit receiving notification of an aircraft's intention to change from IFR to VFR flight shall, as soon as practicable thereafter, so inform all other ATS units to whom the IFR flight plan was addressed, except those units through whose regions or areas the flight has already passed.

## 4.9 WAKE TURBULENCE CATEGORIES

*Note.— The term "wake turbulence" is used in this context to describe the effect of the rotating air masses generated behind the wing tips of large jet aircraft, in preference to the term "wake vortex" which describes the nature of the air masses. Detailed characteristics of wake vortices and their effect on aircraft are contained in the* Air Traffic Services Planning Manual *(Doc 9426), Part II, Section 5.*

### 4.9.1 Wake turbulence categories of aircraft

4.9.1.1 Wake turbulence separation minima shall be based on a grouping of aircraft types into three categories according to the maximum certificated take-off mass as follows:

a) HEAVY (H) — all aircraft types of 136 000 kg or more;

b) MEDIUM (M) — aircraft types less than 136 000 kg but more than 7 000 kg; and

c) LIGHT (L) — aircraft types of 7 000 kg or less.

4.9.1.2 Helicopters should be kept well clear of light aircraft when hovering or while air taxiing.

*Note 1.— Helicopters produce vortices when in flight and there is some evidence that, per kilogram of gross mass, their vortices are more intense than those of fixed-wing aircraft.*

*Note 2.— The provisions governing wake turbulence separation minima are set forth in Chapter 5, Section 5.8, and Chapter 8, Section 8.7.3.*

### 4.9.2 Indication of heavy wake turbulence category

For aircraft in the heavy wake turbulence category the word "Heavy" shall be included immediately after the aircraft call sign in the initial radiotelephony contact between such aircraft and ATS units.

*Note.— Wake turbulence categories are specified in the instructions for completing Item 9 of the flight plan in Appendix 2.*

## 4.10 ALTIMETER SETTING PROCEDURES

### 4.10.1 Expression of vertical position of aircraft

4.10.1.1 For flights in the vicinity of aerodromes and within terminal control areas the vertical position of aircraft shall, except as provided for in 4.10.1.2, be expressed in terms of altitudes at or below the transition altitude and in terms of flight levels at or above the transition level. While passing through the transition layer, vertical position shall be expressed in terms of flight levels when climbing and in terms of altitudes when descending.

4.10.1.2 When an aircraft which has been given clearance to land is completing its approach using atmospheric pressure at aerodrome elevation (QFE), the vertical position of the aircraft shall be expressed in terms of height above aerodrome elevation during that portion of its flight for which QFE may be used, except that it shall be expressed in terms of height above runway threshold elevation:

a) for instrument runways, if the threshold is 2 m (7 ft) or more below the aerodrome elevation; and

b) for precision approach runways.

4.10.1.3 For flights en route, the vertical position of aircraft shall be expressed in terms of:

a) flight levels at or above the lowest usable flight level; and

b) altitudes below the lowest usable flight level;

except where, on the basis of regional air navigation agreements, a transition altitude has been established for a specified area, in which case the provisions of 4.10.1.1 shall apply.

### 4.10.2 Determination of the transition level

4.10.2.1 The appropriate ATS unit shall establish the transition level to be used in the vicinity of the aerodrome(s) concerned and, when relevant, the terminal control area (TMA) concerned, for the appropriate period of time on the basis of QNH (altimeter subscale setting to obtain elevation when on the ground) reports and forecast mean sea level pressure, if required.

4.10.2.2 The transition level shall be the lowest flight level available for use above the transition altitude established for the aerodrome(s) concerned. Where a common transition altitude has been established for two or more aerodromes which are so closely located as to require coordinated procedures, the appropriate ATS units shall establish a common transition level to be used at any given time in the vicinity of the aerodrome and, when relevant, in the TMA concerned.

*Note.— See 4.10.3.2 regarding the determination of the lowest usable flight level(s) for control areas.*

### 4.10.3 Minimum cruising level for IFR flights

4.10.3.1 Except when specifically authorized by the appropriate authority, cruising levels below the minimum flight altitudes established by the State shall not be assigned.

4.10.3.2 ATC units shall, when circumstances warrant it, determine the lowest usable flight level or levels for the whole or parts of the control area for which they are responsible, use it when assigning flight levels and pass it to pilots on request.

*Note 1.— Unless otherwise prescribed by the State concerned, the lowest usable flight level is that flight level which corresponds to, or is immediately above, the established minimum flight altitude.*

*Note 2.— The portion of a control area for which a particular lowest usable flight level applies is determined in accordance with air traffic services requirements.*

*Note 3.— The objectives of the air traffic control service as prescribed in Annex 11 do not include prevention of collision with terrain. The procedures prescribed in this document do not relieve pilots of their responsibility to ensure that any clearances issued by air traffic control units are safe in this respect. When an IFR flight is vectored or is given a direct routing which takes the aircraft off an ATS route, the procedures in Chapter 8, 8.6.5.2 apply.*

### 4.10.4 Provision of altimeter setting information

4.10.4.1 Appropriate ATS units shall at all times have available for transmission to aircraft in flight, on request, the information required to determine the lowest flight level which will ensure adequate terrain clearance on routes or segments of routes for which this information is required.

*Note.— If so prescribed on the basis of regional air navigation agreements, this information may consist of climatological data.*

4.10.4.2 Flight information centres and ACCs shall have available for transmission to aircraft, on request, an appropriate number of QNH reports or forecast pressures for the FIRs and control areas for which they are responsible, and for those adjacent.

4.10.4.3 The flight crew shall be provided with the transition level in due time prior to reaching it during descent. This may be accomplished by voice communications, ATIS broadcast or data link.

4.10.4.4 The transition level shall be included in approach clearances when so prescribed by the appropriate authority or requested by the pilot.

4.10.4.5 A QNH altimeter setting shall be included in the descent clearance when first cleared to an altitude below the transition level, in approach clearances or clearances to enter the traffic circuit, and in taxi clearances for departing aircraft, except when it is known that the aircraft has already received the information.

4.10.4.6 A QFE altimeter setting shall be provided to aircraft on request or on a regular basis in accordance with local arrangements; it shall be the QFE for the aerodrome elevation except for:

a) non-precision approach runways, if the threshold is 2 m (7 ft) or more below the aerodrome elevation; and

b) precision approach runways;

in which cases the QFE for the relevant runway threshold shall be provided.

4.10.4.7 Altimeter settings provided to aircraft shall be rounded down to the nearest lower whole hectopascal.

*Note 1.— Unless otherwise prescribed by the State concerned, the lowest usable flight level is that flight level which corresponds to, or is immediately above, the established minimum flight altitude.*

*Note 2.— The portion of a control area for which a particular lowest usable flight level applies is determined in accordance with air traffic services requirements.*

*Note 3.— See Foreword, Note 2 to paragraph 2.1.*

## 4.11 POSITION REPORTING

### 4.11.1 Transmission of position reports

4.11.1.1 On routes defined by designated significant points, position reports shall be made by the aircraft when over, or as soon as possible after passing, each designated compulsory reporting point, except as provided in 4.11.1.3 and 4.11.3. Additional reports over other points may be requested by the appropriate ATS unit.

4.11.1.2 On routes not defined by designated significant points, position reports shall be made by the aircraft as soon as possible after the first half hour of flight and at hourly intervals thereafter, except as provided in 4.11.1.3. Additional reports at shorter intervals of time may be requested by the appropriate ATS unit.

4.11.1.3 Under conditions specified by the appropriate ATS authority, flights may be exempted from the requirement to make position reports at each designated compulsory reporting point or interval. In applying this, account should be taken of the meteorological requirement for the making and reporting of routine aircraft observations.

*Note.— This is intended to apply in cases where adequate flight progress data are available from other sources, e.g. radar or ADS-B (see Chapter 8, 8.6.4.4), or ADS-C (see Chapter 13) and in other circumstances where the omission of routine reports from selected flights is found to be acceptable.*

4.11.1.4 The position reports required by 4.11.1.1 and 4.11.1.2 shall be made to the ATS unit serving the airspace in which the aircraft is operated. In addition, when so prescribed by the appropriate ATS authority in aeronautical information publications or requested by the appropriate ATS unit, the last position report before passing from one FIR or control area to an adjacent FIR or control area shall be made to the ATS unit serving the airspace about to be entered.

4.11.1.5 If a position report is not received at the expected time, subsequent control shall not be based on the assumption that the estimated time is accurate. Immediate action shall be taken to obtain the report if it is likely to have any bearing on the control of other aircraft.

### 4.11.2 Contents of voice position reports

4.11.2.1 The position reports required by 4.11.1.1 and 4.11.1.2 shall contain the following elements of information, except that elements d), e) and f) may be omitted from position reports transmitted by radiotelephony, when so prescribed on the basis of regional air navigation agreements:

a) aircraft identification;

b) position;

c) time;

d) flight level or altitude, including passing level and cleared level if not maintaining the cleared level;

e) next position and time over; and

f) ensuing significant point.

4.11.2.1.1 Element d), flight level or altitude, shall, however, be included in the initial call after a change of air-ground voice communication channel.

4.11.2.2 When assigned a speed to maintain, the flight crew shall include this speed in their position reports. The assigned speed shall also be included in the initial call after a change of air-ground voice communication channel, whether or not a full position report is required.

*Note.— Omission of element d) may be possible when flight level or altitude, as appropriate, derived from pressure-altitude information can be made continuously available to controllers in labels associated with the position indication of aircraft and when adequate procedures have been developed to guarantee the safe and efficient use of this altitude information.*

### 4.11.3 Radiotelephony procedures for air-ground voice communication channel changeover

When so prescribed by the appropriate ATS authority, the initial call to an ATC unit after a change of air-ground voice communication channel shall contain the following elements:

a) designation of the station being called;

b) call sign and, for aircraft in the heavy wake turbulence category, the word "Heavy";

c) level, including passing and cleared levels if not maintaining the cleared level;

d) speed, if assigned by ATC; and

e) additional elements, as required by the appropriate ATS authority.

### 4.11.4 Transmission of ADS-C reports

The position reports shall be made automatically to the ATS unit serving the airspace in which the aircraft is operating. The requirements for the transmission and contents of automatic dependent surveillance — contract (ADS-C) reports shall be established by the controlling ATC unit on the basis of current operational conditions and communicated to the aircraft and acknowledged through an ADS-C agreement.

### 4.11.5 Contents of ADS-C reports

4.11.5.1 ADS-C reports shall be composed of data blocks selected from the following:

a) **Aircraft identification**

b) **Basic ADS-C**
latitude
longitude
altitude
time
figure of merit

c) **Ground vector**
track
ground speed
rate of climb or descent

d) **Air vector**
heading
Mach or IAS
rate of climb or descent

e) **Projected profile**
next waypoint
estimated altitude at next waypoint
estimated time at next waypoint
(next + 1) waypoint
estimated altitude at (next + 1) waypoint
estimated time at (next + 1) waypoint

f) **Meteorological information**
wind speed
wind direction
wind quality flag
temperature
turbulence (if available)
humidity (if available)

g) **Short-term intent**
latitude at projected intent point
longitude at projected intent point
altitude at projected intent point
time of projection

If an altitude, track or speed change is predicted to occur between the aircraft's current position and the projected intent point, additional information would be provided in an intermediate intent block as follows:

distance from current point to change point
track from current point to change point
altitude at change point
predicted time to change point

h) **Extended projected profile (in response to an interrogation from the ground system)**
next waypoint
estimated altitude at next waypoint
estimated time at next waypoint
(next + 1) waypoint
estimated altitude at (next + 1) waypoint
estimated time at (next + 1) waypoint
(next + 2) waypoint
estimated altitude at (next + 2) waypoint
estimated time at (next + 2) waypoint
[repeated for up to (next + 128) waypoints]

*Note. — The specifications for the elements in the meteorological information data block, including their ranges and resolutions, are shown in Appendix 4 to Annex 3.*

4.11.5.2 The basic ADS-C data block shall be required from all ADS-C-equipped aircraft. Remaining ADS-C data blocks shall be included as necessary. In addition to any requirements concerning its transmission for ATS purposes, data

block f) (Meteorological information) shall be transmitted in accordance with Annex 3, 5.3.1. ADS-C emergency and/or urgency reports shall include the emergency and/or urgency status in addition to the relevant ADS-C report information.

### 4.11.6 Data format of ADS-B messages

*Note.— Data formats of ADS-B messages can be found in Annex 10* — Aeronautical Telecommunications, *Volume III* — Communication Systems, *Part I* — Digital Data Communication Systems, *and Volume IV* — Surveillance Radar and Collision Avoidance Systems.

## 4.12 REPORTING OF OPERATIONAL AND METEOROLOGICAL INFORMATION

### 4.12.1 General

4.12.1.1 When operational and/or routine meteorological information is to be reported by an aircraft en route at points or times where position reports are required in accordance with 4.11.1.1 and 4.11.1.2, the position report shall be given in the form of a routine air-report. Special aircraft observations shall be reported as special air-reports. All air-reports shall be reported as soon as is practicable.

4.12.1.2 When ADS-C is being applied, routine air-reports shall be made in accordance with 4.11.5.2.

### 4.12.2 Contents of routine air-reports

4.12.2.1 Routine air-reports transmitted by voice or data link, when ADS-C is not being applied, shall give information relating to such of the following elements as are necessary for compliance with 4.12.2.2:

*Section 1.— Position information:*

1) aircraft identification
2) position
3) time
4) flight level or altitude
5) next position and time over
6) ensuing significant point

*Section 2.— Operational information:*

7) estimated time of arrival
8) endurance

*Section 3.— Meteorological information:*

9) air temperature
10) wind direction
11) wind speed
12) turbulence
13) aircraft icing
14) humidity (if available).

4.12.2.2 Section 1 of the air-report is obligatory, except that elements 5) and 6) thereof may be omitted when so prescribed on the basis of regional air navigation agreements. Section 2 of the air-report, or a portion thereof, shall only be transmitted when so requested by the operator or a designated representative, or when deemed necessary by the pilot-in-command. Section 3 of the air-report shall be transmitted in accordance with Annex 3, 5.3.2.

*Note.— While element 4), flight level or altitude, may, in accordance with 4.11.2.1, be omitted from the contents of a position report transmitted by radiotelephony when so prescribed on the basis of regional air navigation agreements, that element may not be omitted from Section 1 of an air-report.*

### 4.12.3 Contents of special air-reports

4.12.3.1 Special air-reports shall be made by all aircraft whenever the following conditions are encountered or observed:

a) severe turbulence; or

b) severe icing; or

c) severe mountain wave; or

d) thunderstorms, without hail that are obscured, embedded, widespread or in squall lines; or

e) thunderstorms, with hail that are obscured, embedded, widespread or in squall lines; or

f) heavy duststorm or heavy sandstorm; or

g) volcanic ash cloud; or

h) pre-eruption volcanic activity or a volcanic eruption.

*Note.— Pre-eruption volcanic activity in this context means unusual and/or increasing volcanic activity which could presage a volcanic eruption.*

In addition, in the case of transonic and supersonic flight:

i) moderate turbulence; or

j) hail; or

k) cumulonimbus clouds.

4.12.3.2 When air-ground data link is used, special air-reports shall contain the following elements:

message type designator
aircraft identification

Data block 1:

latitude
longitude
pressure-altitude
time

Data block 2:

wind direction
wind speed
temperature
turbulence (if available)
humidity (if available)

Data block 3:

condition prompting the issuance of the special air-report; to be selected from the list a) to k) presented under 4.12.3.1.

4.12.3.3 When voice communications are used, special air-reports shall contain the following elements:

Message type designator

*Section 1.— Position information*

1) aircraft identification
2) position
3) time
4) flight level or altitude

*Section 3.— Meteorological information*

5) condition prompting the issuance of the special air-report; to be selected from the list a) to k) presented under 4.12.3.1.

### 4.12.4 Compilation and transmission of air-reports by voice communications

4.12.4.1 Forms based on the model AIREP/AIREP SPECIAL form at Appendix 1 shall be provided for the use of flight crews in compiling the reports. The detailed instructions for reporting, as given at Appendix 1, shall be complied with.

4.12.4.2 The detailed instructions, including the formats of messages and the phraseologies given at Appendix 1, shall be used by flight crews when transmitting air-reports and by air traffic services units when retransmitting such reports.

*Note.— Increasing use of air-reports in automated systems makes it essential that the elements of such reports be transmitted in the order and form prescribed.*

### 4.12.5 Recording of special air-reports of volcanic activity

Special air-reports containing observations of volcanic activity shall be recorded on the special air-report of volcanic activity form. Forms based on the model form for special air-reports of volcanic activity at Appendix 1 shall be provided for flight crews operating on routes which could be affected by volcanic ash clouds.

*Note.— The recording and reporting instructions may conveniently be printed on the back of the special air-report of volcanic activity form.*

### 4.12.6 Forwarding of meteorological information

4.12.6.1 When receiving ADS-C reports which contain a meteorological information block, air traffic services units shall relay the basic ADS-C and meteorological information blocks and aircraft registration without delay to the world area forecast centres (WAFCs).

*Note.— Specifications concerning the format to be used in the relay of meteorological information to the WAFCs are contained in the* Manual on Aeronautical Meteorological Practice *(Doc 8896).*

4.12.6.2 When receiving special air-reports by data link communications, air traffic services units shall forward them without delay to their associated meteorological watch office and the WAFCs.

4.12.6.3 When receiving air-reports by voice communications, air traffic services units shall forward them without delay to their associated meteorological watch offices. In the case of routine air-reports which contain a Section 3, the air traffic services unit shall forward Section 1, sub-items 1 to 3 and Section 3.

## 4.13 PRESENTATION AND UPDATING OF FLIGHT PLAN AND CONTROL DATA

### 4.13.1 General

The appropriate authority shall establish provisions and procedures for the presentation to controllers, and subsequent updating, of flight plan and control data for all flights being provided with a service by an ATS unit. Provision shall also be made for the presentation of any other information required or desirable for the provision of ATS.

### 4.13.2 Information and data to be presented

4.13.2.1 Sufficient information and data shall be presented in such a manner as to enable the controller to have a complete representation of the current air traffic situation within the controller's area of responsibility and, when relevant, movements on the manoeuvring area of aerodromes. The presentation shall be updated in accordance with the progress of aircraft, in order to facilitate the timely detection and resolution of conflicts as well as to facilitate and provide a record of coordination with adjacent ATS units and control sectors.

4.13.2.2 An appropriate representation of the airspace configuration, including significant points and information related to such points, shall be provided. Data to be presented shall include relevant information from flight plans and position reports as well as clearance and coordination data. The information display may be generated and updated automatically, or the data may be entered and updated by authorized personnel.

4.13.2.3 Requirements regarding other information to be displayed, or to be available for display, shall be specified by the appropriate authority.

### 4.13.3 Presentation of information and data

4.13.3.1 The required flight plan and control data may be presented through the use of paper flight progress strips or electronic flight progress strips, by other electronic presentation forms or by a combination of presentation methods.

4.13.3.2 The method(s) of presenting information and data shall be in accordance with Human Factors principles. All data, including data related to individual aircraft, shall be presented in a manner minimizing the potential for misinterpretation or misunderstanding.

4.13.3.3 Means and methods for manually entering data in ATC automation systems shall be in accordance with Human Factors principles.

4.13.3.4 When flight progress strips (FPS) are used, there should be at least one individual FPS for each flight. The number of FPS for individual flights shall be sufficient to meet the requirements of the ATS unit concerned. Procedures for annotating data and provisions specifying the types of data to be entered on FPS, including the use of symbols, shall be specified by the appropriate ATS authority.

*Note.— Guidance material on the use of paper FPS is contained in the* Air Traffic Services Planning Manual *(Doc 9426).*

4.13.3.5 Data generated automatically shall be presented to the controller in a timely manner. The presentation of information and data for individual flights shall continue until such time as the data is no longer required for the purpose of providing control, including conflict detection and the coordination of flights, or until terminated by the controller.

### 4.13.4 Recording and retention of data for investigative purposes

Paper FPS shall be retained for a period of at least 30 days. Electronic flight progress and coordination data shall be recorded and retained for at least the same period of time.

## 4.14 FAILURE OR IRREGULARITY OF SYSTEMS AND EQUIPMENT

ATC units shall immediately report in accordance with local instructions any failure or irregularity of communication, navigation and surveillance systems or any other safety-significant systems or equipment which could adversely affect the safety or efficiency of flight operations and/or the provision of air traffic control service.

## 4.15 DATA LINK COMMUNICATIONS INITIATION PROCEDURES

### 4.15.1 General

4.15.1.1 Before entering an airspace where data link applications are required by the ATS unit, data link communications shall be initiated between the aircraft and the ATS unit in order to register the aircraft and, when necessary, allow the start of a data link application. This shall be initiated by the aircraft, either automatically or by the pilot, or by the ATS unit on address forwarding.

*Note.— Guidance material relating to the data link initiation capability (DLIC) can be found in the* Manual of Air Traffic Services Data Link Applications *(Doc 9694).*

4.15.1.2 The DLIC address associated with an ATS unit shall be published in Aeronautical Information Publications.

*Note.— A given FIR may have multiple DLIC addresses; and more than one FIR may share the same DLIC address.*

### 4.15.2 Aircraft initiation

Whenever the pilot or the aircraft initiates data link communication procedures, an initiation message shall be sent. Except when the initiation message is corrupted, it shall not be rejected by the ATS unit.

### 4.15.3 ATS unit forwarding

Where the ground system initially contacted by the aircraft is able to pass the necessary aircraft address information to another ATS unit, it shall pass the aircraft updated ground addressing information for data link applications previously coordinated in sufficient time to permit the establishment of data link communications.

### 4.15.4 Failure

In the case of an initiation failure, the originator of the data link initiation process shall be informed.

# Chapter 5

# SEPARATION METHODS AND MINIMA

## 5.1 INTRODUCTION

*Note 1.— With the exceptions stated below, Chapter 5 contains procedures and procedural separation minima for use in the separation of aircraft in the en-route phase as well as aircraft in the arrival and departure phases of flight.*

*Note 2.— Procedures and separation minima applicable to approaches to parallel runways are contained in Chapter 6. Procedures and separation minima applicable in the provision of aerodrome control service are contained in Chapter 7 and procedures and separation minima applicable to the use of ATS surveillance systems are contained in Chapter 8.*

## 5.2 PROVISIONS FOR THE SEPARATION OF CONTROLLED TRAFFIC

### 5.2.1 General

5.2.1.1 Vertical or horizontal separation shall be provided:

a) between all flights in Class A and B airspaces;

b) between IFR flights in Class C, D and E airspaces;

c) between IFR flights and VFR flights in Class C airspace;

d) between IFR flights and special VFR flights; and

e) between special VFR flights, when so prescribed by the appropriate ATS authority;

except, for the cases under b) above in airspace Classes D and E, during the hours of daylight when flights have been cleared to climb or descend subject to maintaining own separation and remaining in visual meteorological conditions. Conditions applicable to the use of this procedure are contained in Section 5.9.

5.2.1.2 No clearance shall be given to execute any manoeuvre that would reduce the spacing between two aircraft to less than the separation minimum applicable in the circumstances.

5.2.1.3 Larger separations than the specified minima should be applied whenever exceptional circumstances such as unlawful interference or navigational difficulties call for extra precautions. This should be done with due regard to all relevant factors so as to avoid impeding the flow of air traffic by the application of excessive separations.

*Note.— Unlawful interference with an aircraft constitutes a case of exceptional circumstances which might require the application of separations larger than the specified minima, between the aircraft being subjected to unlawful interference and other aircraft.*

5.2.1.4 Where the type of separation or minimum used to separate two aircraft cannot be maintained, another type of separation or another minimum shall be established prior to the time when the current separation minimum would be infringed.

### 5.2.2 Degraded aircraft performance

Whenever, as a result of failure or degradation of navigation, communications, altimetry, flight control or other systems, aircraft performance is degraded below the level required for the airspace in which it is operating, the flight crew shall advise the ATC unit concerned without delay. Where the failure or degradation affects the separation minimum currently being employed, the controller shall take action to establish another appropriate type of separation or separation minimum.

## 5.3 VERTICAL SEPARATION

### 5.3.1 Vertical separation application

Vertical separation is obtained by requiring aircraft using prescribed altimeter setting procedures to operate at different levels expressed in terms of flight levels or altitudes in accordance with the provisions in Chapter 4, Section 4.10.

### 5.3.2 Vertical separation minimum

The vertical separation minimum (VSM) shall be:

a) a nominal 300 m (1 000 ft) below FL 290 and a nominal 600 m (2 000 ft) at or above this level, except as provided for in b) below; and

b) within designated airspace, subject to a regional air navigation agreement: a nominal 300 m (1 000 ft) below FL 410 or a higher level where so prescribed for use under specified conditions, and a nominal 600 m (2 000 ft) at or above this level.

*Note.— Guidance material relating to vertical separation is contained in the* Manual on Implementation of a 300 m (1 000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive *(Doc 9574).*

### 5.3.3 Assignment of cruising levels for controlled flights

5.3.3.1 Except when traffic conditions and coordination procedures permit authorization of cruise climb, an ATC unit shall normally authorize only one level for an aircraft beyond its control area, i.e. that level at which the aircraft will enter the next control area whether contiguous or not. It is the responsibility of the accepting ATC unit to issue clearance for further climb as appropriate. When relevant, aircraft will be advised to request en route any cruising level changes desired.

5.3.3.2 Aircraft authorized to employ cruise climb techniques shall be cleared to operate between two levels or above a level.

5.3.3.3 If it is necessary to change the cruising level of an aircraft operating along an established ATS route extending partly within and partly outside controlled airspace and where the respective series of cruising levels are not identical, the change shall, whenever possible, be effected within controlled airspace.

5.3.3.4 When an aircraft has been cleared into a control area at a cruising level which is below the established minimum cruising level for a subsequent portion of the route, the ATC unit responsible for the area should issue a revised clearance to the aircraft even though the pilot has not requested the necessary cruising level change.

5.3.3.5 An aircraft may be cleared to change cruising level at a specified time, place or rate.

*Note.— See 5.3.4.1.1 concerning procedures for vertical speed control.*

5.3.3.6 In so far as practicable, cruising levels of aircraft flying to the same destination shall be assigned in a manner that will be correct for an approach sequence at destination.

5.3.3.7 An aircraft at a cruising level shall normally have priority over other aircraft requesting that cruising level. When two or more aircraft are at the same cruising level, the preceding aircraft shall normally have priority.

5.3.3.8 The cruising levels, or, in the case of cruise climb, the range of levels, to be assigned to controlled flights shall be selected from those allocated to IFR flights in:

a) the tables of cruising levels in Appendix 3 of Annex 2; or

b) a modified table of cruising levels, when so prescribed in accordance with Appendix 3 of Annex 2 for flights above FL 410;

except that the correlation of levels to track as prescribed therein shall not apply whenever otherwise indicated in air traffic control clearances or specified by the appropriate ATS authority in AIPs.

### 5.3.4 Vertical separation during climb or descent

5.3.4.1 An aircraft may be cleared to a level previously occupied by another aircraft after the latter has reported vacating it, except when:

a) severe turbulence is known to exist;

b) the higher aircraft is effecting a cruise climb; or

c) the difference in aircraft performance is such that less than the applicable separation minimum may result;

in which case such clearance shall be withheld until the aircraft vacating the level has reported at or passing another level separated by the required minimum.

5.3.4.1.1 When the aircraft concerned are entering or established in the same holding pattern, consideration shall be given to aircraft descending at markedly different rates and, if necessary, additional measures such as specifying a maximum descent rate for the higher aircraft and a minimum descent rate for the lower aircraft should be applied to ensure that the required separation is maintained.

5.3.4.2 Pilots in direct communication with each other may, with their concurrence, be cleared to maintain a specified vertical separation between their aircraft during ascent or descent.

## 5.4 HORIZONTAL SEPARATION

*Note 1.— Nothing in the provisions detailed in Sections 5.4.1 and 5.4.2 hereunder precludes a State from establishing:*

*a) other minima for use in circumstances not prescribed; or*

*b) additional conditions to those prescribed for the use of a given minimum;*

*provided that the level of safety inherent in the provisions detailed in Sections 5.4.1 and 5.4.2 hereunder is at all times assured.*

*Note 2.— Details on track spacing between parallel routes are provided in Annex 11, Attachments A and B.*

*Note 3.— Attention is drawn to the following guidance material:*

*a)* Air Traffic Services Planning Manual *(Doc 9426);*

*b)* Manual on Airspace Planning Methodology for the Determination of Separation Minima *(Doc 9689); and*

*c)* Performance-based Navigation Manual *(Doc 9613).*

*Note 4.— Provisions concerning reductions in separation minima are contained in Section 5.11 and in Chapter 2, ATS Safety Management.*

### 5.4.1 Lateral separation

#### 5.4.1.1 LATERAL SEPARATION APPLICATION

5.4.1.1.1 Lateral separation shall be applied so that the distance between those portions of the intended routes for which the aircraft are to be laterally separated is never less than an established distance to account for navigational inaccuracies plus a specified buffer. This buffer shall be determined by the appropriate authority and included in the lateral separation minima as an integral part thereof.

*Note.— In the minima specified in 5.4.1.2 an appropriate buffer has already been included.*

5.4.1.1.2 Lateral separation of aircraft is obtained by requiring operation on different routes or in different geographical locations as determined by visual observation, by the use of navigation aids or by the use of area navigation (RNAV) equipment.

5.4.1.1.3 When information is received indicating navigation equipment failure or deterioration below the navigation performance requirements, ATC shall then, as required, apply alternative separation methods or minima.

#### 5.4.1.2 LATERAL SEPARATION CRITERIA AND MINIMA

5.4.1.2.1 Means by which lateral separation may be applied include the following:

5.4.1.2.1.1 *By reference to the same or different geographic locations.* By position reports which positively indicate the aircraft are over different geographic locations as determined visually or by reference to a navigation aid (see Figure 5-1).

5.4.1.2.1.2 *By use of the same navigation aid or method.* By requiring aircraft to fly on specified tracks which are separated by a minimum amount appropriate to the navigation aid or method employed. Lateral separation between two aircraft exists when:

a) *VOR:* both aircraft are established on radials diverging by at least 15 degrees and at least one aircraft is at a distance of 28 km (15 NM) or more from the facility (see Figure 5-2);

b) *NDB:* both aircraft are established on tracks to or from the NDB which are diverging by at least 30 degrees and at least one aircraft at a distance of 28 km (15 NM) or more from the facility (see Figure 5-3);

c) *dead reckoning (DR):* both aircraft are established on tracks diverging by at least 45 degrees and at least one aircraft is at a distance of 28 km (15 NM) or more from the point of intersection of the tracks, this point being determined either visually or by reference to a navigation aid and both aircraft are established outbound from the intersection (see Figure 5-4); or

d) *RNAV operations:* both aircraft are established on tracks which diverge by at least 15 degrees and the protected airspace associated with the track of one aircraft does not overlap with the protected airspace associated with the track of the other aircraft. This is determined by applying the angular difference between two tracks and the appropriate protected airspace value. The derived value is expressed as a distance from the intersection of the two tracks at which lateral separation exists.

5.4.1.2.1.2.1 When aircraft are operating on tracks which are separated by considerably more than the foregoing minimum figures, States may reduce the distance at which lateral separation is achieved.

5.4.1.2.1.3 *By use of different navigation aids or methods.* Lateral separation between aircraft using different navigation aids, or when one aircraft is using RNAV equipment, shall be established by ensuring that the derived protected airspaces for the navigation aid(s) or RNP do not overlap.

5.4.1.2.1.4 *RNAV operations where RNP is specified on parallel tracks or ATS routes.* Within designated airspace or on designated routes, where RNP is specified, lateral separation between RNAV-equipped aircraft may be obtained by requiring aircraft to be established on the centre lines of parallel tracks or ATS routes spaced at a distance which ensures that the protected airspace of the tracks or ATS routes does not overlap.

*Note.— The spacing between parallel tracks or between parallel ATS route centre lines for which an RNP type is required will be dependent upon the relevant RNP type specified. Guidance material related to the spacing between tracks or ATS routes based on RNP type is contained in Annex 11, Attachment B.*

5.4.1.2.1.5 *RNAV operations (where RNP is specified) on intersecting tracks or ATS routes.* The use of this separation is limited to intersecting tracks that converge to or diverge from a common point at angles between 15 and 135 degrees.

5.4.1.2.1.5.1 For intersecting tracks, the entry points to and the exit points from the area in which lateral distance between the tracks is less than the required minimum are termed lateral separation points. The area bound by the lateral separation points is termed the area of conflict (see Figure 5-5).

5.4.1.2.1.5.2 The distance of the lateral separation points from the track intersection shall be determined by collision risk analysis and will depend on complex factors such as the navigation accuracy of the aircraft, traffic density, and occupancy.

*Note.— Information on the establishment of lateral separation points and collision risk analyses are contained in the* Manual on Airspace Planning Methodology for the Determination of Separation Minima *(Doc 9689).*

5.4.1.2.1.5.3 Lateral separation exists between two aircraft when at least one of the aircraft is outside the area of conflict.

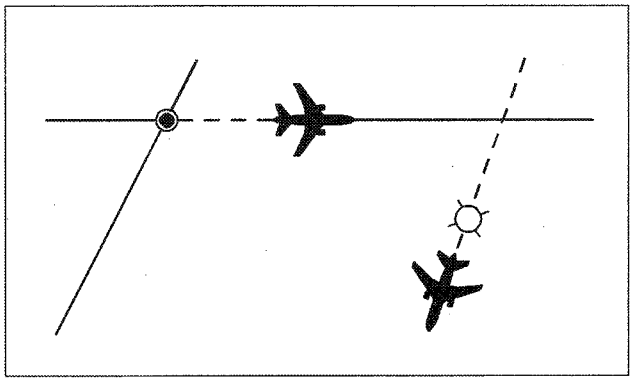


**Figure 5-1. Using same or different geographic locations (see 5.4.1.2.1.1)**

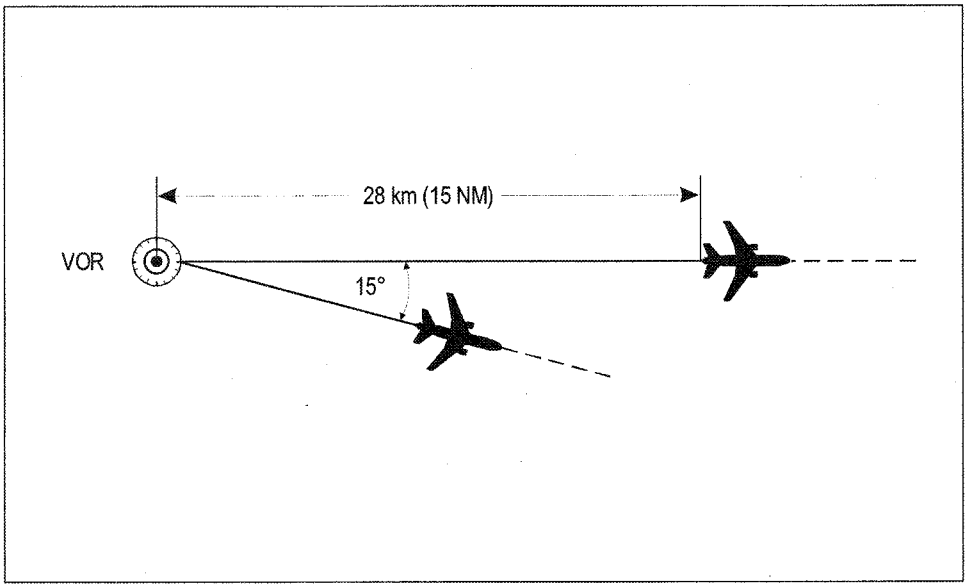



**Figure 5-2. Separation using the same VOR (see 5.4.1.2.1.2 a))**

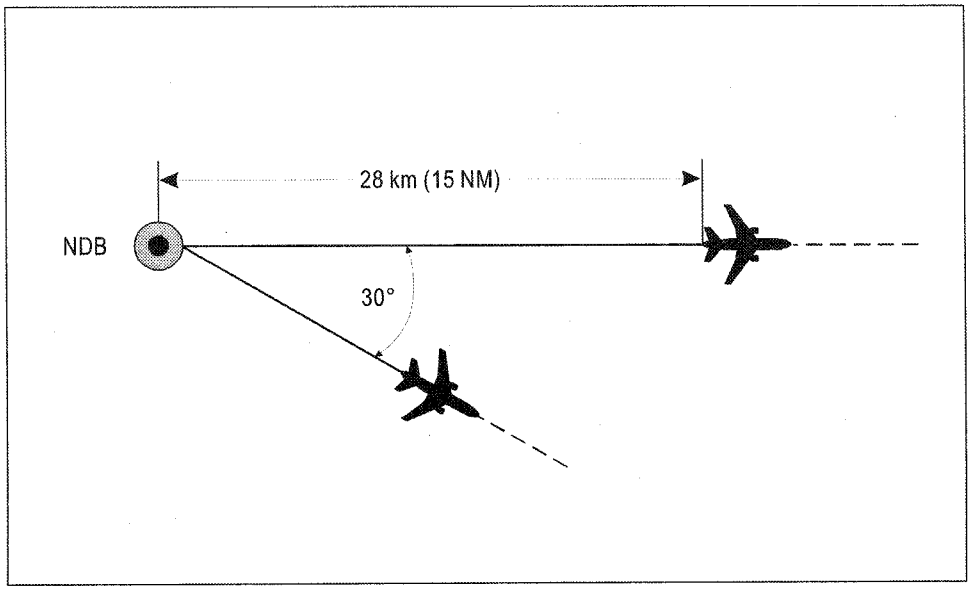



**Figure 5-3. Separation using the same NDB (see 5.4.1.2.1.2 b))**

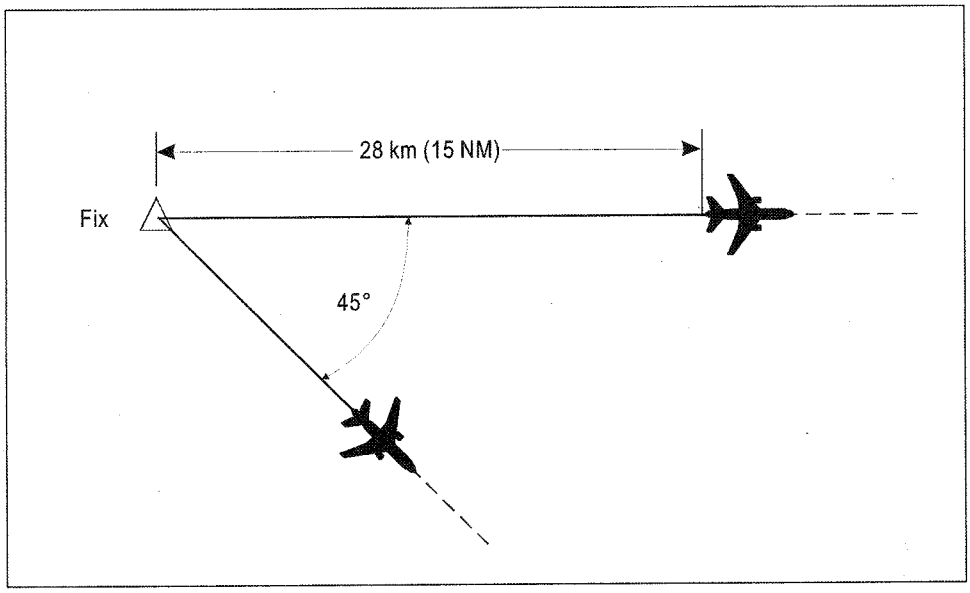



**Figure 5-4. Separation using dead reckoning (see 5.4.1.2.1.2 c))**

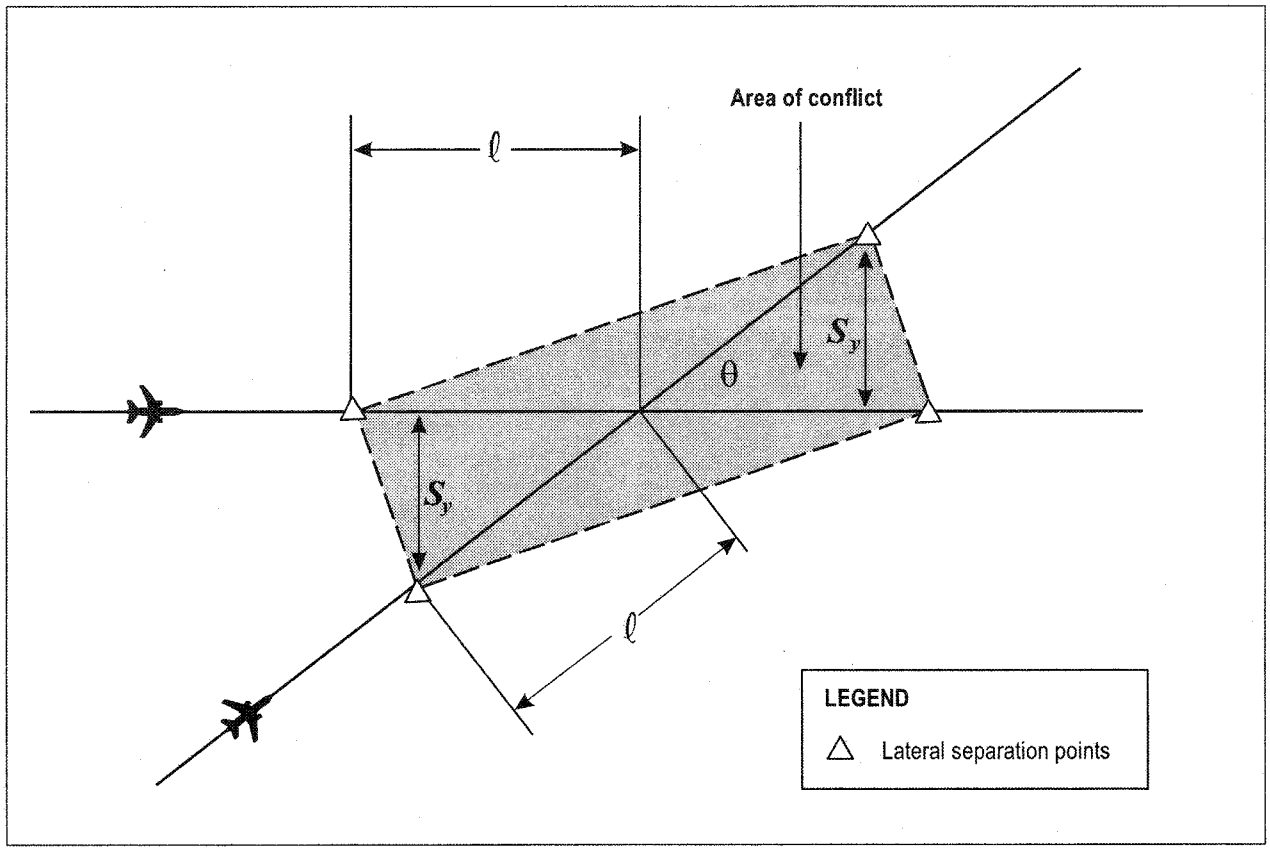



**Figure 5-5. Lateral separation points and the area of conflict (see 5.4.1.2.1.5.1)**

*Note.— The lateral separation points are calculated by the formula*: $\ell = S_y / \sin \theta$

*where:*

$S_y$ = *the lateral distance between the tracks equal to the lateral separation minimum;*
$\ell$ = *the distance of the lateral separation point from the intersection; and*
$\theta$ = *the angle between tracks.*

5.4.1.2.1.6 *Transitioning into airspace where a greater lateral separation minimum applies.* Lateral separation will exist when aircraft are established on specified tracks which:

a) are separated by an appropriate minimum; and

b) diverge by at least 15 degrees until the applicable lateral separation minimum is established;

providing that it is possible to ensure, by means approved by the appropriate ATS authority, that aircraft have the navigation capability necessary to ensure accurate track guidance.

## 5.4.2 Longitudinal separation

### 5.4.2.1 LONGITUDINAL SEPARATION APPLICATION

5.4.2.1.1 Longitudinal separation shall be applied so that the spacing between the estimated positions of the aircraft being separated is never less than a prescribed minimum. Longitudinal separation between aircraft following the same or diverging tracks may be maintained by application of speed control, including the Mach number technique. When applicable, use of the Mach number technique shall be prescribed on the basis of a regional air navigation agreement.

*Note 1.— Attention is drawn to the guidance material contained in the* Air Traffic Services Planning Manual *(Doc 9426) regarding the application of the Mach number technique to separation of subsonic aircraft.*

*Note 2.— The Mach number technique is applied using true Mach number.*

5.4.2.1.2 In applying a time- or distance-based longitudinal separation minimum between aircraft following the same track, care shall be exercised to ensure that the separation minimum will not be infringed whenever the following aircraft is maintaining a higher airspeed than the preceding aircraft. When aircraft are expected to reach minimum separation, speed control shall be applied to ensure that the required separation minimum is maintained.

5.4.2.1.3 Longitudinal separation may be established by requiring aircraft to depart at a specified time, to arrive over a geographical location at a specified time, or to hold over a geographical location until a specified time.

5.4.2.1.4 Longitudinal separation between supersonic aircraft during the transonic acceleration and supersonic phases of flight should normally be established by appropriate timing of the start of transonic acceleration rather than by the imposition of speed restrictions in supersonic flight.

5.4.2.1.5 For the purpose of application of longitudinal separation, the terms *same track, reciprocal tracks* and *crossing tracks* shall have the following meanings:

a) Same track (see Figure 5-6):

same direction tracks and intersecting tracks or portions thereof, the angular difference of which is less than 45 degrees or more than 315 degrees, and whose protected airspaces overlap.

b) Reciprocal tracks (see Figure 5-7):

opposite tracks and intersecting tracks or portions thereof, the angular difference of which is more than 135 degrees but less than 225 degrees, and whose protected airspaces overlap.

c) Crossing tracks (see Figure 5-8):

intersecting tracks or portions thereof other than those specified in a) and b) above.

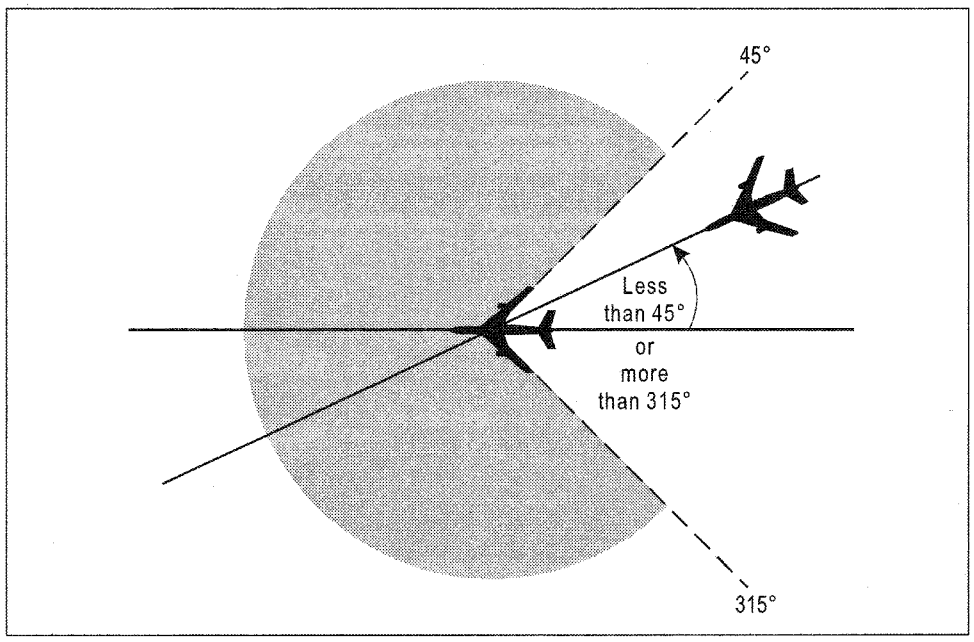



**Figure 5-6. Aircraft on same track (see 5.4.2.1.5 a))**

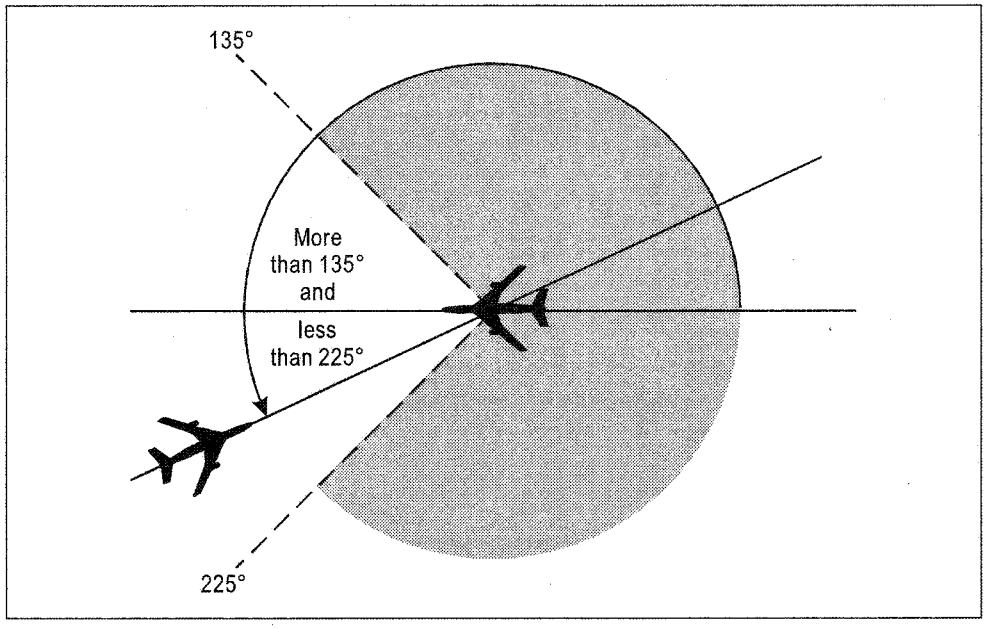



**Figure 5-7. Aircraft on reciprocal tracks (see 5.4.2.1.5 b))**

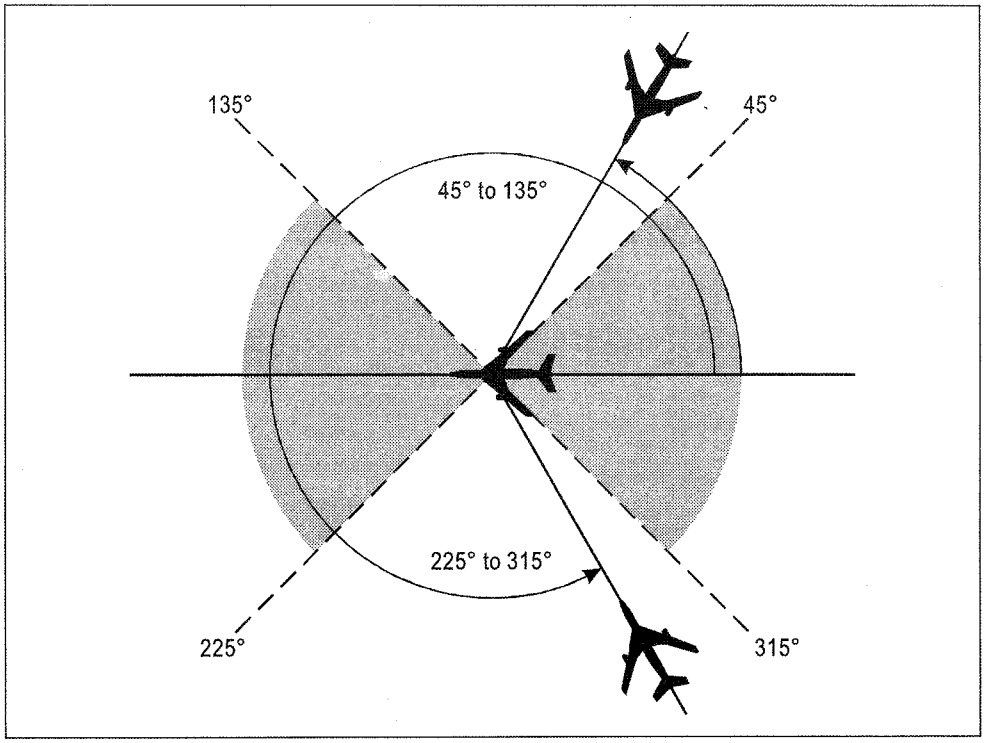



**Figure 5-8. Aircraft on crossing tracks (see 5.4.2.1.5 c))**

5.4.2.1.6 Time-based separation applied in accordance with 5.4.2.2 and 5.4.2.4 may be based on position information and estimates derived from voice reports, CPDLC or ADS-C.

### 5.4.2.2 LONGITUDINAL SEPARATION MINIMA BASED ON TIME

#### 5.4.2.2.1 *AIRCRAFT MAINTAINING THE SAME LEVEL*

5.4.2.2.1.1 *Aircraft flying on the same track:*

a) 15 minutes (see Figure 5-9); or

b) 10 minutes, if navigation aids permit frequent determination of position and speed (see Figure 5-10); or

c) 5 minutes in the following cases, provided that in each case the preceding aircraft is maintaining a true airspeed of 37 km/h (20 kt) or more faster than the succeeding aircraft (see Figure 5-11):

1) between aircraft that have departed from the same aerodrome;

2) between en-route aircraft that have reported over the same exact significant point;

3) between departing and en-route aircraft after the en-route aircraft has reported over a fix that is so located in relation to the departure point as to ensure that five-minute separation can be established at the point the departing aircraft will join the air route; or

d) 3 minutes in the cases listed under c) provided that in each case the preceding aircraft is maintaining a true airspeed of 74 km/h (40 kt) or more faster than the succeeding aircraft (see Figure 5-12).

5.4.2.2.1.2 *Aircraft flying on crossing tracks:*

a) 15 minutes at the point of intersection of the tracks (see Figure 5-13); or

b) 10 minutes if navigation aids permit frequent determination of position and speed (see Figure 5-14).

5.4.2.2.2 *AIRCRAFT CLIMBING OR DESCENDING*

5.4.2.2.2.1 *Aircraft on the same track.* When an aircraft will pass through the level of another aircraft on the same track, the following minimum longitudinal separation shall be provided:

a) 15 minutes while vertical separation does not exist (see Figures 5-15A and 5-15B); or

b) 10 minutes while vertical separation does not exist, provided that such separation is authorized only where navigation aids permit frequent determination of position and speed (see Figures 5-16A and 5-16B); or

c) 5 minutes while vertical separation does not exist, provided that the level change is commenced within 10 minutes of the time the second aircraft has reported over an exact reporting point (see Figures 5-17A and 5-17B).

*Note.— To facilitate application of the procedure where a considerable change of level is involved, a descending aircraft may be cleared to some convenient level above the lower aircraft, or a climbing aircraft to some convenient level below the higher aircraft, to permit a further check on the separation that will be obtained while vertical separation does not exist.*

5.4.2.2.2.2 *Aircraft on crossing tracks:*

a) 15 minutes while vertical separation does not exist (see Figures 5-18A and 5-18B); or

b) 10 minutes while vertical separation does not exist if navigation aids permit frequent determination of position and speed (see Figures 5-19A and 5-19B).

5.4.2.2.3 *Aircraft on reciprocal tracks.* Where lateral separation is not provided, vertical separation shall be provided for at least ten minutes prior to and after the time the aircraft are estimated to pass, or are estimated to have passed (see Figure 5-20). Provided it has been determined that the aircraft have passed each other, this minimum need not apply.

### 5.4.2.3 LONGITUDINAL SEPARATION MINIMA BASED ON DISTANCE USING DISTANCE MEASURING EQUIPMENT (DME) AND/OR GNSS

*Note.— Where the term "on track" is used in the provisions relating to the application of longitudinal separation minima using DME and/or GNSS, it means that the aircraft is flying either directly inbound to or directly outbound from the station/waypoint.*

5.4.2.3.1 Separation shall be established by maintaining not less than specified distance(s) between aircraft positions as reported by reference to DME in conjunction with other appropriate navigation aids and/or GNSS. This type of separation shall be applied between two aircraft using DME, or two aircraft using GNSS, or one aircraft using DME and one aircraft using GNSS. Direct controller-pilot VHF voice communication shall be maintained while such separation is used.

*Note.— For the purpose of applying GNSS-based separation minimum, a distance derived from an integrated navigation system incorporating GNSS input is regarded as equivalent to GNSS distance.*

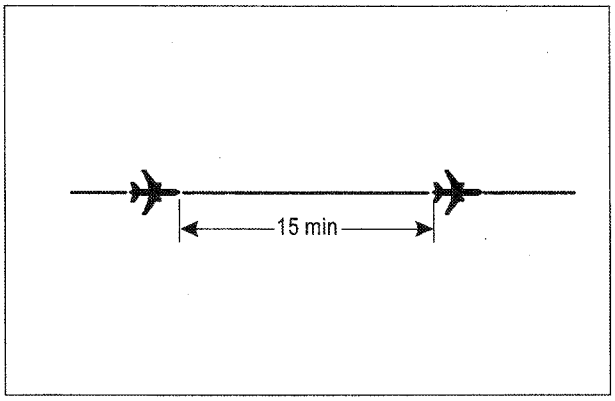



**Figure 5-9. Fifteen-minute separation between aircraft on same track and same level (see 5.4.2.2.1.1 a))**

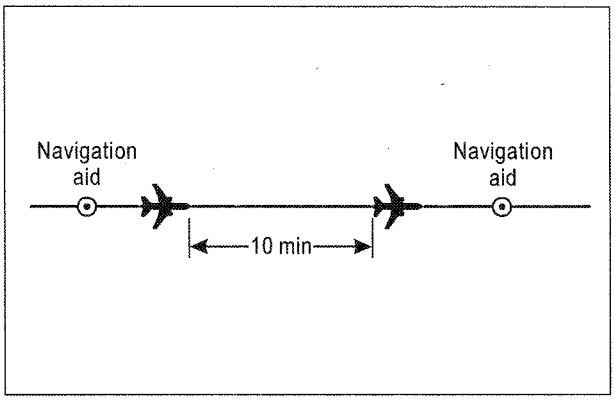



**Figure 5-10. Ten-minute separation between aircraft on same track and same level (see 5.4.2.2.1.1 b))**

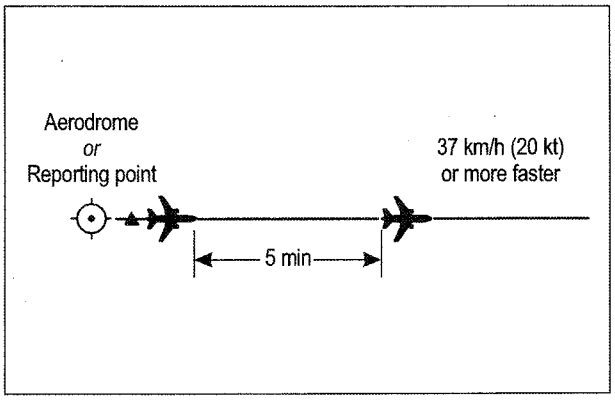



**Figure 5-11. Five-minute separation between aircraft on same track and same level (see 5.4.2.2.1.1 c))**

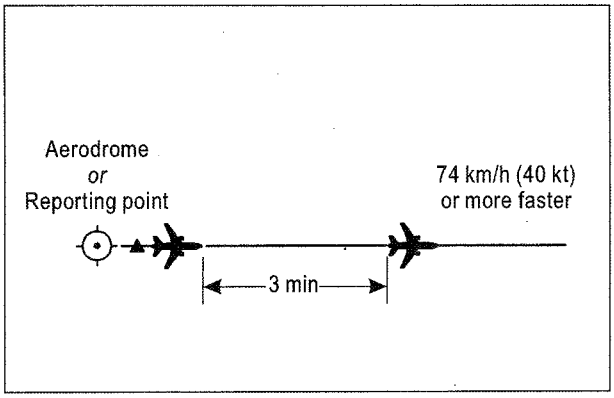



**Figure 5-12. Three-minute separation between aircraft on same track and same level (see 5.4.2.2.1.1 d))**

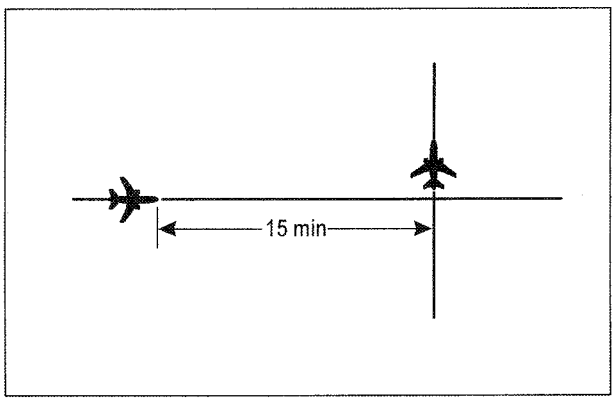



**Figure 5-13. Fifteen-minute separation between aircraft on crossing tracks and same level (see 5.4.2.2.1.2 a))**

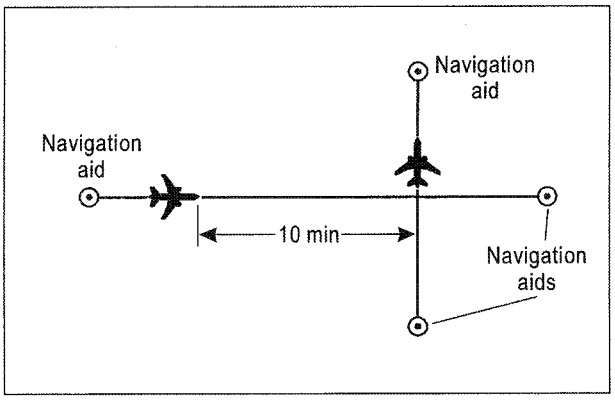



**Figure 5-14. Ten-minute separation between aircraft on crossing tracks and same level (see 5.4.2.2.1.2 b))**

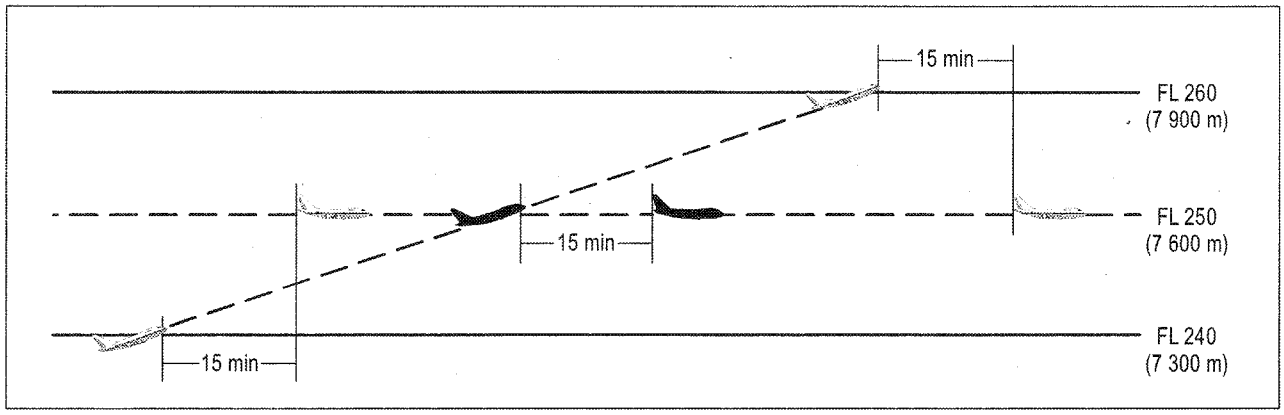



**Figure 5-15A. Fifteen-minute separation between aircraft climbing and on same track (see 5.4.2.2.2.1 a))**

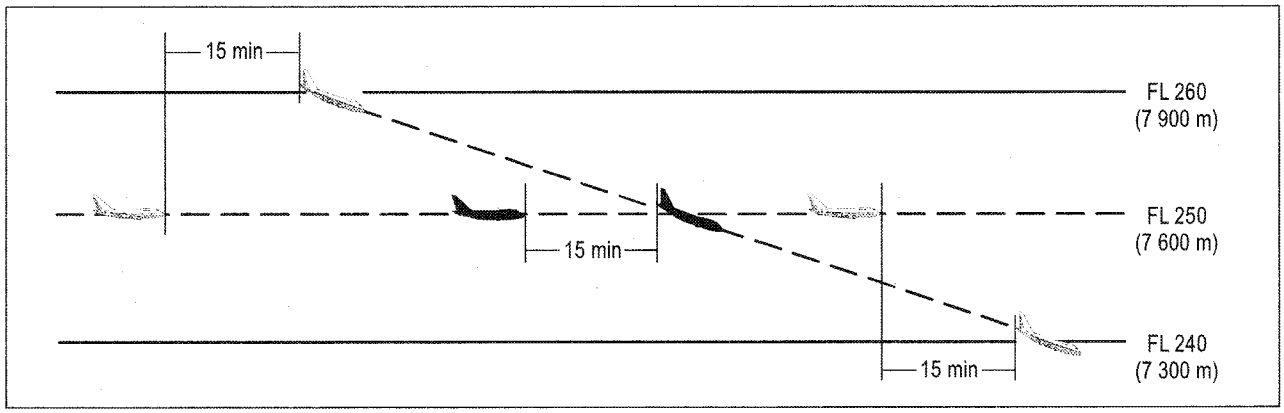



**Figure 5-15B. Fifteen-minute separation between aircraft descending and on same track (see 5.4.2.2.2.1 a))**

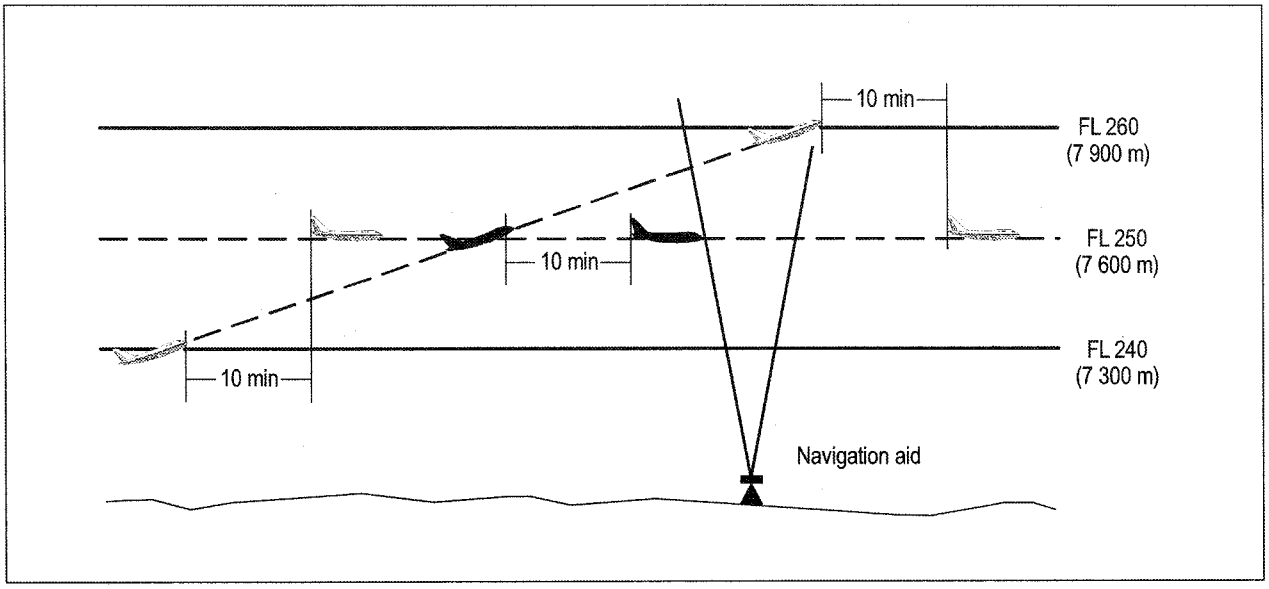



**Figure 5-16A. Ten-minute separation between aircraft climbing and on same track (see 5.4.2.2.2.1 b))**

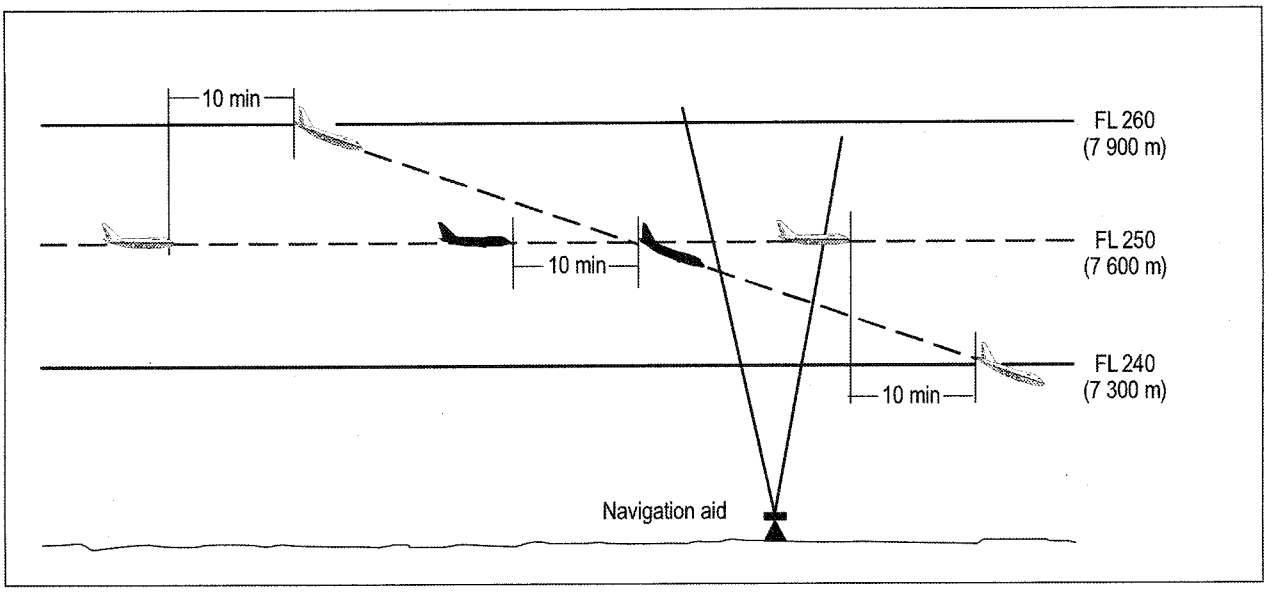



**Figure 5-16B. Ten-minute separation between aircraft descending and on same track (see 5.4.2.2.2.1 b))**

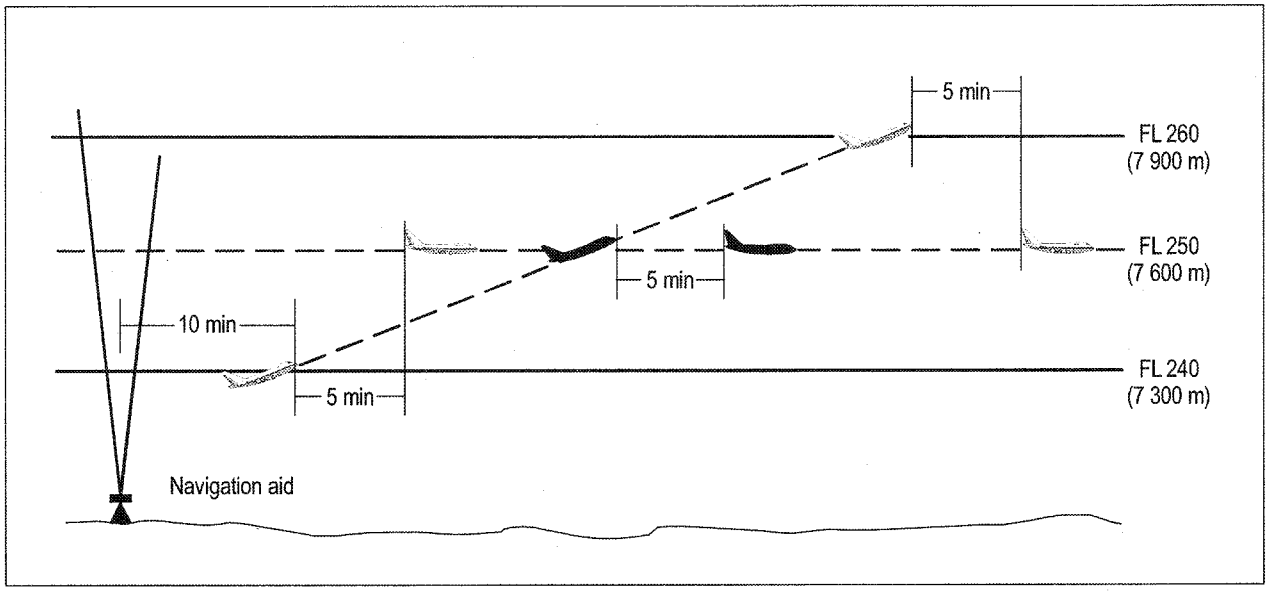



**Figure 5-17A. Five-minute separation between aircraft climbing and on same track (see 5.4.2.2.2.1 c))**

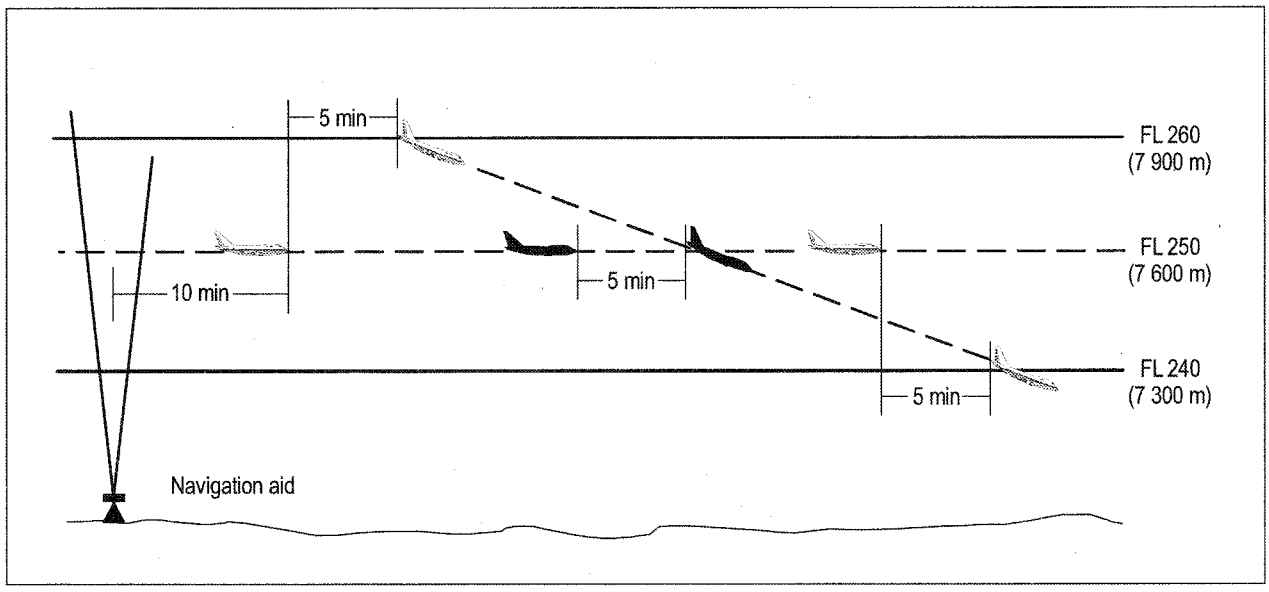



**Figure 5-17B. Five-minute separation between aircraft descending and on same track (see 5.4.2.2.2.1 c))**

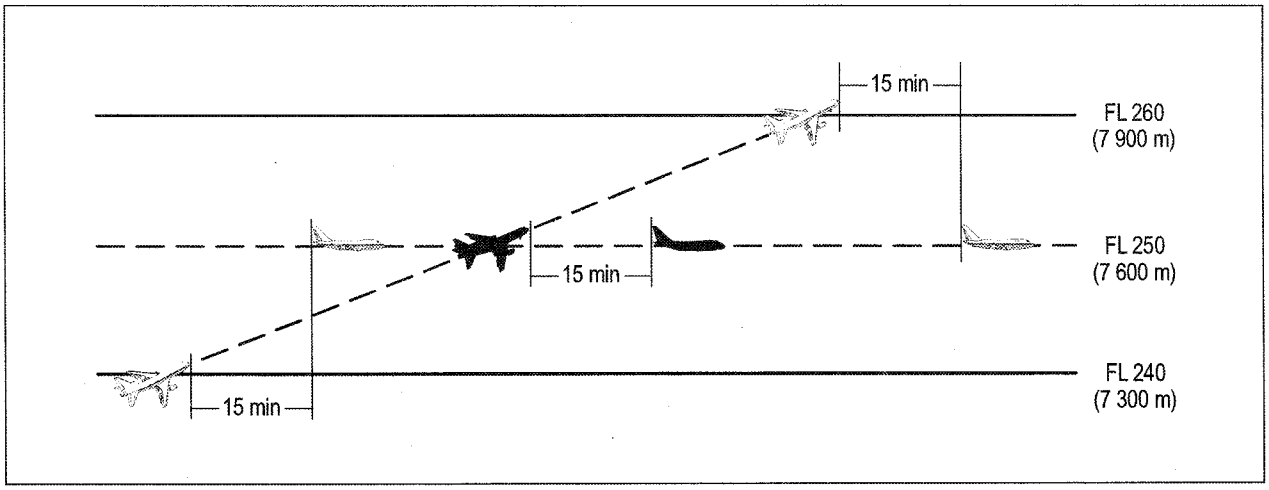



**Figure 5-18A. Fifteen-minute separation between aircraft climbing and on crossing tracks (see 5.4.2.2.2.2 a))**

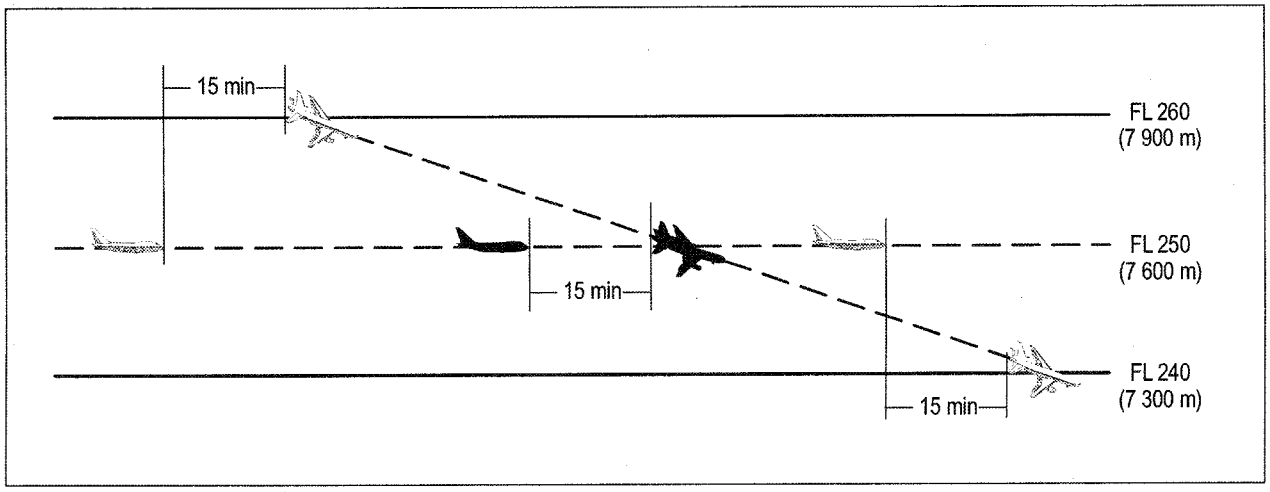



**Figure 5-18B. Fifteen-minute separation between aircraft descending and on crossing tracks (see 5.4.2.2.2.2 a))**

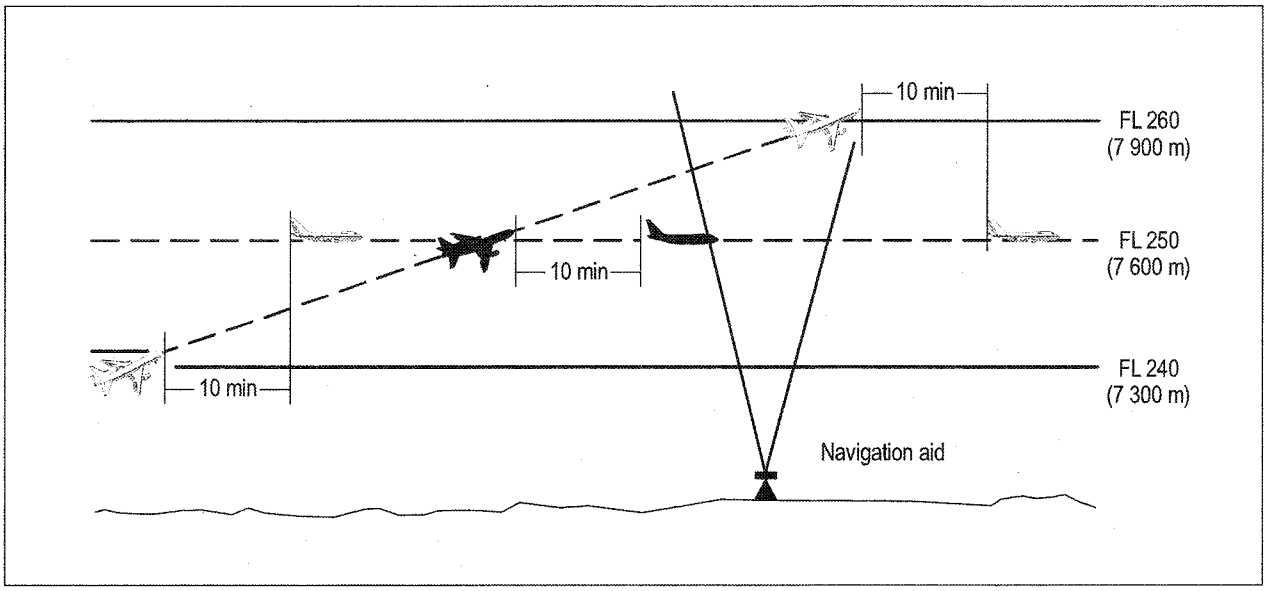



**Figure 5-19A. Ten-minute separation between aircraft climbing and on crossing tracks (see 5.4.2.2.2.2 b))**

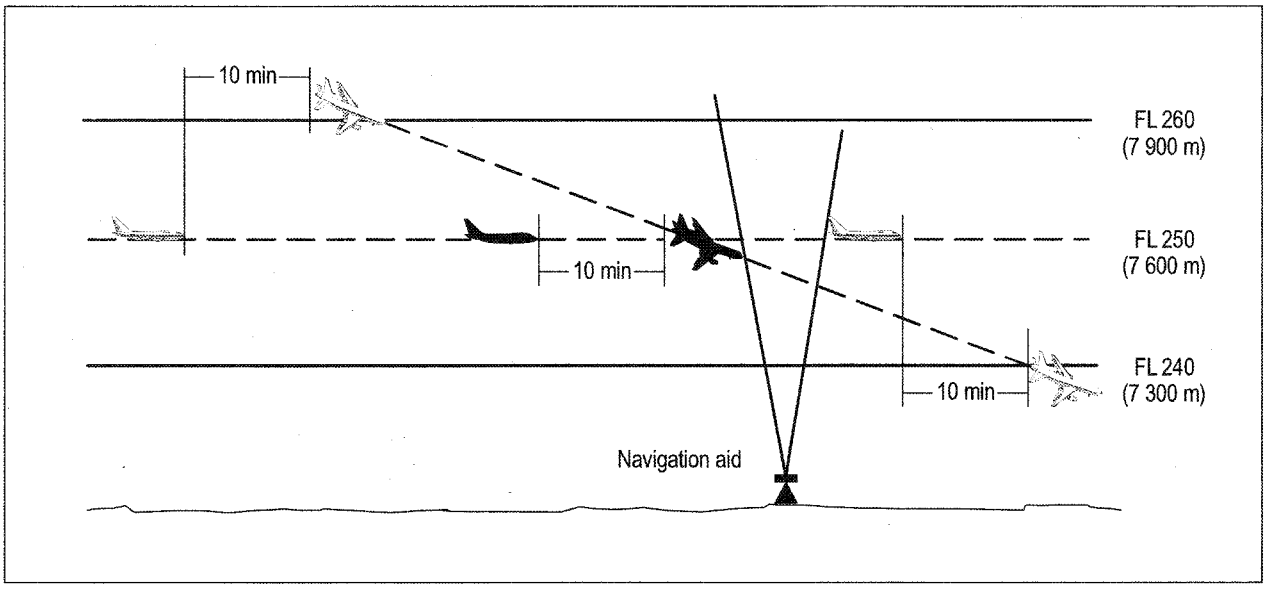



**Figure 5-19B. Ten-minute separation between aircraft descending and on crossing tracks (see 5.4.2.2.2.2 b))**

5.4.2.3.2 When applying these separation minima between any aircraft with area navigation capability, controllers shall specifically request GNSS-derived distance.

*Note.— Reasons making a pilot unable to provide GNSS distance information may include inadequate on-board equipment, no GNSS input into an integrated navigation system, or a loss of GNSS integrity.*

5.4.2.3.3 *AIRCRAFT AT THE SAME CRUISING LEVEL*

5.4.2.3.3.1 *Aircraft on the same track:*

a) 37 km (20 NM), provided:

1) each aircraft utilizes:

i) the same "on-track" DME station when both aircraft are utilizing DME; or

ii) an "on-track" DME station and a collocated waypoint when one aircraft is utilizing DME and the other is utilizing GNSS; or

iii) the same waypoint when both aircraft are utilizing GNSS; and

2) separation is checked by obtaining simultaneous DME and/or GNSS readings from the aircraft at frequent intervals to ensure that the minimum will not be infringed (see Figure 5-21);

b) 19 km (10 NM), provided:

1) the leading aircraft maintains a true airspeed of 37 km/h (20 kt) or more faster than the succeeding aircraft;

2) each aircraft utilizes:

i) the same "on-track" DME station when both aircraft are utilizing DME; or

ii) an "on-track" DME station and a collocated waypoint when one aircraft is utilizing DME and the other is utilizing GNSS; or

iii) the same waypoint when both aircraft are utilizing GNSS; and

3) separation is checked by obtaining simultaneous DME and/or GNSS readings from the aircraft at such intervals as are necessary to ensure that the minimum is established and will not be infringed (see Figure 5-22).

5.4.2.3.3.2 *Aircraft on crossing tracks.* The longitudinal separation prescribed in 5.4.2.3.3.1 shall also apply provided each aircraft reports distance from the DME station and/or collocated waypoint or same waypoint located at the crossing point of the tracks and that the relative angle between the tracks is less than 90 degrees (see Figures 5-23A and 5-23B).

5.4.2.3.4 *AIRCRAFT CLIMBING AND DESCENDING*

5.4.2.3.4.1 *Aircraft on the same track:* 19 km (10 NM) while vertical separation does not exist, provided:

a) each aircraft utilizes:

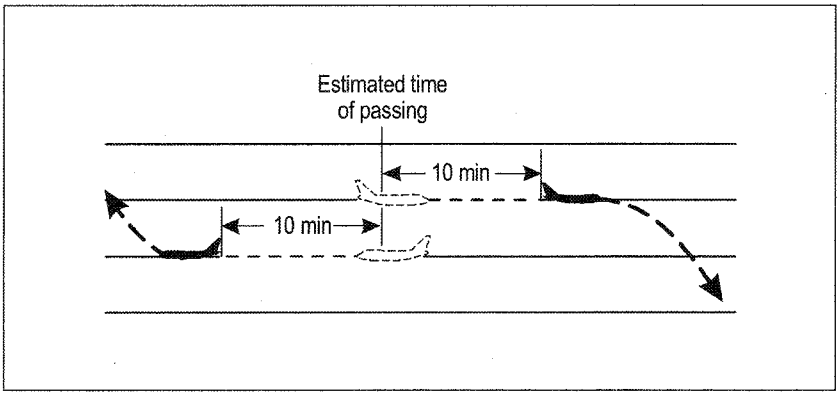



**Figure 5-20. Ten-minute separation between aircraft on reciprocal tracks (see 5.4.2.2.3)**

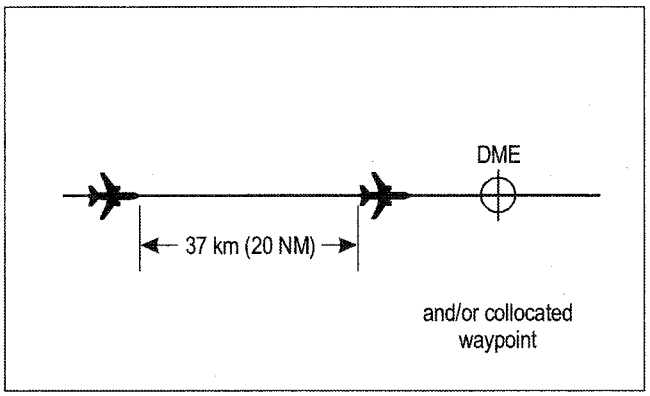



**Figure 5-21. 37 km (20 NM) DME or GNSS-based separation between aircraft on same track and same level (see 5.4.2.3.3.1 a))**

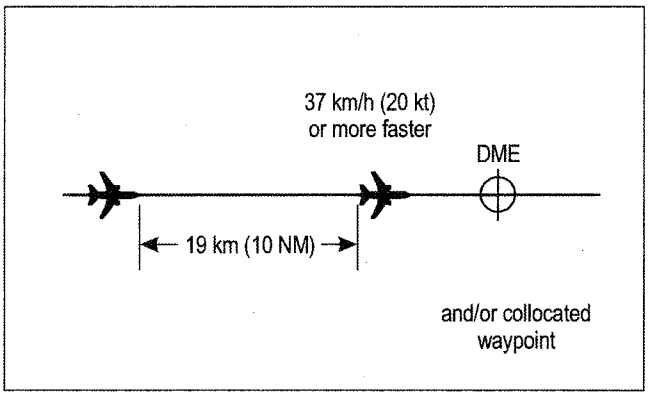



**Figure 5-22. 19 km (10 NM) DME or GNSS-based separation between aircraft on same track and same level (see 5.4.2.3.3.1 b))**

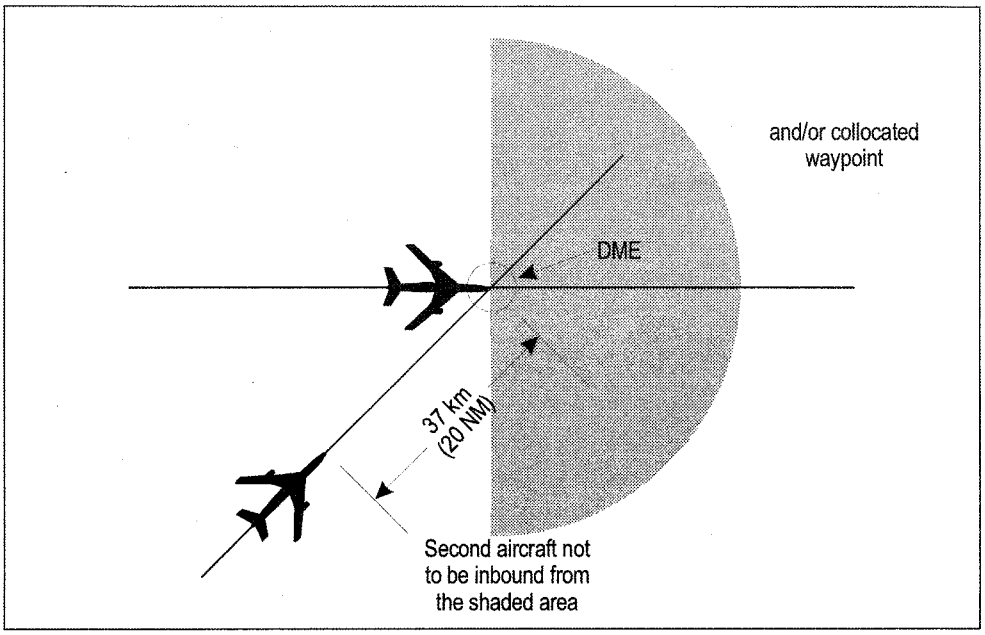



**Figure 5-23A. 37 km (20 NM) DME or GNSS-based separation between aircraft on crossing tracks and same level (see 5.4.2.3.3.2)**

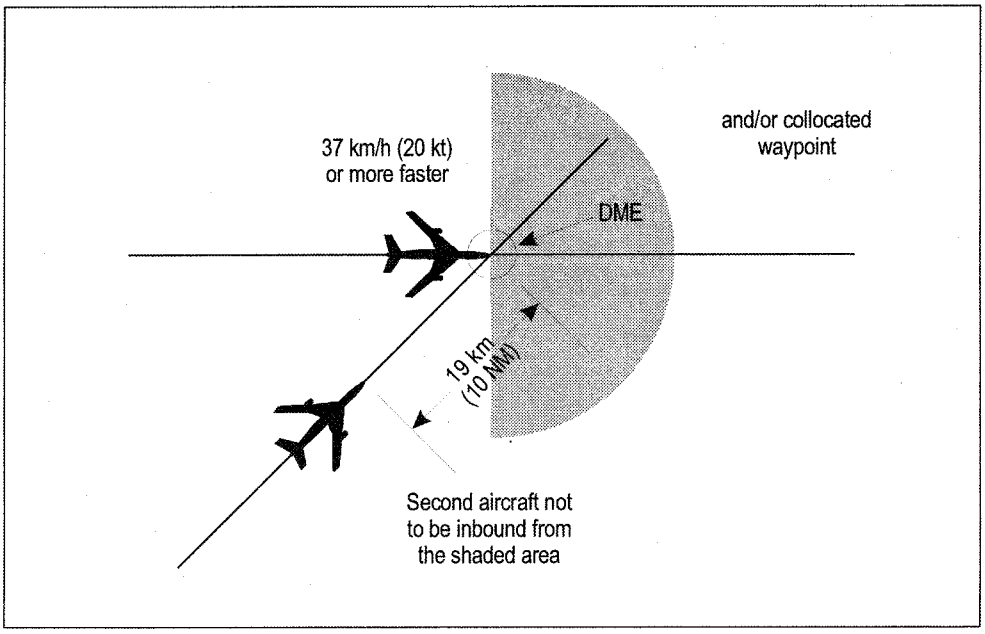



**Figure 5-23B. 19 km (10 NM) DME or GNSS-based separation between aircraft on crossing tracks and same level (see 5.4.2.3.3.2)**

i) the same "on-track" DME station when both aircraft are utilizing DME; or

ii) an "on-track" DME station and a collocated waypoint when one aircraft is utilizing DME and the other is utilizing GNSS; or

iii) the same waypoint when both aircraft are utilizing GNSS; and

b) one aircraft maintains a level while vertical separation does not exist; and

c) separation is established by obtaining simultaneous DME and/or GNSS readings from the aircraft (see Figures 5-24A and 5-24B).

*Note.— To facilitate application of the procedure where a considerable change of level is involved, a descending aircraft may be cleared to some convenient level above the lower aircraft, or a climbing aircraft to some convenient level below the higher aircraft, to permit a further check on the separation that will be obtained while vertical separation does not exist.*

5.4.2.3.4.2 *Aircraft on reciprocal tracks.* Aircraft utilizing on-track DME and/or collocated waypoint or same waypoint may be cleared to climb or descend through the levels occupied by other aircraft utilizing on-track DME and/or collocated waypoint or same waypoint, provided that it has been positively established that the aircraft have passed each other and are at least 10 NM apart, or such other value as prescribed by the appropriate ATS authority.

### 5.4.2.4 LONGITUDINAL SEPARATION MINIMA WITH MACH NUMBER TECHNIQUE BASED ON TIME

5.4.2.4.1 Turbojet aircraft shall adhere to the true Mach number approved by ATC and shall request ATC approval before making any changes thereto. If it is essential to make an immediate temporary change in the Mach number (e.g. due to turbulence), ATC shall be notified as soon as possible that such a change has been made.

5.4.2.4.2 If it is not feasible, due to aircraft performance, to maintain the last assigned Mach number during en-route climbs and descents, pilots of aircraft concerned shall advise ATC at the time of the climb/descent request.

5.4.2.4.3 When the Mach number technique is applied and provided that:

a) the aircraft concerned have reported over the same common point and follow the same track or continuously diverging tracks until some other form of separation is provided; or

b) if the aircraft have not reported over the same common point and it is possible to ensure, by radar, ADS-B or other means, that the appropriate time interval will exist at the common point from which they either follow the same track or continuously diverging tracks;

minimum longitudinal separation between turbojet aircraft on the same track, whether in level, climbing or descending flight shall be:

1) 10 minutes; or

2) between 9 and 5 minutes inclusive, provided that:

the preceding aircraft is maintaining a true Mach number greater than the following aircraft in accordance with the following:

— 9 minutes, if the preceding aircraft is Mach 0.02 faster than the following aircraft;

— 8 minutes, if the preceding aircraft is Mach 0.03 faster than the following aircraft;

— 7 minutes, if the preceding aircraft is Mach 0.04 faster than the following aircraft;

— 6 minutes, if the preceding aircraft is Mach 0.05 faster than the following aircraft;

— 5 minutes, if the preceding aircraft is Mach 0.06 faster than the following aircraft.

5.4.2.4.4 When the 10-minute longitudinal separation minimum with Mach number technique is applied, the preceding aircraft shall maintain a true Mach number equal to or greater than that maintained by the following aircraft.

### 5.4.2.5 LONGITUDINAL SEPARATION MINIMA WITH MACH NUMBER TECHNIQUE BASED ON DISTANCE USING RNAV

*Note.— Guidance material on RNAV operations is contained in the* Performance-based Navigation Manual *(Doc 9613).*

5.4.2.5.1 Turbojet aircraft shall adhere to the true Mach number approved by ATC and shall request ATC approval before making any changes thereto. If it is essential to make an immediate temporary change in the Mach number (e.g. due to turbulence), ATC shall be notified as soon as possible that such a change has been made.

5.4.2.5.1.1 If it is not feasible, due to aircraft performance, to maintain the last assigned Mach number during en-route climbs and descents, pilots of aircraft concerned shall advise ATC at the time of the climb/descent request.

5.4.2.5.2 RNAV distance-based separation minima shall not be applied after ATC has received pilot advice indicating navigation equipment deterioration or failure.

5.4.2.5.3 Separation shall be established by maintaining not less than the specified distance between aircraft positions as reported by reference to RNAV equipment. Direct controller-pilot communications should be maintained, while such separation is used. Where high frequency or general purpose extended range very high frequency air-ground communication channels are used for area control service and are worked by air-ground communicators, suitable arrangements shall be made to permit direct controller-pilot communications, or monitoring by the controller of all air-ground communications.

5.4.2.5.3.1 To assist pilots to readily provide the required RNAV distance information, such position reports should, wherever possible, be referenced to a common waypoint ahead of both aircraft.

5.4.2.5.4 RNAV distance-based separation may be applied between RNAV-equipped aircraft when operating on designated RNAV routes or on ATS routes defined by VOR.

5.4.2.5.5 A 150 km (80 NM) RNAV distance-based separation minimum with Mach number technique may be used on same-direction tracks in lieu of a 10-minute longitudinal separation minimum with Mach number technique, provided:

a) each aircraft reports its distance to or from the same "on-track" common point;

b) separation between aircraft at the same level is checked by obtaining simultaneous RNAV distance readings from the aircraft at frequent intervals to ensure that the minimum will not be infringed (see Figure 5-25);

c) separation between aircraft climbing or descending is established by obtaining simultaneous RNAV distance readings from the aircraft (see Figures 5-26A and 5-26B); and

d) in the case of aircraft climbing or descending, one aircraft maintains a level while vertical separation does not exist.

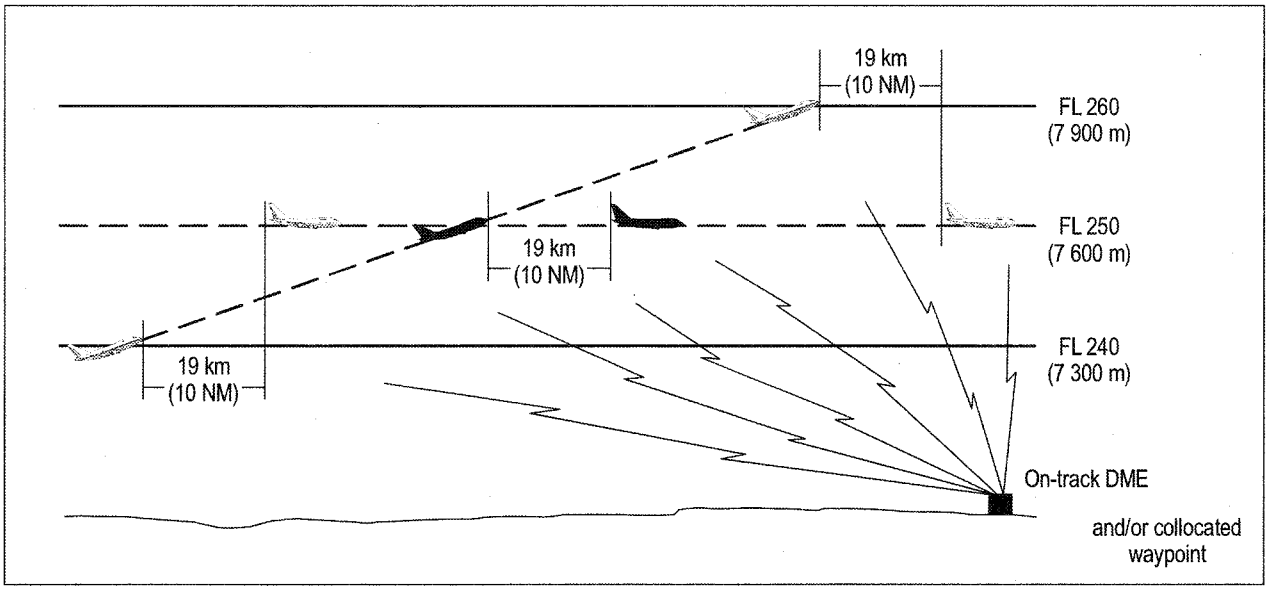



**Figure 5-24A. 19 km (10 NM) DME or GNSS-based separation between aircraft climbing and on same track (see 5.4.2.3.4.1 c))**

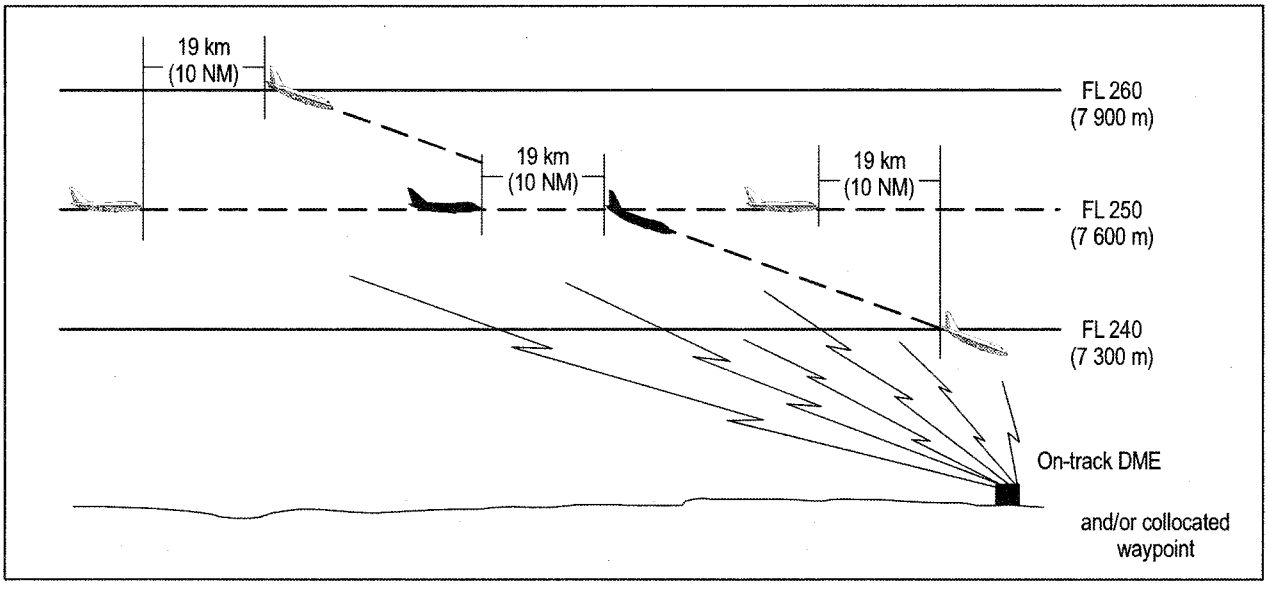



**Figure 5-24B. 19 km (10 NM) DME or GNSS-based separation between aircraft descending and on same track (see 5.4.2.3.4.1 c))**

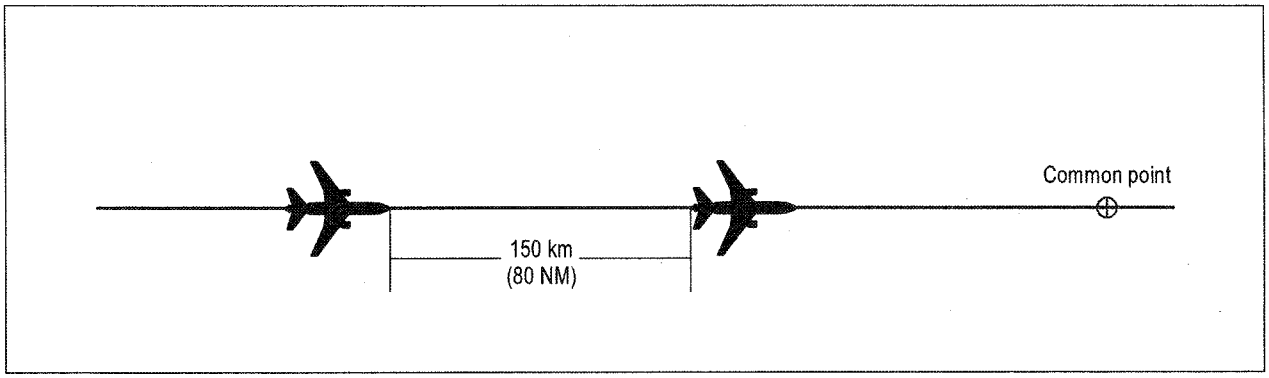



**Figure 5-25. 150 km (80 NM) RNAV-based separation between aircraft at the same level (see 5.4.2.5.5 b))**

5.4.2.5.6 When the 150 km (80 NM) longitudinal separation minimum with Mach number technique is applied, the preceding aircraft shall maintain a true Mach number equal to or greater than that maintained by the following aircraft.

*Note.— To facilitate application of the procedure where a considerable change of level is involved, a descending aircraft may be cleared to some convenient level above the lower aircraft, or a climbing aircraft to some convenient level below the higher aircraft, to permit a further check on the separation that will be obtained while vertical separation does not exist.*

5.4.2.5.7 *Aircraft on reciprocal tracks.* Aircraft utilizing RNAV may be cleared to climb or descend to or through the levels occupied by other aircraft utilizing RNAV provided it has been positively established by simultaneous RNAV distance readings to or from the same "on-track" common point that the aircraft have passed each other and are at least 150 km (80 NM) apart (see Figure 5-27).

### 5.4.2.6 LONGITUDINAL SEPARATION MINIMA BASED ON DISTANCE USING RNAV WHERE RNP IS SPECIFIED

*Note.— Guidance material is contained in Attachment B to Annex 11, the* Performance-based Navigation Manual *(Doc 9613), the* Air Traffic Services Planning Manual *(Doc 9426) and the* Manual on Airspace Planning Methodology for the Determination of Separation Minima *(Doc 9689).*

5.4.2.6.1 Within designated airspace, or on designated routes, separation minima in accordance with the provisions of this section (5.4.2.6) may be used, subject to regional air navigation agreements.

5.4.2.6.2 Separation shall be established by maintaining not less than the specified distance between aircraft positions as reported by reference to the same "on-track" common point, whenever possible ahead of both aircraft, or by means of an automated position reporting system.

*Note.— The term "on track" means that the aircraft is flying either directly inbound to or directly outbound from the station or waypoint.*

5.4.2.6.2.1 When information is received indicating navigation equipment failure or deterioration below the navigation performance requirements, ATC shall then, as required, apply alternative separation minima.

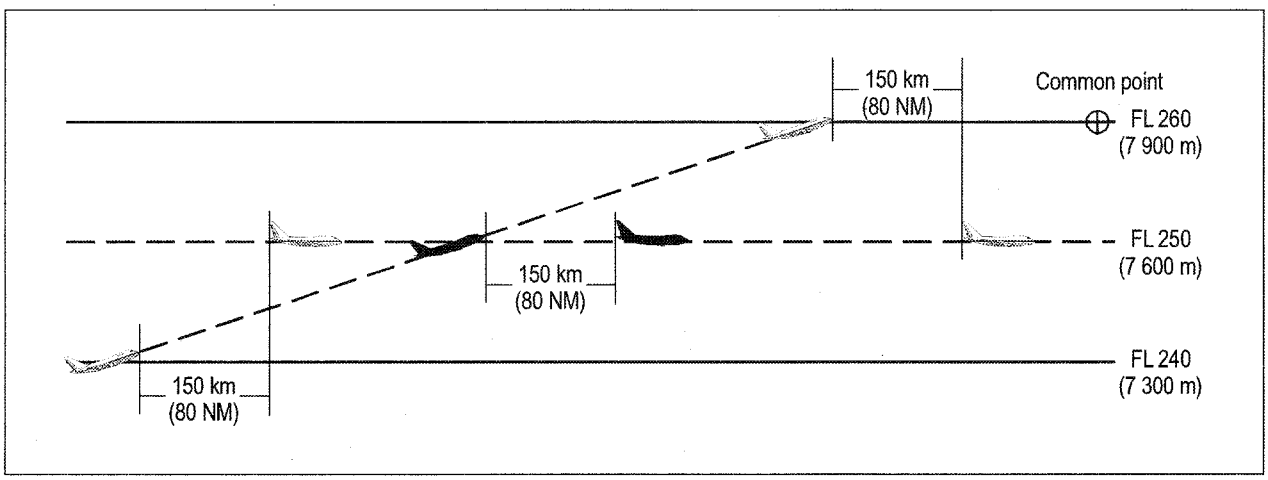



**Figure 5-26A. 150 km (80 NM) RNAV-based separation between aircraft climbing and on same track (see 5.4.2.5.5 c))**

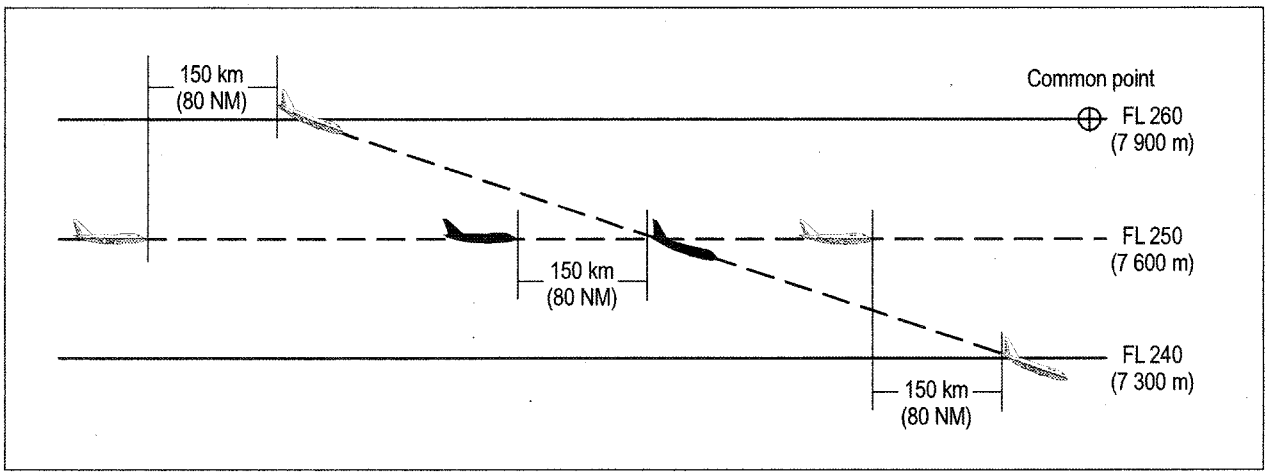



**Figure 5-26B. 150 km (80 NM) RNAV-based separation between aircraft descending and on same track (see 5.4.2.5.5 c))**

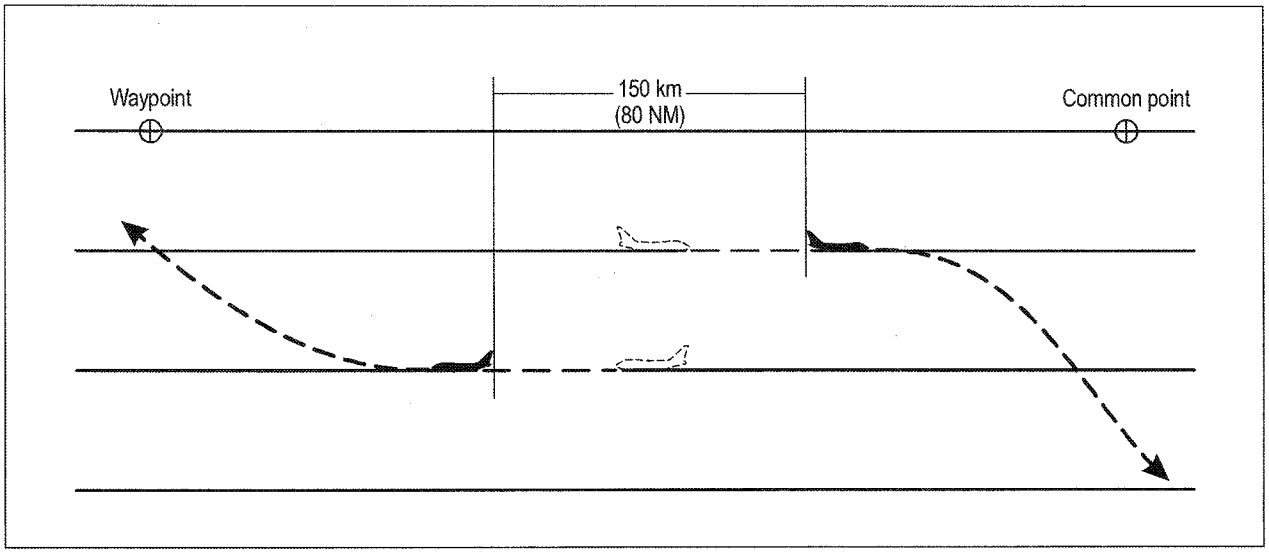



**Figure 5-27. 150 km (80 NM) RNAV-based separation between aircraft on reciprocal tracks (see 5.4.2.5.7)**

5.4.2.6.2.2 Direct controller-pilot communications shall be maintained while applying a distance-based separation minima. Direct controller-pilot communications shall be voice or CPDLC. The communication criteria necessary for CPDLC to satisfy the requirement for direct controller-pilot communications shall be established by an appropriate safety assessment.

*Note.— The communication criteria which are used as a basis for the derivation of the separation minima in this section are set out in Appendix 5 of the* Manual on Airspace Planning Methodology for the Determination of Separation Minima *(Doc 9689). Guidance material for CPDLC is contained in the* Manual of Air Traffic Services Data Link Applications *(Doc 9694).*

5.4.2.6.2.2.1 Prior to and during the application of a distance-based separation minimum, the controller should determine the adequacy of the available communication link, considering the time element required to receive replies from two or more aircraft, and the overall workload/traffic volume associated with the application of such minima.

5.4.2.6.2.3 When aircraft are at, or are expected to reduce to, the minimum separation applicable, speed control techniques, including assigning Mach number, shall be applied to ensure that the minimum distance exists throughout the period of application of the minima.

5.4.2.6.3 *LONGITUDINAL DISTANCE-BASED SEPARATION MINIMA IN AN RNP RNAV ENVIRONMENT NOT USING ADS-C*

5.4.2.6.3.1 For aircraft cruising, climbing or descending on the same track, the following separation minimum may be used:

| *Separation minimum* | *RNP type* | *Communication requirement* | *Surveillance requirement* | *Distance verification requirements* |
|---|---|---|---|---|
| 93 km (50 NM) | 10 | Direct controller-pilot communications | Procedural position reports | At least every 24 minutes |

*Note 1.— Where a considerable change of level is involved using distance-based separation, a descending aircraft may be cleared to some convenient level above the lower aircraft, or a climbing aircraft to some convenient level below the higher aircraft (e.g. 1 200 m (4 000 ft) or less) to permit a further check on the separation that will be maintained while vertical separation does not exist.*

*Note 2.— It should be noted that the separation minimum depicted above is based on safety assessments performed specifically for a particular network of tracks or routes. As such, the assessments evaluated traffic characteristics which might be unique to the network being assessed.*

*Note 3.— The separation minimum above was developed in accordance with a collision risk analysis which dictates conditions under which this separation can be applied.*

*Note 4.— Detailed information on the analysis used to determine the separation minimum and on performing safety assessments is contained in the* Manual on Airspace Planning Methodology for the Determination of Separation Minima *(Doc 9689).*

5.4.2.6.3.2 During the application of the 93 km (50 NM) separation, when an aircraft fails to report its position, the controller shall take action within 3 minutes to establish communication. If communication has not been established within 8 minutes of the time the report should have been received, the controller shall take action to apply an alternative form of separation.

5.4.2.6.3.3 Where automated position reporting applies, a common time reference shall be used.

5.4.2.6.3.4 *Aircraft on reciprocal tracks.* Aircraft may be cleared to climb or descend to or through the levels occupied by the other provided that it has been positively established that the aircraft have passed each other and the distance between them is equal to at least the applicable separation minimum.

5.4.2.6.4 *LONGITUDINAL DISTANCE-BASED SEPARATION MINIMA IN AN RNP RNAV ENVIRONMENT USING ADS-C*

5.4.2.6.4.1 Separation based on the use of ADS-C shall be applied so that the distance between the calculated positions of the aircraft is never less than the prescribed minimum. This distance shall be obtained by one of the following methods:

a) when the aircraft are on the same identical track, the distance may be measured between the calculated positions of the aircraft or may be calculated by measuring the distances to a common point on the track (see Figures 5-28 and 5-29);

*Note.— Same identical tracks are a special case of same track defined in 5.4.2.1.5 a) where the angular difference is zero degrees or reciprocal tracks defined in 5.4.2.1.5 b) where the angular difference is 180 degrees.*

b) when the aircraft are on same or reciprocal non-parallel tracks other than in a) above, the distance shall be calculated by measuring the distances to the common point of intersection of the tracks or projected track (see Figures 5-30 to 5-32); and

c) when the aircraft are on parallel tracks whose protection areas overlap, the distance shall be measured along the track of one of the aircraft as in a) above using its calculated position and the point abeam the calculated position of the other aircraft (see Figure 5-33).

*Note.— In all cases presented in Figures 5-28 to 5-33, "d" is calculated by subtracting the distance of the closer aircraft from the common point from the distance of the more distant aircraft from the common point, except in Figure 5-32 where the two distances are added and the order of the aircraft is not important in the calculation.*

5.4.2.6.4.2 When aircraft are at, or are expected to reduce to, the minimum separation applicable, speed control techniques, including assigning Mach number, shall be applied to ensure that the minimum distance exists throughout the period of application of the minima.

5.4.2.6.4.3 For aircraft cruising, climbing or descending on the same track, the following separation minima may be used:

| *Separation minima* | *RNP type* | *Maximum ADS-C periodic reporting interval* |
|---|---|---|
| 93 km (50 NM) | 10 | 27 minutes |
| | 4 | 32 minutes |
| 55.5 km (30 NM) | 4 | 14 minutes |

*Note 1.— Detailed information on the analysis used to determine these separation minima and on performing safety assessments, including examples of communication media and operational assumptions that can satisfy the intervention requirements, are contained in the* Manual on Airspace Planning Methodology for the Determination of Separation Minima *(Doc 9689). The indicated periodic reporting intervals are specific to the use of ADS-C and are derived from performed safety assessments. As a result, these intervals may differ from those required for use with other procedural RNAV longitudinal separation minima.*

*Note 2.— The separation minima shown in the above table require specific RNP values and are based on collision risk modelling which determines communications and surveillance requirements. However, this modelling does not include all operational and technical aspects and is dependent upon parameter values that may vary depending on the particular airspace where the minimum will be applied. Therefore, prior to implementation, a system verification of sufficient duration and integrity must be performed to assess such parameters and conditions including weather deviations or other contingency events for the airspace concerned and to demonstrate that operational and technical requirements are met.*

5.4.2.6.4.3.1 Operational and technical requirements for the provision of ADS-C services shall comply with the provisions in Chapter 13.

*Note.— Before implementation, particular attention should be given to the requirements in Chapter 13, 13.4.3 and 13.4.3.4.6.*

5.4.2.6.4.3.2 The communication system provided to enable the application of the separation minima in 5.4.2.6.4.3 shall allow a controller, within 4 minutes, to intervene and resolve a potential conflict by contacting an aircraft using the normal means of communication. An alternative means shall be available to allow the controller to intervene and resolve the conflict within a total time of 10½ minutes, should the normal means of communication fail.

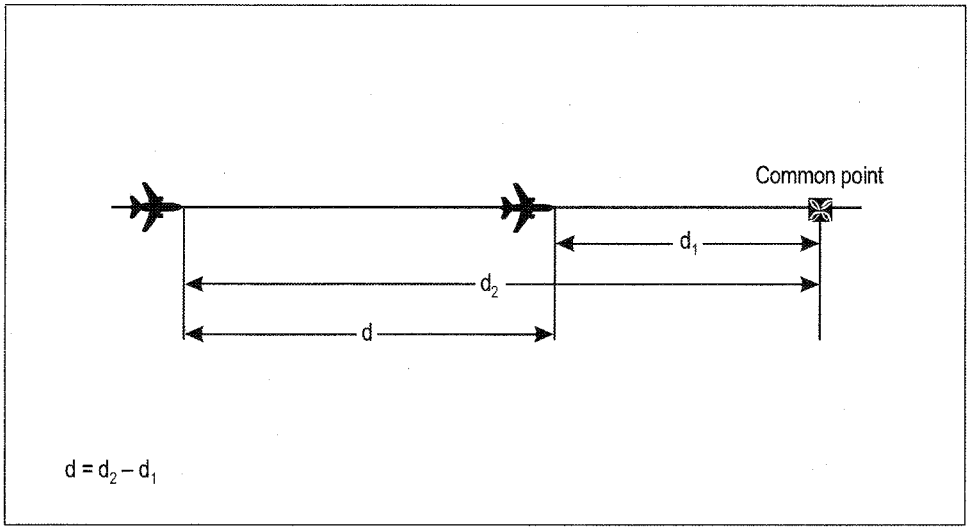



**Figure 5-28. Calculation of longitudinal distance between aircraft — identical track, same direction (see 5.4.2.6.4.1 a))**

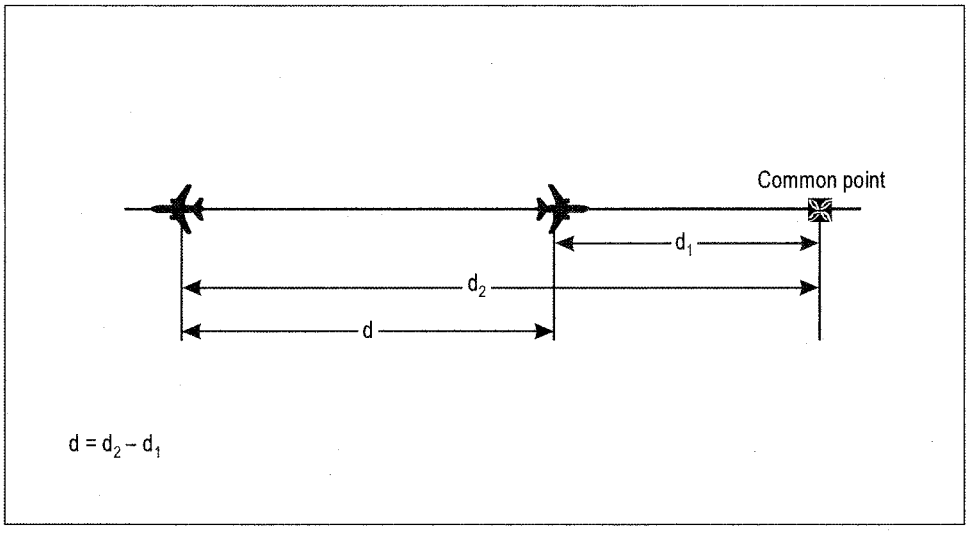



**Figure 5-29. Calculation of longitudinal distance between aircraft — identical track, opposite direction (see 5.4.2.6.4.1 a))**

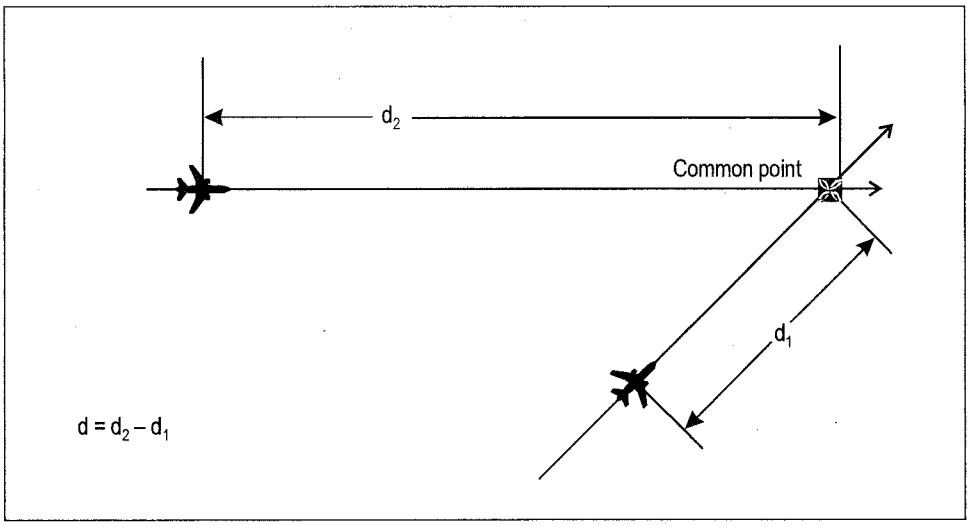



**Figure 5-30. Calculation of longitudinal distance between aircraft — same track, but not identical (see 5.4.2.6.4.1 b))**

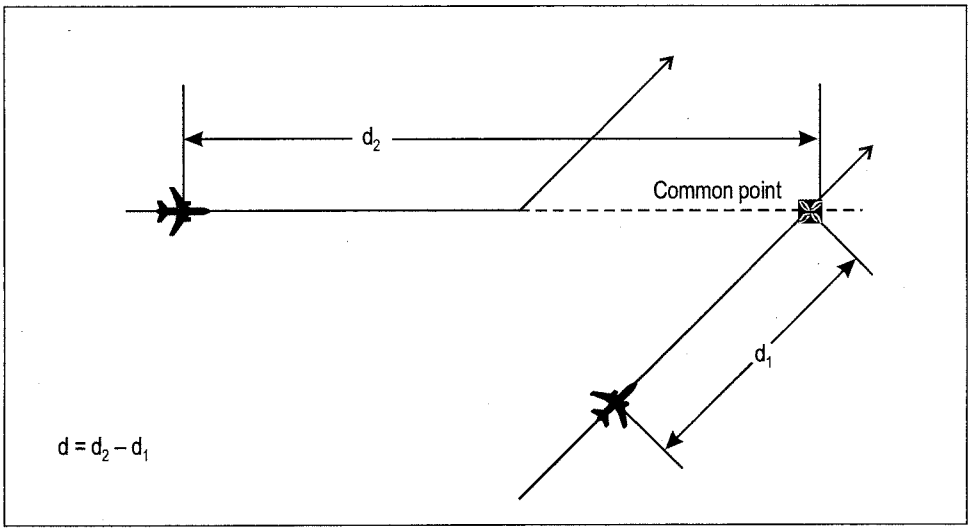



**Figure 5-31. Calculation of longitudinal distance between aircraft — same track projected, but not identical (see 5.4.2.6.4.1 b))**

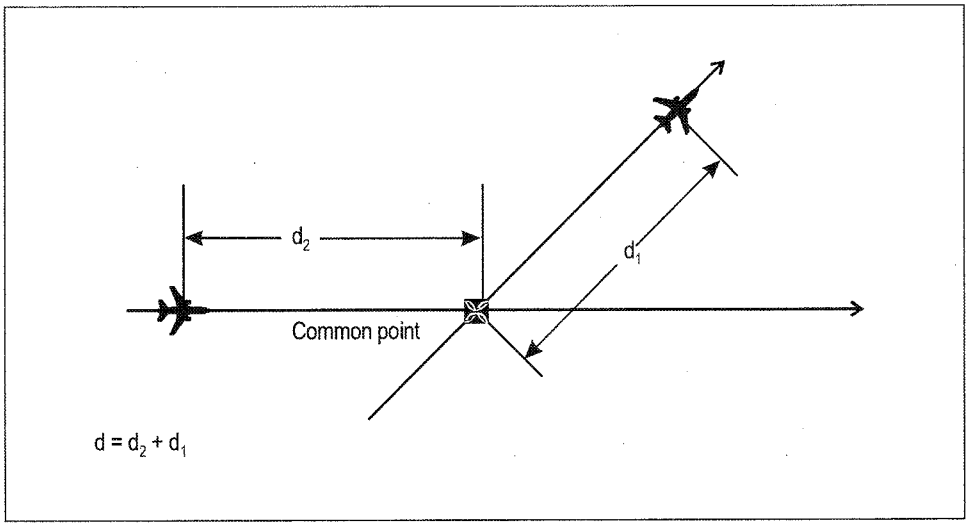



**Figure 5-32. Calculation of longitudinal distance between aircraft — opposite sides of the common point (see 5.4.2.6.4.1 b))**

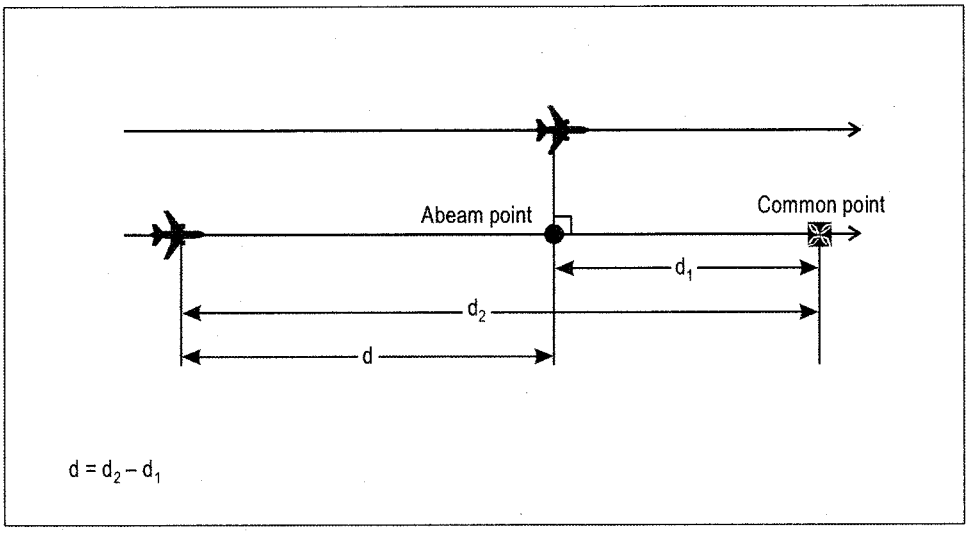



**Figure 5-33. Calculation of longitudinal distance between aircraft — parallel tracks (see 5.4.2.6.4.1 c))**

5.4.2.6.4.3.3 When an ADS-C periodic or waypoint change event report is not received within 3 minutes of the time it should have been sent, the report is considered overdue and the controller shall take action to obtain the report as quickly as possible, normally by ADS-C or CPDLC. If a report is not received within 6 minutes of the time the original report should have been sent, and there is a possibility of loss of separation with other aircraft, the controller shall take action to resolve any potential conflict(s) as soon as possible. The communication means provided shall be such that the conflict is resolved within a further 7½ minutes.

5.4.2.6.4.4 Opposite-direction aircraft on reciprocal tracks may be cleared to climb or descend to or through the levels occupied by another aircraft provided that the aircraft have passed each other by the applicable separation minimum, calculated in accordance with 5.4.2.6.4.1.

## 5.5 SEPARATION OF AIRCRAFT HOLDING IN FLIGHT

5.5.1 Aircraft established in adjacent holding patterns shall, except when lateral separation between the holding areas exists as determined by the appropriate ATS authority, be separated by the applicable vertical separation minimum.

5.5.2 Except when lateral separation exists, vertical separation shall be applied between aircraft holding in flight and other aircraft, whether arriving, departing or en route, whenever the other aircraft concerned are within five minutes flying time of the holding area or within a distance prescribed by the appropriate authority. (See Figure 5-34.)

## 5.6 MINIMUM SEPARATION BETWEEN DEPARTING AIRCRAFT

*Note.— The following provisions are complementary to the longitudinal separation minima specified in Section 5.4.2.*

5.6.1 One-minute separation is required if aircraft are to fly on tracks diverging by at least 45 degrees immediately after take-off so that lateral separation is provided (see Figure 5-35). This minimum may be reduced when aircraft are using parallel runways or when the procedure in Chapter 6, 6.3.3.1, is adopted for operations on diverging runways which do not cross, provided instructions covering the procedure have been approved by the appropriate ATS authority and lateral separation is effected immediately after take-off.

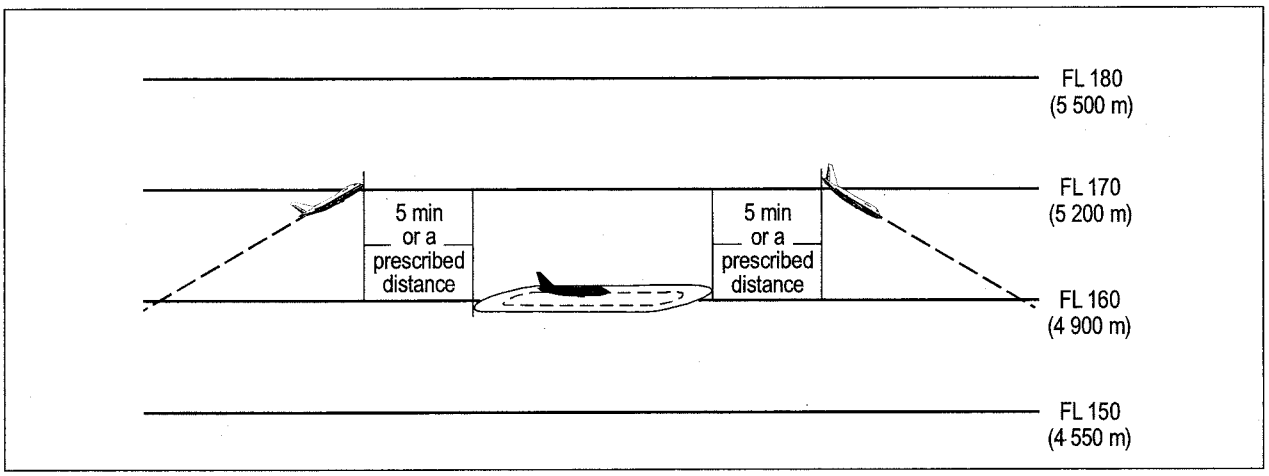



**Figure 5-34. Separation between holding aircraft and en-route aircraft (see 5.5.2)**

*Note 1.— Wake turbulence categories of aircraft are contained in Chapter 4, Section 4.9.1 and longitudinal separation minima are contained in Section 5.8 and in Chapter 8, Section 8.7.*

*Note 2.— Detailed characteristics of wake vortices and their effect on aircraft are contained in the* Air Traffic Services Planning Manual *(Doc 9426), Part II, Section 5.*

5.6.2 Two minutes are required between take-offs when the preceding aircraft is 74 km/h (40 kt) or more faster than the following aircraft and both aircraft will follow the same track (see Figure 5-36).

*Note.— See Chapter 4, Section 4.6, concerning speed control instructions. Calculations, based on TAS, of speed differentials of aircraft during climb may not be sufficiently accurate in all circumstances for determining if the procedure in 5.6.2 can be applied, in which case calculations based on IAS may be more suitable.*

5.6.3 Five-minute separation is required while vertical separation does not exist if a departing aircraft will be flown through the level of a preceding departing aircraft and both aircraft propose to follow the same track (see Figure 5-37). Action must be taken to ensure that the five-minute separation will be maintained or increased while vertical separation does not exist.

## 5.7 SEPARATION OF DEPARTING AIRCRAFT FROM ARRIVING AIRCRAFT

5.7.1 Except as otherwise prescribed by the appropriate ATS authority, the following separation shall be applied when take-off clearance is based on the position of an arriving aircraft.

5.7.1.1 If an arriving aircraft is making a complete instrument approach, a departing aircraft may take off:

a) in any direction until an arriving aircraft has started its procedure turn or base turn leading to final approach;

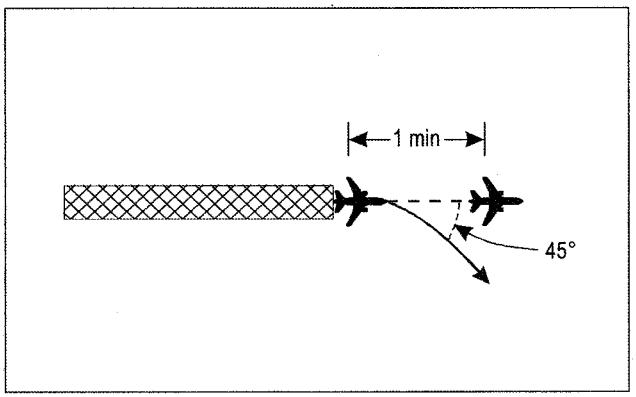



**Figure 5-35. One-minute separation between departing aircraft following tracks diverging by at least 45 degrees (see 5.6.1)**

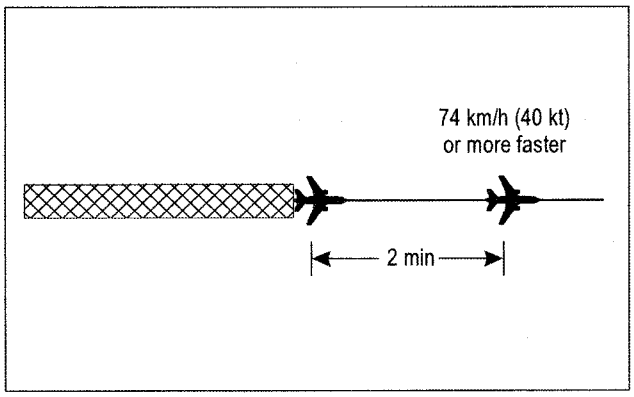



**Figure 5-36. Two-minute separation between aircraft following same track (see 5.6.2)**

b) in a direction which is different by at least 45 degrees from the reciprocal of the direction of approach after the arriving aircraft has started procedure turn or base turn leading to final approach, provided that the take-off will be made at least 3 minutes before the arriving aircraft is estimated to be over the beginning of the instrument runway (see Figure 5-38).

5.7.1.2 If an arriving aircraft is making a straight-in approach, a departing aircraft may take off:

a) in any direction until 5 minutes before the arriving aircraft is estimated to be over the instrument runway;

b) in a direction which is different by at least 45 degrees from the reciprocal of the direction of approach of the arriving aircraft:

1) until 3 minutes before the arriving aircraft is estimated to be over the beginning of the instrument runway (see Figure 5-38); or

2) before the arriving aircraft crosses a designated fix on the approach track; the location of such fix to be determined by the appropriate ATS authority after consultation with the operators.

## 5.8 TIME-BASED WAKE TURBULENCE LONGITUDINAL SEPARATION MINIMA

*Note.— Distance-based wake turbulence separation minima are set forth in Chapter 8, 8.7.3.4.*

### 5.8.1 Applicability

5.8.1.1 The ATC unit concerned shall not be required to apply wake turbulence separation:

a) for arriving VFR flights landing on the same runway as a preceding landing HEAVY or MEDIUM aircraft; and

b) between arriving IFR flights executing visual approach when the aircraft has reported the preceding aircraft in sight and has been instructed to follow and maintain own separation from that aircraft.

5.8.1.2 The ATC unit shall, in respect of the flights specified in 5.8.1.1 a) and b), as well as when otherwise deemed necessary, issue a caution of possible wake turbulence. The pilot-in-command of the aircraft concerned shall be responsible for ensuring that the spacing from a preceding aircraft of a heavier wake turbulence category is acceptable. If it is determined that additional spacing is required, the flight crew shall inform the ATC unit accordingly, stating their requirements.

### 5.8.2 Arriving aircraft

5.8.2.1 Except as provided for in 5.8.1.1 a) and b), the following separation minima shall be applied.

5.8.2.1.1 The following minima shall be applied to aircraft landing behind a HEAVY or a MEDIUM aircraft:

a) MEDIUM aircraft behind HEAVY aircraft — 2 minutes;

b) LIGHT aircraft behind a HEAVY or MEDIUM aircraft — 3 minutes.

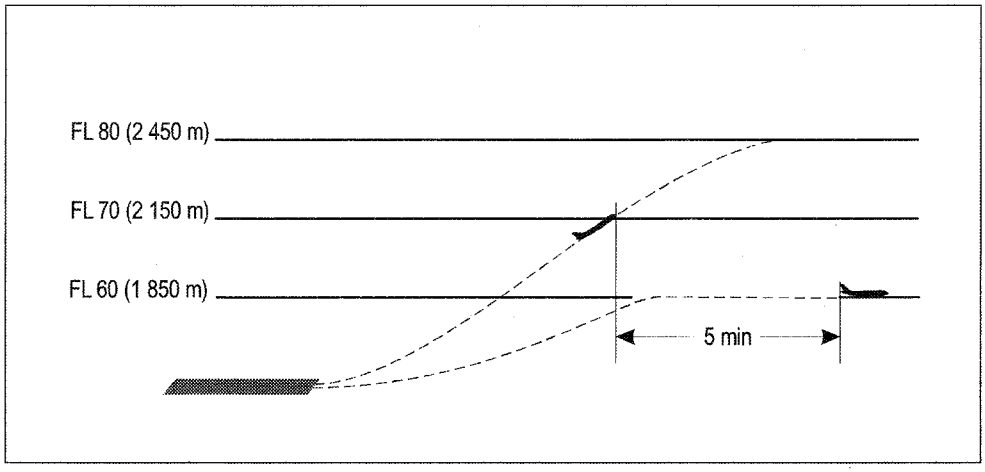



**Figure 5-37. Five-minute separation of departing aircraft following same track (see 5.6.3)**

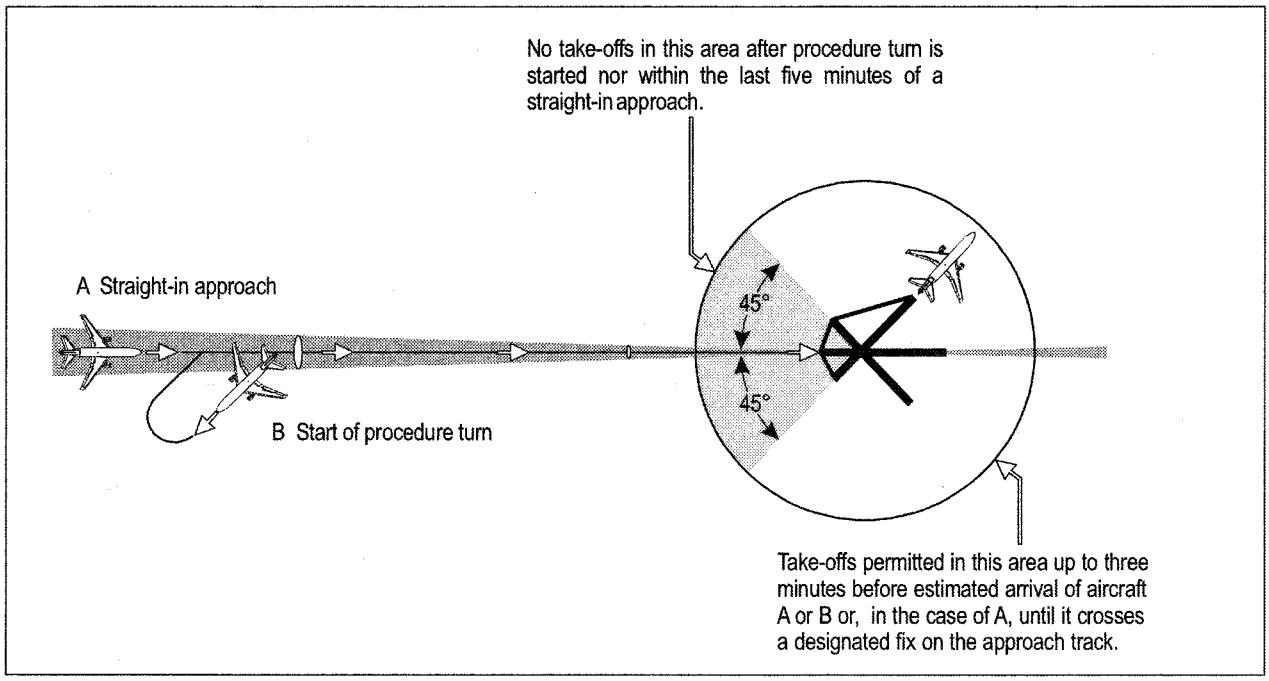



**Figure 5-38. Separation of departing aircraft from arriving aircraft (see 5.7.1.1 b) and 5.7.1.2 b))**

### 5.8.3 Departing aircraft

5.8.3.1 A minimum separation of 2 minutes shall be applied between a LIGHT or MEDIUM aircraft taking off behind a HEAVY aircraft or a LIGHT aircraft taking off behind a MEDIUM aircraft when the aircraft are using:

a) the same runway;

b) parallel runways separated by less than 760 m (2 500 ft);

c) crossing runways if the projected flight path of the second aircraft will cross the projected flight path of the first aircraft at the same altitude or less than 300 m (1 000 ft) below;

d) parallel runways separated by 760 m (2 500 ft) or more, if the projected flight path of the second aircraft will cross the projected flight path of the first aircraft at the same altitude or less than 300 m (1 000 ft) below.

*Note.— See Figures 5-39 and 5-40.*

5.8.3.2 A separation minimum of 3 minutes shall be applied between a LIGHT or MEDIUM aircraft when taking off behind a HEAVY aircraft or a LIGHT aircraft when taking off behind a MEDIUM aircraft from:

a) an intermediate part of the same runway; or

b) an intermediate part of a parallel runway separated by less than 760 m (2 500 ft).

*Note.— See Figure 5-41.*

### 5.8.4 Displaced landing threshold

A separation minimum of 2 minutes shall be applied between a LIGHT or MEDIUM aircraft and a HEAVY aircraft and between a LIGHT aircraft and a MEDIUM aircraft when operating on a runway with a displaced landing threshold when:

a) a departing LIGHT or MEDIUM aircraft follows a HEAVY aircraft arrival and a departing LIGHT aircraft follows a MEDIUM aircraft arrival; or

b) an arriving LIGHT or MEDIUM aircraft follows a HEAVY aircraft departure and an arriving LIGHT aircraft follows a MEDIUM aircraft departure if the projected flight paths are expected to cross.

### 5.8.5 Opposite direction

A separation minimum of 2 minutes shall be applied between a LIGHT or MEDIUM aircraft and a HEAVY aircraft and between a LIGHT aircraft and a MEDIUM aircraft when the heavier aircraft is making a low or missed approach and the lighter aircraft is:

a) utilizing an opposite-direction runway for take-off; or

*Note.— See Figure 5-42.*

b) landing on the same runway in the opposite direction, or on a parallel opposite-direction runway separated by less than 760 m (2 500 ft).

*Note.— See Figure 5-43.*

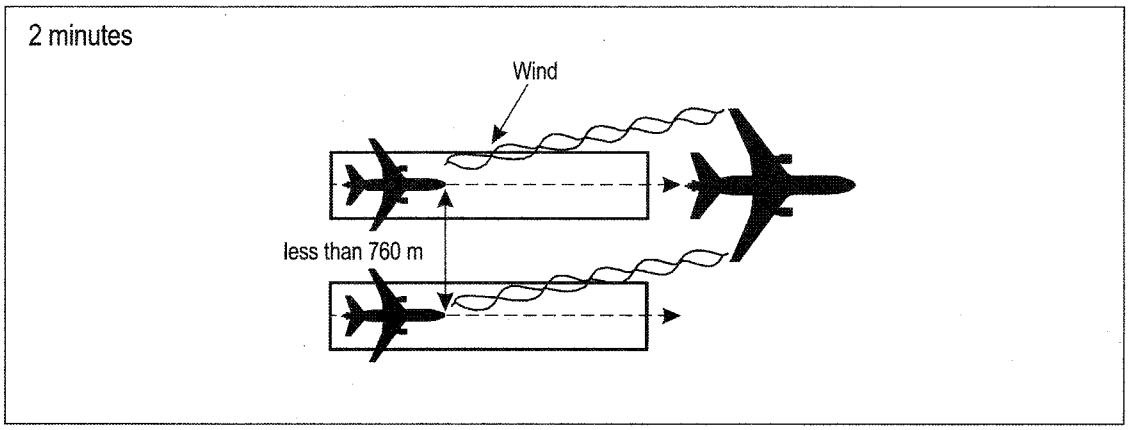



**Figure 5-39. Two-minute separation for following aircraft (see 5.8.3.1 a) and b))**

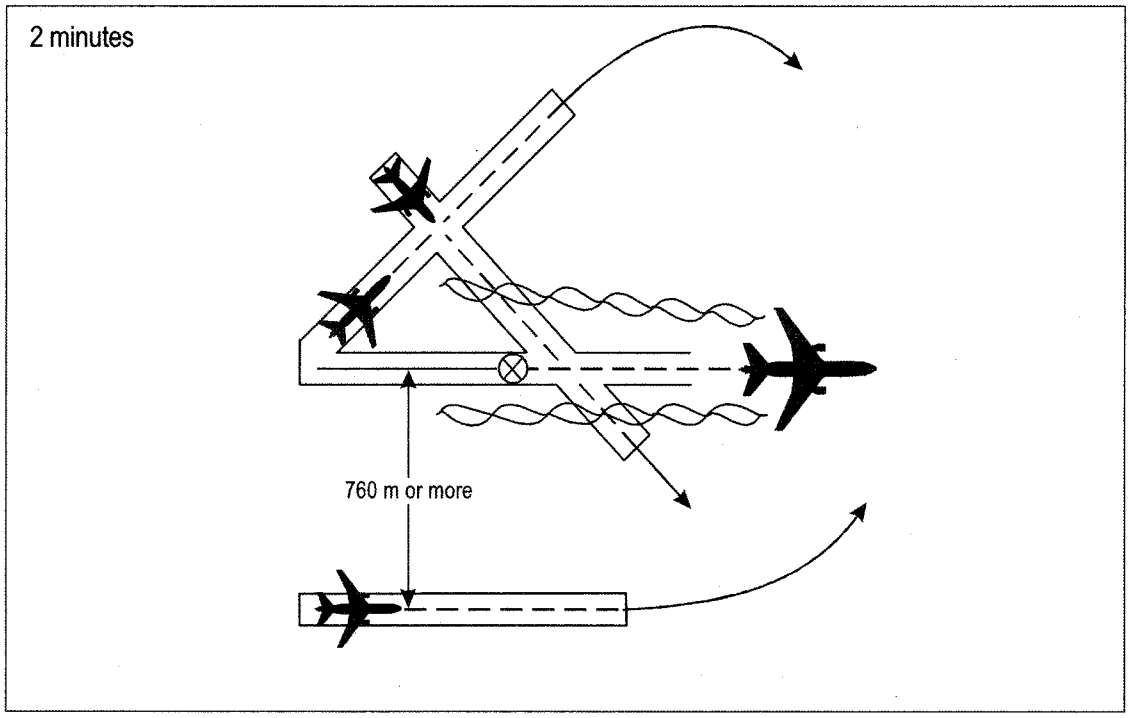



**Figure 5-40. Two-minute wake turbulence separation for crossing aircraft (see 5.8.3.1 c) and d))**

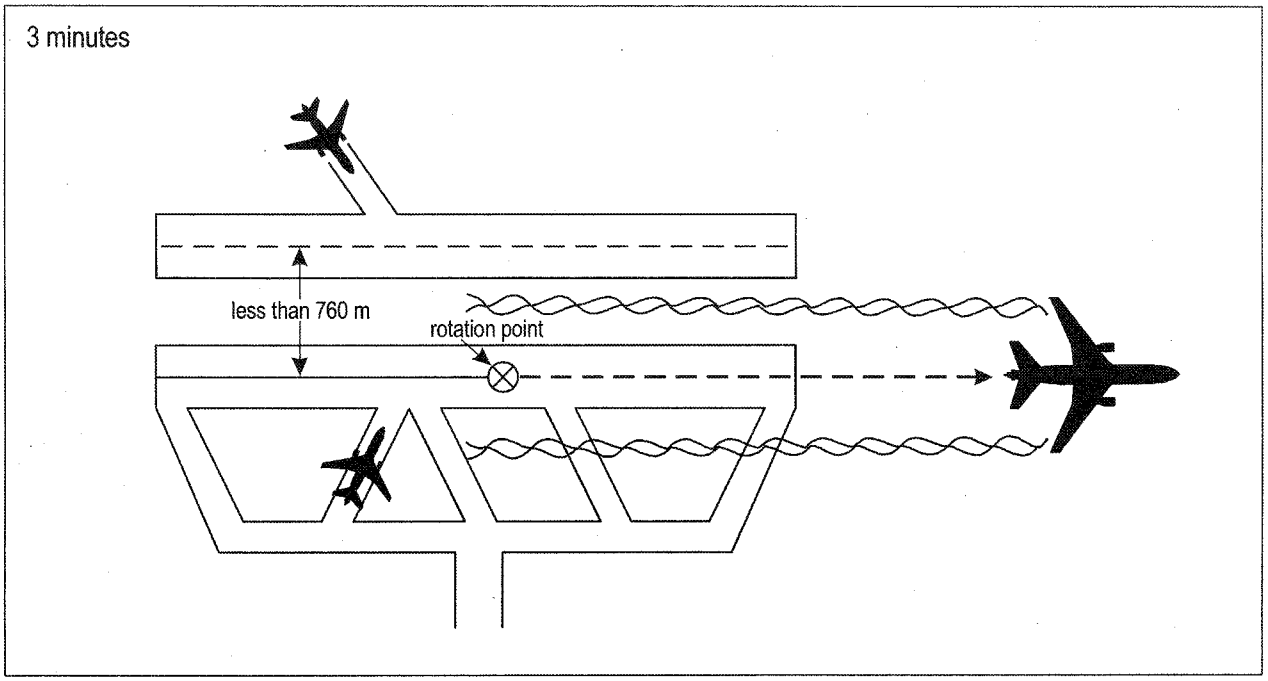



**Figure 5-41. Three-minute wake turbulence separation for following aircraft (see 5.8.3.2)**

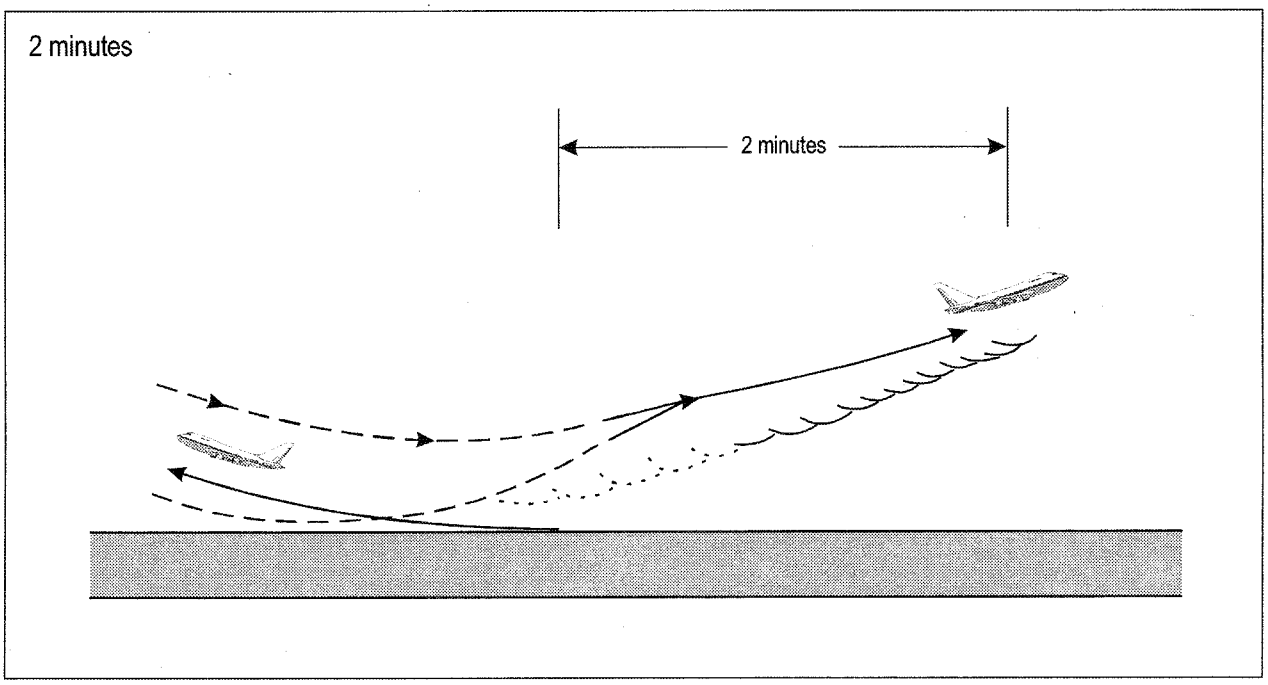



**Figure 5-42. Two-minute wake turbulence separation for opposite-direction take-off (see 5.8.5 a))**

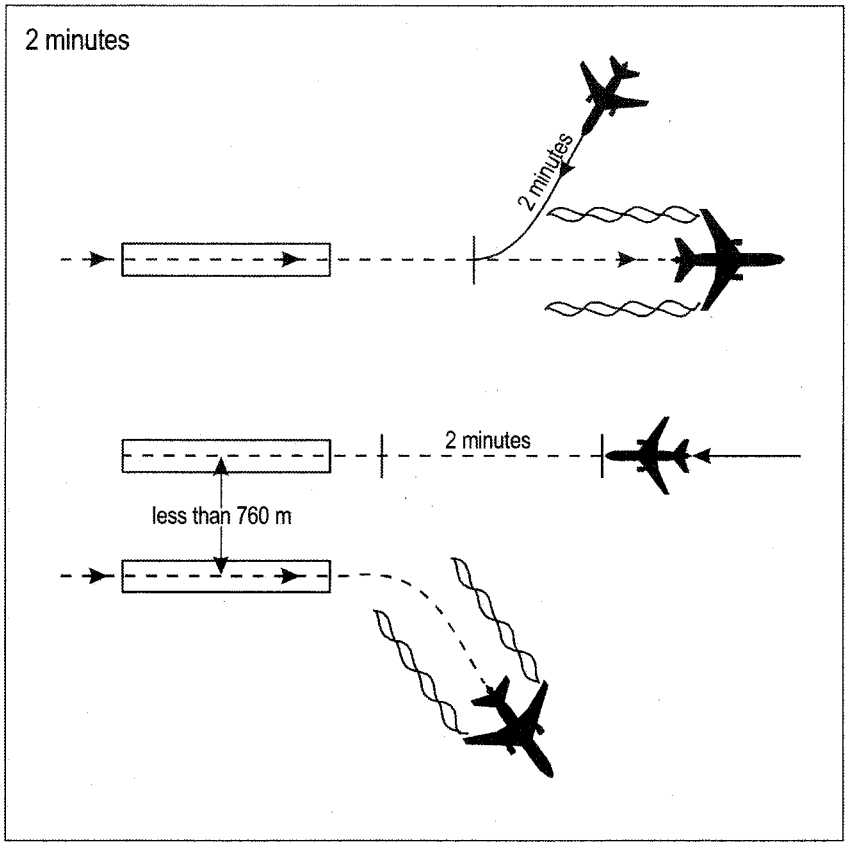



**Figure 5-43. Two-minute wake turbulence separation for opposite-direction landing (see 5.8.5 b))**

## 5.9 CLEARANCES TO FLY MAINTAINING OWN SEPARATION WHILE IN VISUAL METEOROLOGICAL CONDITIONS

*Note 1.— As indicated in this Section, the provision of vertical or horizontal separation by an air traffic control unit is not applicable in respect of any specified portion of a flight cleared subject to maintaining own separation and remaining in visual meteorological conditions. It is for the flight so cleared to ensure, for the duration of the clearance, that it is not operated in such proximity to other flights as to create a collision hazard.*

*Note 2.— It is axiomatic that a VFR flight must remain in visual meteorological conditions at all times. Accordingly, the issuance of a clearance to a VFR flight to fly subject to maintaining own separation and remaining in visual meteorological conditions has no other object than to signify that, for the duration of the clearance, separation from other aircraft by air traffic control is not provided.*

*Note 3.— The objectives of the air traffic control service as prescribed in Annex 11 do not include prevention of collision with terrain. The procedures prescribed in this document do not relieve pilots of their responsibility to ensure that any clearances issued by air traffic control units are safe in this respect. When an IFR flight is vectored or is given a direct routing which takes the aircraft off an ATS route, the procedures in Chapter 8, 8.6.5.2 apply.*

When so requested by an aircraft and provided it is agreed by the pilot of the other aircraft and so authorized by the appropriate ATS authority, an ATC unit may clear a controlled flight, including departing and arriving flights, operating in airspace Classes D and E in visual meteorological conditions during the hours of daylight to fly subject to maintaining own separation to one other aircraft and remaining in visual meteorological conditions. When a controlled flight is so cleared, the following shall apply:

a) the clearance shall be for a specified portion of the flight at or below 3 050 m (10 000 ft), during climb or descent and subject to further restrictions as and when prescribed on the basis of regional air navigation agreements;

b) if there is a possibility that flight under visual meteorological conditions may become impracticable, an IFR flight shall be provided with alternative instructions to be complied with in the event that flight in visual meteorological conditions (VMC) cannot be maintained for the term of the clearance;

c) the pilot of an IFR flight, on observing that conditions are deteriorating and considering that operation in VMC will become impossible, shall inform ATC before entering instrument meteorological conditions (IMC) and shall proceed in accordance with the alternative instructions given.

*Note.— See also 5.10.1.2.*

## 5.10 ESSENTIAL TRAFFIC INFORMATION

### 5.10.1 General

5.10.1.1 Essential traffic is that controlled traffic to which the provision of separation by ATC is applicable, but which, in relation to a particular controlled flight is not, or will not be, separated from other controlled traffic by the appropriate separation minimum.

*Note.— Pursuant to Section 5.2, but subject to certain exceptions stated therein, ATC is required to provide separation between IFR flights in airspace Classes A to E, and between IFR and VFR flights in Classes B and C. ATC is not required to provide separation between VFR flights, except within airspace Class B. Therefore, IFR or VFR flights may constitute essential traffic to IFR traffic, and IFR flights may constitute essential traffic to VFR traffic. However, a VFR flight would not constitute essential traffic to other VFR flights except within Class B airspace.*

5.10.1.2 Essential traffic information shall be given to controlled flights concerned whenever they constitute essential traffic to each other.

*Note.— This information will inevitably relate to controlled flights cleared subject to maintaining own separation and remaining in visual meteorological conditions and also whenever the intended separation minimum has been infringed.*

### 5.10.2 Information to be provided

Essential traffic information shall include:

a) direction of flight of aircraft concerned;

b) type and wake turbulence category (if relevant) of aircraft concerned;

c) cruising level of aircraft concerned; and

1) estimated time over the reporting point nearest to where the level will be crossed; or

2) relative bearing of the aircraft concerned in terms of the 12-hour clock as well as distance from the conflicting traffic; or

3) actual or estimated position of the aircraft concerned.

*Note 1. — Nothing in Section 5.10 is intended to prevent ATC from imparting to aircraft under its control any other information at its disposal with a view to enhancing air safety in accordance with the objectives of ATS as defined in Chapter 2 of Annex 11.*

*Note 2.— Wake turbulence category will only be essential traffic information if the aircraft concerned is of a heavier wake turbulence category than the aircraft to which the traffic information is directed.*

## 5.11 REDUCTION IN SEPARATION MINIMA

*Note.— See also Chapter 2, ATS Safety Management.*

5.11.1 Provided an appropriate safety assessment has shown that an acceptable level of safety will be maintained, and after prior consultation with users, the separation minima detailed in 5.4.1 and 5.4.2 may be reduced in the following circumstances:

5.11.1.1 As determined by the appropriate ATS authority as appropriate:

a) when special electronic or other aids enable the pilot-in-command of an aircraft to determine accurately the aircraft's position and when adequate communication facilities exist for that position to be transmitted without delay to the appropriate air traffic control unit; or

b) when, in association with rapid and reliable communication facilities, information of an aircraft's position, derived from an ATS surveillance system, is available to the appropriate air traffic control unit; or

c) when special electronic or other aids enable the air traffic controller to predict rapidly and accurately the flight paths of aircraft, and adequate facilities exist to verify frequently the actual aircraft positions with the predicted positions; or

d) when RNAV-equipped aircraft operate within the coverage of electronic aids that provide the necessary updates to maintain navigation accuracy.

5.11.1.2 In accordance with regional air navigation agreements when:

a) special electronic, area navigation or other aids enable the aircraft to closely adhere to their current flight plans; and

b) the air traffic situation is such that the conditions in 5.11.1.1 a) regarding communications between pilots and the appropriate ATC unit or units need not necessarily be met to the degree specified therein.

*Note.— Attention is drawn to the guidance material contained in the* Air Traffic Services Planning Manual *(Doc 9426) regarding conditions governing the reduction of separation minima and to the* Manual on Airspace Planning Methodology for the Determination of Separation Minima *(Doc 9689).*

# Chapter 6

# SEPARATION IN THE VICINITY OF AERODROMES

## 6.1 REDUCTION IN SEPARATION MINIMA IN THE VICINITY OF AERODROMES

In addition to the circumstances mentioned in Chapter 5, 5.11.1, the separation minima detailed in Chapter 5, 5.4.1 and 5.4.2, may be reduced in the vicinity of aerodromes if:

a) adequate separation can be provided by the aerodrome controller when each aircraft is continuously visible to this controller; or

b) each aircraft is continuously visible to flight crews of the other aircraft concerned and the pilots thereof report that they can maintain their own separation; or

c) in the case of one aircraft following another, the flight crew of the succeeding aircraft reports that the other aircraft is in sight and separation can be maintained.

## 6.2 ESSENTIAL LOCAL TRAFFIC

6.2.1 Information on essential local traffic known to the controller shall be transmitted without delay to departing and arriving aircraft concerned.

*Note 1.— Essential local traffic in this context consists of any aircraft, vehicle or personnel on or near the runway to be used, or traffic in the take-off and climb-out area or the final approach area, which may constitute a collision hazard to a departing or arriving aircraft.*

*Note 2.— See also Chapter 5, Section 5.10, Chapter 7, 7.4.1.3 and Chapter 8, 8.8.2.*

6.2.1.1 Essential local traffic shall be described so as to be easily identified.

## 6.3 PROCEDURES FOR DEPARTING AIRCRAFT

### 6.3.1 General

6.3.1.1 Clearances for departing aircraft shall specify, when necessary for the separation of aircraft, direction of take-off and turn after take-off; heading or track to be made good before taking up the cleared departure track; level to maintain before continuing climb to assigned level; time, point and/or rate at which a level change shall be made; and any other necessary manoeuvre consistent with safe operation of the aircraft.

6.3.1.2 At aerodromes where standard instrument departures (SIDs) have been established, departing aircraft should normally be cleared to follow the appropriate SID.

### 6.3.2 Standard clearances for departing aircraft

#### 6.3.2.1 GENERAL

The appropriate ATS authority should, wherever possible, establish standardized procedures for transfer of control between the ATC units concerned, and standard clearances for departing aircraft.

*Note.— The provisions applying to standardized procedures for coordination and transfer of control are specified in Chapter 10, Section 10.1.1.*

#### 6.3.2.2 COORDINATION

6.3.2.2.1 Where standard clearances for departing aircraft have been agreed to between the units concerned, the aerodrome control tower will normally issue the appropriate standard clearance without prior coordination with or approval from the approach control unit or ACC.

6.3.2.2.2 Prior coordination of clearances should be required only in the event that a variation to the standard clearance or the standardized transfer of control procedures is necessary or desirable for operational reasons.

6.3.2.2.3 Provision shall be made to ensure that the approach control unit at all times is kept informed of the sequence in which aircraft will depart as well as the runway to be used.

6.3.2.2.4 Provision shall be made to display the designators of assigned SIDs to the aerodrome control tower, the approach control unit and/or the ACC as applicable.

#### 6.3.2.3 CONTENTS

Standard clearances for departing aircraft shall contain the following items:

a) aircraft identification;

b) clearance limit, normally destination aerodrome;

c) designator of the assigned SID, if applicable;

d) initial level, except when this element is included in the SID description;

e) allocated SSR code;

f) any other necessary instructions or information not contained in the SID description, e.g. instructions relating to change of frequency.

#### 6.3.2.4 CLIMB CLEARANCE ABOVE LEVELS SPECIFIED IN A SID

*Note.— See also 11.4.2.6.2.5.*

When a departing aircraft on a SID is cleared to climb to a level higher than the initially cleared level or the level(s) specified in a SID, the aircraft shall follow the published vertical profile of a SID, unless such restrictions are explicitly cancelled by ATC.

6.3.2.5 COMMUNICATION FAILURE

6.3.2.5.1 Clearances for departing aircraft may specify an initial or intermediate level other than that indicated in the filed flight plan for the en-route phase of flight, without a time or geographical limit for the initial level. Such clearances will normally be used to facilitate the application of tactical control methods by ATC, normally through the use of an ATS surveillance system.

6.3.2.5.2 Where clearances for departing aircraft containing no time or geographical limit for an initial or intermediate level are utilized, action to be taken by an aircraft experiencing air-ground communication failure in the event the aircraft has been radar vectored away from the route specified in its current flight plan should be prescribed on the basis of a regional air navigation agreement and included in the SID description or published in AIPs.

### 6.3.3 Departure sequence

6.3.3.1 Departing aircraft may be expedited by suggesting a take-off direction which is not into the wind. It is the responsibility of the pilot-in-command of an aircraft to decide between making such a take-off or waiting for take-off in a preferred direction.

6.3.3.2 If departures are delayed, the delayed flights shall normally be cleared in an order based on their estimated time of departure, except that deviation from this order may be made to:

a) facilitate the maximum number of departures with the least average delay;

b) accommodate requests by an operator in respect of that operator's flights to the extent practicable.

6.3.3.3 Air traffic control units should, when practicable, advise aircraft operators or their designated representatives when anticipated delays are expected to exceed 30 minutes.

## 6.4 INFORMATION FOR DEPARTING AIRCRAFT

*Note.— See Chapter 11, 11.4.3, regarding flight information messages.*

### 6.4.1 Meteorological conditions

Information regarding significant changes in the meteorological conditions in the take-off or climb-out area, obtained by the unit providing approach control service after a departing aircraft has established communication with such unit, shall be transmitted to the aircraft without delay, except when it is known that the aircraft already has received the information.

*Note.— Significant changes in this context include those relating to surface wind direction or speed, visibility, runway visual range or air temperature (for turbine-engined aircraft), and the occurrence of thunderstorm or cumulonimbus, moderate or severe turbulence, wind shear, hail, moderate or severe icing, severe squall line, freezing precipitation, severe mountain waves, sandstorm, duststorm, blowing snow, tornado or waterspout.*

### 6.4.2 Operational status of visual or non-visual aids

Information regarding changes in the operational status of visual or non-visual aids essential for take-off and climb shall be transmitted without delay to a departing aircraft, except when it is known that the aircraft already has received the information.

## 6.5 PROCEDURES FOR ARRIVING AIRCRAFT

### 6.5.1 General

6.5.1.1 When it becomes evident that delays will be encountered by arriving aircraft, operators or designated representatives shall, to the extent practicable, be notified and kept currently informed of any changes in such expected delays.

6.5.1.2 Arriving aircraft may be required to report when leaving or passing a significant point or navigation aid, or when starting procedure turn or base turn, or to provide other information required by the controller, to expedite departing and arriving aircraft.

6.5.1.3 An IFR flight shall not be cleared for an initial approach below the appropriate minimum altitude as specified by the State concerned nor to descend below that altitude unless:

a) the pilot has reported passing an appropriate point defined by a navigation aid or as a waypoint; or

b) the pilot reports that the aerodrome is and can be maintained in sight; or

c) the aircraft is conducting a visual approach; or

d) the controller has determined the aircraft's position by the use of an ATS surveillance system, and a lower minimum altitude has been specified for use when providing ATS surveillance services.

6.5.1.4 At aerodromes where standard instrument arrivals (STARs) have been established, arriving aircraft should normally be cleared to follow the appropriate STAR. The aircraft shall be informed of the type of approach to expect and runway-in-use as early as possible.

*Note.— See Section 6.5.2 concerning Standard arrival clearances.*

6.5.1.5 After coordination with the approach control unit, the ACC may clear the first arriving aircraft for approach rather than to a holding fix.

### 6.5.2 Standard clearances for arriving aircraft

#### 6.5.2.1 GENERAL

The appropriate ATS authority should, wherever possible, establish standardized procedures for transfer of control between the ATC units concerned, and standard clearances for arriving aircraft.

*Note.— The provisions applying to standardized procedures for coordination and transfer of control are specified in Chapter 10, Section 10.1.1.*

#### 6.5.2.2 COORDINATION

6.5.2.2.1 Where standard clearances for arriving aircraft are in use and, provided no terminal delay is expected, clearance to follow the appropriate STAR will normally be issued by the ACC without prior coordination with or approval from the approach control unit or the aerodrome control tower as applicable.

6.5.2.2.2 Prior coordination of clearances should be required only in the event that a variation to the standard clearance or the standardized transfer of control procedures is necessary or desirable for operational reasons.

6.5.2.2.3 Provision shall be made to ensure that the approach control unit is at all times kept informed of the sequence of aircraft following the same STAR.

6.5.2.2.4 Provision shall be made to display the designators of assigned STARs to the ACC, the approach control unit and/or the aerodrome control tower, as applicable.

#### 6.5.2.3 CONTENTS

Standard clearances for arriving aircraft shall contain the following items:

a) aircraft identification;

b) designator of the assigned STAR;

c) runway-in-use, except when part of the STAR description;

d) initial level, except when this element is included in the STAR description; and

e) any other necessary instructions or information not contained in the STAR description, e.g. change of communications.

#### 6.5.2.4 DESCENT BELOW LEVELS SPECIFIED IN A STAR

*Note.— See also 11.4.2.6.2.5.*

When an arriving aircraft on a STAR is cleared to descend to a level lower than the level or the level(s) specified in a STAR, the aircraft shall follow the published vertical profile of a STAR, unless such restrictions are explicitly cancelled by ATC. Published minimum levels based on terrain clearance shall always be applied.

### 6.5.3 Visual approach

6.5.3.1 Subject to the conditions in 6.5.3.3, clearance for an IFR flight to execute a visual approach may be requested by a flight crew or initiated by the controller. In the latter case, the concurrence of the flight crew shall be required.

6.5.3.2 Controllers shall exercise caution in initiating a visual approach when there is reason to believe that the flight crew concerned is not familiar with the aerodrome and its surrounding terrain. Controllers should also take into consideration the prevailing traffic and meteorological conditions when initiating visual approaches.

6.5.3.3 An IFR flight may be cleared to execute a visual approach provided the pilot can maintain visual reference to the terrain and:

a) the reported ceiling is at or above the approved initial approach level for the aircraft so cleared; or

b) the pilot reports at the initial approach level or at any time during the instrument approach procedure that the meteorological conditions are such that with reasonable assurance a visual approach and landing can be completed.

6.5.3.4 Separation shall be provided between an aircraft cleared to execute a visual approach and other arriving and departing aircraft.

6.5.3.5 For successive visual approaches, separation shall be maintained by the controller until the pilot of a succeeding aircraft reports having the preceding aircraft in sight. The aircraft shall then be instructed to follow and maintain own separation from the preceding aircraft. When both aircraft are of a heavy wake turbulence category, or the preceding aircraft is of a heavier wake turbulence category than the following, and the distance between the aircraft is less than the appropriate wake turbulence minimum, the controller shall issue a caution of possible wake turbulence. The pilot-in-command of the aircraft concerned shall be responsible for ensuring that the spacing from a preceding aircraft of a heavier wake turbulence category is acceptable. If it is determined that additional spacing is required, the flight crew shall inform the ATC unit accordingly, stating their requirements.

6.5.3.6 Transfer of communications to the aerodrome controller should be effected at such a point or time that information on essential local traffic, if applicable, and clearance to land or alternative instructions can be issued to the aircraft in a timely manner.

### 6.5.4 Instrument approach

6.5.4.1 The approach control unit shall specify the instrument approach procedure to be used by arriving aircraft. A flight crew may request an alternative procedure and, if circumstances permit, should be cleared accordingly.

6.5.4.2 If a pilot reports or it is clearly apparent to the ATC unit that the pilot is not familiar with an instrument approach procedure, the initial approach level, the point (in minutes from the appropriate reporting point) at which base turn or procedure turn will be started, the level at which the procedure turn shall be carried out and the final approach track shall be specified, except that only the last-mentioned need be specified if the aircraft is to be cleared for a straight-in approach. The frequency(ies) of the navigation aid(s) to be used as well as the missed approach procedure shall also be specified when deemed necessary.

6.5.4.3 If visual reference to terrain is established before completion of the approach procedure, the entire procedure must nevertheless be executed unless the aircraft requests and is cleared for a visual approach.

### 6.5.5 Holding

6.5.5.1 In the event of extended delays, aircraft should be advised of the anticipated delay as early as possible and, when practicable, be instructed or given the option to reduce speed en route in order to absorb delay.

6.5.5.2 When delay is expected, the ACC shall normally be responsible for clearing aircraft to the holding fix, and for including holding instructions, and expected approach time or onward clearance time, as applicable, in such clearances. (See Section 6.5.8.)

6.5.5.3 After coordination with the approach control unit, the ACC may clear an arriving aircraft to a visual holding location to hold until further advised by the approach control unit.

6.5.5.4 After coordination with the aerodrome control tower, the approach control unit may clear an arriving aircraft to a visual holding location to hold until further advised by the aerodrome control tower.

6.5.5.5 Holding and holding pattern entry shall be accomplished in accordance with procedures established by the appropriate ATS authority and published in AIPs. If entry and holding procedures have not been published or if the procedures are not known to a flight crew, the appropriate air traffic control unit shall specify the designator of the location or aid to be used, the inbound track, radial or bearing, direction of turn in the holding pattern as well as the time of the outbound leg or the distances between which to hold.

6.5.5.6 Aircraft should normally be held at a designated holding fix. The required minimum vertical, lateral or longitudinal separation from other aircraft shall be provided. Criteria and procedures for the simultaneous use of adjacent holding patterns shall be prescribed in local instructions.

*Note.— See Chapter 5, Section 5.5, concerning separation of aircraft holding in flight.*

6.5.5.7 Levels at a holding fix or visual holding location shall as far as practicable be assigned in a manner that will facilitate clearing each aircraft to approach in its proper priority. Normally, the first aircraft to arrive over a holding fix or visual holding location should be at the lowest level, with following aircraft at successively higher levels.

6.5.5.8 When extended holding is anticipated, turbojet aircraft should, when practicable, be permitted to hold at higher levels in order to conserve fuel, while retaining their order in the approach sequence.

6.5.5.9 If an aircraft is unable to comply with the published or cleared holding procedure, alternative instructions shall be issued.

6.5.5.10 For the purpose of maintaining a safe and orderly flow of traffic, an aircraft may be instructed to orbit at its present or at any other position, provided the required obstacle clearance is ensured.

### 6.5.6 Approach sequence

#### 6.5.6.1 GENERAL

The following procedures shall be applied whenever approaches are in progress.

6.5.6.1.1 The approach sequence shall be established in a manner which will facilitate arrival of the maximum number of aircraft with the least average delay. Priority shall be given to:

a) an aircraft which anticipates being compelled to land because of factors affecting the safe operation of the aircraft (engine failure, shortage of fuel, etc.);

b) hospital aircraft or aircraft carrying any sick or seriously injured person requiring urgent medical attention;

c) aircraft engaged in search and rescue operations; and

d) other aircraft as may be determined by the appropriate authority.

*Note.— An aircraft which has encountered an emergency is handled as outlined in Chapter 15, Section 15.1.*

6.5.6.1.2 Succeeding aircraft shall be cleared for approach:

a) when the preceding aircraft has reported that it is able to complete its approach without encountering instrument meteorological conditions; or

b) when the preceding aircraft is in communication with and sighted by the aerodrome control tower, and reasonable assurance exists that a normal landing can be accomplished; or

c) when timed approaches are used, the preceding aircraft has passed the defined point inbound, and reasonable assurance exists that a normal landing can be accomplished;

*Note.— See 6.5.6.2.1 concerning timed approach procedures.*

d) when the use of an ATS surveillance system confirms that the required longitudinal spacing between succeeding aircraft has been established.

6.5.6.1.3 In establishing the approach sequence, the need for increased longitudinal spacing between arriving aircraft due to wake turbulence shall be taken into account.

6.5.6.1.4 If the pilot of an aircraft in an approach sequence has indicated an intention to hold for weather improvement, or for other reasons, such action shall be approved. However, when other holding aircraft indicate intention to continue their approach to land, the pilot desiring to hold will be cleared to an adjacent fix for holding awaiting weather change or re-routing. Alternatively, the aircraft should be given a clearance to place it at the top of the approach sequence so that other holding aircraft may be permitted to land. Coordination shall be effected with any adjacent ATC unit or control sector, when required, to avoid conflict with the traffic under the jurisdiction of that unit or sector.

6.5.6.1.5 When establishing the approach sequence, an aircraft which has been authorized to absorb a specified period of notified terminal delay by cruising at a reduced speed en route, should, in so far as practicable, be credited with the time absorbed en route.

### 6.5.6.2 SEQUENCING AND SPACING OF INSTRUMENT APPROACHES

#### 6.5.6.2.1 *TIMED APPROACH PROCEDURES*

6.5.6.2.1.1 Subject to approval by the appropriate ATS authority, the following procedure should be utilized as necessary to expedite the approaches of a number of arriving aircraft:

a) a suitable point on the approach path, which shall be capable of being accurately determined by the pilot, shall be specified, to serve as a checkpoint in timing successive approaches;

b) aircraft shall be given a time at which to pass the specified point inbound, which time shall be determined with the aim of achieving the desired interval between successive landings on the runway while respecting the applicable separation minima at all times, including the period of runway occupancy.

6.5.6.2.1.2 The time at which aircraft should pass the specified point shall be determined by the unit providing approach control service and notified to the aircraft sufficiently in advance to permit the pilot to arrange the flight path accordingly.

6.5.6.2.1.3 Each aircraft in the approach sequence shall be cleared to pass the specified point inbound at the previously notified time, or any revision thereof, after the preceding aircraft has reported passing the point inbound.

#### 6.5.6.2.2 *INTERVAL BETWEEN SUCCESSIVE APPROACHES*

In determining the time interval or longitudinal distance to be applied between successive approaching aircraft, the relative speeds between succeeding aircraft, the distance from the specified point to the runway, the need to apply wake turbulence separation, runway occupancy times, the prevailing meteorological conditions as well as any condition which may affect runway occupancy times shall be considered. When an ATS surveillance system is used to establish an approach sequence, the minimum distance to be established between succeeding aircraft shall be specified in local instructions. Local instructions shall additionally specify the circumstances under which any increased longitudinal distance between approaches may be required as well as the minima to be used under such circumstances.

#### 6.5.6.2.3 *INFORMATION ON APPROACH SEQUENCE*

Provision shall be made to ensure that the aerodrome control tower is kept informed of the sequence in which aircraft will be established on final approach for landing.

*Note 1.— Guidance material on factors to be taken into account when determining separation for timed approaches is contained in the* Air Traffic Services Planning Manual *(Doc 9426).*

*Note 2.— Wake turbulence categories and wake turbulence separation minima are contained in Chapter 4, Section 4.9, Chapter 5, Section 5.8 and Chapter 8, Section 8.7.*

*Note 3.— Detailed characteristics of wake vortices and their effect on aircraft are contained in the* Air Traffic Services Planning Manual *(Doc 9426), Part II, Section 5.*

### 6.5.7 Expected approach time

6.5.7.1 An expected approach time shall be determined for an arriving aircraft that will be subjected to a delay of 10 minutes or more or such other period as has been determined by the appropriate authority. The expected approach time shall be transmitted to the aircraft as soon as practicable and preferably not later than at the commencement of its initial descent from cruising level. A revised expected approach time shall be transmitted to the aircraft without delay whenever it differs from that previously transmitted by 5 minutes or more, or such lesser period of time as has been established by the appropriate ATS authority or agreed between the ATS units concerned.

6.5.7.2 An expected approach time shall be transmitted to the aircraft by the most expeditious means whenever it is anticipated that the aircraft will be required to hold for 30 minutes or more.

6.5.7.3 The holding fix to which an expected approach time relates shall be identified together with the expected approach time whenever circumstances are such that this would not otherwise be evident to the pilot.

### 6.5.8 Onward clearance time

In the event an aircraft is held en route or at a location or aid other than the initial approach fix, the aircraft concerned shall, as soon as practicable, be given an expected onward clearance time from the holding fix. The aircraft shall also be advised if further holding at a subsequent holding fix is expected.

*Note.— "Onward clearance time" is the time at which an aircraft can expect to leave the fix at which it is being held.*

## 6.6 INFORMATION FOR ARRIVING AIRCRAFT

*Note.— See Chapter 11, 11.4.3, regarding flight information messages.*

6.6.1 As early as practicable after an aircraft has established communication with the unit providing approach control service, the following elements of information, in the order listed, shall be transmitted to the aircraft, with the exception of such elements which it is known the aircraft has already received:

a) type of approach and runway-in-use;

b) meteorological information, as follows:

1) surface wind direction and speed, including significant variations;

2) visibility and, when applicable, runway visual range (RVR);

3) present weather;

4) cloud below 1 500 m (5 000 ft) or below the highest minimum sector altitude, whichever is greater; cumulonimbus; if the sky is obscured, vertical visibility when available;

5) air temperature;

6) dew point temperature, inclusion determined on the basis of a regional air navigation agreement;

7) altimeter setting(s);

8) any available information on significant meteorological phenomena in the approach area; and

9) trend-type landing forecast, when available.

*Note.— The meteorological information listed above is identical to that required in ATIS broadcasts for arriving aircraft as specified in Annex 11, 4.3.7 j) to r), and is to be extracted from local meteorological routine and special reports, in accordance with Chapter 11, 11.4.3.2.2 to 11.4.3.2.3.*

c) current runway surface conditions, in case of precipitants or other temporary hazards;

d) changes in the operational status of visual and non-visual aids essential for approach and landing.

6.6.2 In applying the provisions in 6.7.3.1.1, it should be recognized that information published by NOTAM or disseminated by other means may not have been received by the aircraft prior to departure or during en-route flight.

6.6.3 If it becomes necessary or operationally desirable that an arriving aircraft follow an instrument approach procedure or use a runway other than that initially stated, the flight crew shall be advised without delay.

6.6.4 At the commencement of final approach, the following information shall be transmitted to aircraft:

a) significant changes in the mean surface wind direction and speed;

*Note.— Significant changes are specified in Annex 3, Chapter 4. However, if the controller possesses wind information in the form of components, the significant changes are:*

— *Mean headwind component:* *19 km/h (10 kt)*

— *Mean tailwind component:* *4 km/h (2 kt)*

— *Mean crosswind component:* *9 km/h (5 kt)*

b) the latest information, if any, on wind shear and/or turbulence in the final approach area;

c) the current visibility representative of the direction of approach and landing or, when provided, the current runway visual range value(s) and the trend.

6.6.5 During final approach, the following information shall be transmitted without delay:

a) the sudden occurrence of hazards (e.g. unauthorized traffic on the runway);

b) significant variations in the current surface wind, expressed in terms of minimum and maximum values;

c) significant changes in runway surface conditions;

d) changes in the operational status of required visual or non-visual aids;

e) changes in observed RVR value(s), in accordance with the reported scale in use, or changes in the visibility representative of the direction of approach and landing.

## 6.7 OPERATIONS ON PARALLEL OR NEAR-PARALLEL RUNWAYS

### 6.7.1 General

Where parallel or near-parallel runways are used for simultaneous operations, the requirements and procedures below shall apply.

*Note.— Guidance material is contained in the* Manual on Simultaneous Operations on Parallel or Near-Parallel Instrument Runways (SOIR) *(Doc 9643).*

### 6.7.2 Departing aircraft

#### 6.7.2.1 TYPES OF OPERATION

Parallel runways may be used for independent instrument departures as follows:

a) both runways are used exclusively for departures (independent departures);

b) one runway is used exclusively for departures while the other runway is used for a mixture of arrivals and departures (semi-mixed operation); and

c) both runways are used for mixed arrivals and departures (mixed operation).

#### 6.7.2.2 REQUIREMENTS AND PROCEDURES FOR INDEPENDENT PARALLEL DEPARTURES

Independent IFR departures may be conducted from parallel runways provided:

a) the runway centre lines are spaced by the distance specified in Annex 14, Volume I;

b) the departure tracks diverge by at least 15 degrees immediately after take-off;

c) suitable surveillance radar capable of identification of the aircraft within 2 km (1.0 NM) from the end of the runway is available; and

d) ATS operational procedures ensure that the required track divergence is achieved.

### 6.7.3 Arriving aircraft

#### 6.7.3.1 TYPES OF OPERATIONS

6.7.3.1.1 Parallel runways may be used for simultaneous instrument operations for:

a) independent parallel approaches; or

b) dependent parallel approaches; or

c) segregated parallel operations.

6.7.3.1.2 Whenever parallel approaches are carried out, separate controllers should be responsible for the sequencing and spacing of arriving aircraft to each runway.

### 6.7.3.2 REQUIREMENTS AND PROCEDURES FOR INDEPENDENT PARALLEL APPROACHES

6.7.3.2.1 Independent parallel approaches may be conducted to parallel runways provided that:

a) the runway centre lines are spaced by the distance specified in Annex 14, Volume I; and

1) where runway centre lines are spaced by less than 1 310 m but not less than 1 035 m, suitable secondary surveillance radar (SSR) equipment, with a minimum azimuth accuracy of 0.06 degrees (one sigma), an update period of 2.5 seconds or less and a high resolution display providing position prediction and deviation alert is available; or

2) where runway centre lines are spaced by less than 1 525 m but not less than 1 310 m, SSR equipment with performance specifications other than the foregoing may be applied, provided they are equal to or better than those stated under 3) below, and when it is determined that the safety of aircraft operation would not be adversely affected; or

3) where runway centre lines are spaced by 1 525 m or more, suitable surveillance radar with a minimum azimuth accuracy of 0.3 degrees (one sigma) or better and update period of 5 seconds or less is available;

b) instrument landing system (ILS) and/or microwave landing system (MLS) approaches are being conducted on both runways;

c) the missed approach track for one approach diverges by at least 30 degrees from the missed approach track of the adjacent approach;

d) an obstacle survey and evaluation is completed, as appropriate, for the areas adjacent to the final approach segments;

e) aircraft are advised of the runway identification and ILS localizer or MLS frequency as early as possible;

f) vectoring is used to intercept the ILS localizer course or the MLS final approach track;

g) a no transgression zone (NTZ) at least 610 m (2 000 ft) wide is established equidistant between extended runway centre lines and is depicted on the situation display;

h) separate controllers monitor the approaches to each runway and ensure that when the 300 m (1 000 ft) vertical separation is reduced:

1) aircraft do not penetrate the depicted NTZ; and

2) the applicable minimum longitudinal separation between aircraft on the same ILS localizer course or MLS final approach track is maintained; and

i) if no dedicated radio channels are available for the controllers to control the aircraft until landing:

1) transfer of communication of aircraft to the respective aerodrome controller's channel is effected before the higher of two aircraft on adjacent final approach tracks intercepts the ILS glide path or the specified MLS elevation angle; and

2) the controllers monitoring the approaches to each runway are provided with the capability to override transmissions of aerodrome control on the respective radio channels for each arrival flow.

6.7.3.2.2 As early as practicable after an aircraft has established communication with approach control, the aircraft shall be advised that independent parallel approaches are in force. This information may be provided through the ATIS broadcasts.

6.7.3.2.3 When vectoring to intercept the ILS localizer course or MLS final approach track, the final vector shall enable the aircraft to intercept the ILS localizer course or MLS final approach track at an angle not greater than 30 degrees and to provide at least 2 km (1.0 NM) straight and level flight prior to ILS localizer course or MLS final approach track intercept. The vector shall also enable the aircraft to be established on the ILS localizer course or MLS final approach track in level flight for at least 3.7 km (2.0 NM) prior to intercepting the ILS glide path or specified MLS elevation angle.

6.7.3.2.4 A minimum of 300 m (1 000 ft) vertical separation or, subject to radar system and situation display capabilities, a minimum of 5.6 km (3.0 NM) radar separation shall be provided until aircraft are established:

a) inbound on the ILS localizer course and/or MLS final approach track; and

b) within the normal operating zone (NOZ).

6.7.3.2.5 Subject to radar system and situation display capabilities, a minimum of 5.6 km (3.0 NM) radar separation shall be provided between aircraft on the same ILS localizer course or MLS final approach track unless increased longitudinal separation is required due to wake turbulence or for other reasons.

*Note 1.— See Chapter 8, 8.7.3.4.*

*Note 2.— An aircraft established on an ILS localizer course or MLS final approach track is separated from another aircraft established on an adjacent parallel ILS localizer course or MLS final approach track provided neither aircraft penetrates the NTZ as depicted on the situation display.*

6.7.3.2.6 When assigning the final heading to intercept the ILS localizer course or MLS final approach track, the runway shall be confirmed, and the aircraft shall be advised of:

a) its position relative to a fix on the ILS localizer course or MLS final approach track;

b) the altitude to be maintained until established on the ILS localizer course or MLS final approach track to the ILS glide path or specified MLS elevation angle intercept point; and

c) if required, clearance for the appropriate ILS or MLS approach.

6.7.3.2.7 All approaches regardless of meteorological conditions shall be provided with flight path monitoring using radar. Control instructions and information necessary to ensure separation between aircraft and to ensure aircraft do not enter the NTZ shall be issued.

*Note 1.— The primary responsibility for navigation on the ILS localizer course and/or MLS final approach track rests with the pilot. Control instructions and information are therefore issued only to ensure separation between aircraft and to ensure that aircraft do not penetrate the NTZ.*

*Note 2.— For the purpose of ensuring an aircraft does not penetrate the NTZ, the aircraft is considered to be the centre of its position symbol. However, the edges of the position symbols representing aircraft executing parallel approaches are not allowed to touch (see Chapter 8, 8.7.2).*

6.7.3.2.8 When an aircraft is observed to overshoot the turn-on or to continue on a track which will penetrate the NTZ, the aircraft shall be instructed to return immediately to the correct track.

6.7.3.2.9 When an aircraft is observed penetrating the NTZ, the aircraft on the adjacent ILS localizer course or MLS final approach track shall be instructed to immediately climb and turn to the assigned altitude/height and heading in order to avoid the deviating aircraft. Where parallel approach obstacle assessment surfaces (PAOAS) criteria are applied for the obstacle assessment, the air traffic controller shall not issue the heading instruction to the aircraft below 120 m (400 ft) above the runway threshold elevation, and the heading instruction shall not exceed 45 degrees track difference with the ILS localizer course or MLS final approach track.

6.7.3.2.10 Flight path monitoring using radar shall not be terminated until:

a) visual separation is applied, provided procedures ensure that both controllers are advised whenever visual separation is applied;

b) the aircraft has landed, or in case of a missed approach, is at least 2 km (1.0 NM) beyond the departure end of the runway and adequate separation with any other traffic is established.

*Note.— There is no requirement to advise the aircraft that flight path monitoring using radar is terminated.*

### 6.7.3.3 SUSPENSION OF INDEPENDENT PARALLEL APPROACHES TO CLOSELY-SPACED PARALLEL RUNWAYS

Independent parallel approaches to parallel runways spaced by less than 1 525 m between their centre lines shall be suspended under certain meteorological conditions, as prescribed by the appropriate ATS authority, including wind shear, turbulence, downdrafts, crosswind and significant meteorological conditions such as thunderstorms, which might otherwise increase ILS localizer course and/ or MLS final approach track deviations to the extent that safety may be impaired.

*Note 1.— The increase in final approach track deviations would additionally result in an unacceptable level of deviation alerts being generated.*

*Note 2.— Guidance material relating to meteorological conditions is contained in the* Manual on Simultaneous Operations on Parallel or Near-Parallel Instrument Runways (SOIR) *(Doc 9643).*

### 6.7.3.4 REQUIREMENTS AND PROCEDURES FOR DEPENDENT PARALLEL APPROACHES

6.7.3.4.1 Dependent parallel approaches may be conducted to parallel runways provided:

a) the runway centre lines are spaced by the distance specified in Annex 14, Volume I;

b) the aircraft are vectored to intercept the final approach track;

c) suitable surveillance radar with a minimum azimuth accuracy of 0.3 degrees (one sigma) and update period of 5 seconds or less is available;

d) ILS and/or MLS approaches are being conducted on both runways;

e) aircraft are advised that approaches are in use to both runways (this information may be provided through the ATIS);

f) the missed approach track for one approach diverges by at least 30 degrees from the missed approach track of the adjacent approach; and

g) approach control has a frequency override capability to aerodrome control.

6.7.3.4.2 A minimum of 300 m (1 000 ft) vertical separation or a minimum of 5.6 km (3.0 NM) radar separation shall be provided between aircraft during turn-on to parallel ILS localizer courses and/or MLS final approach tracks.

6.7.3.4.3 The minimum radar separation to be provided between aircraft established on the ILS localizer course and/or MLS final approach track shall be:

a) 5.6 km (3.0 NM) between aircraft on the same ILS localizer course or MLS final approach track unless increased longitudinal separation is required due to wake turbulence; and

b) 3.7 km (2.0 NM) between successive aircraft on adjacent ILS localizer courses or MLS final approach tracks.

### 6.7.3.5 REQUIREMENTS AND PROCEDURES FOR SEGREGATED PARALLEL OPERATIONS

6.7.3.5.1 Segregated parallel operations may be conducted on parallel runways provided:

a) the runway centre lines are spaced by the distance specified in Annex 14, Volume I; and

b) the nominal departure track diverges immediately after take-off by at least 30 degrees from the missed approach track of the adjacent approach (see Figure 6-1).

6.7.3.5.2 The minimum distance between parallel runway centre lines for segregated parallel operations may be decreased by 30 m for each 150 m that the arrival runway is staggered toward the arriving aircraft, to a minimum of 300 m (see Figure 6-2) and should be increased by 30 m for each 150 m that the arrival runway is staggered away from the arriving aircraft (see Figure 6-3).

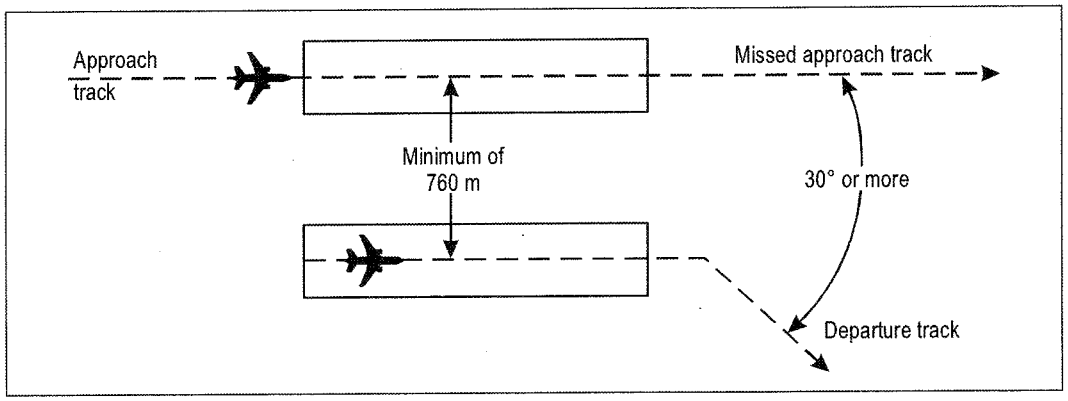
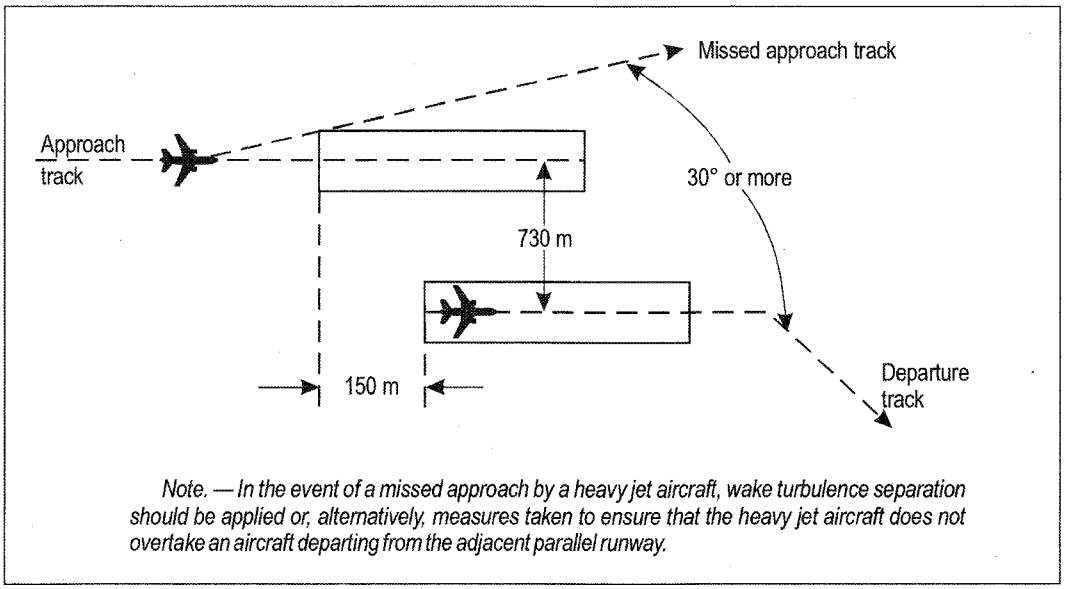



**Figure 6-1. Segregated parallel operations (see 6.7.3.5.1 b))**




*Note. — In the event of a missed approach by a heavy jet aircraft, wake turbulence separation should be applied or, alternatively, measures taken to ensure that the heavy jet aircraft does not overtake an aircraft departing from the adjacent parallel runway.*

**Figure 6-2. Segregated parallel operations where runways are staggered (see 6.7.3.5.2)**

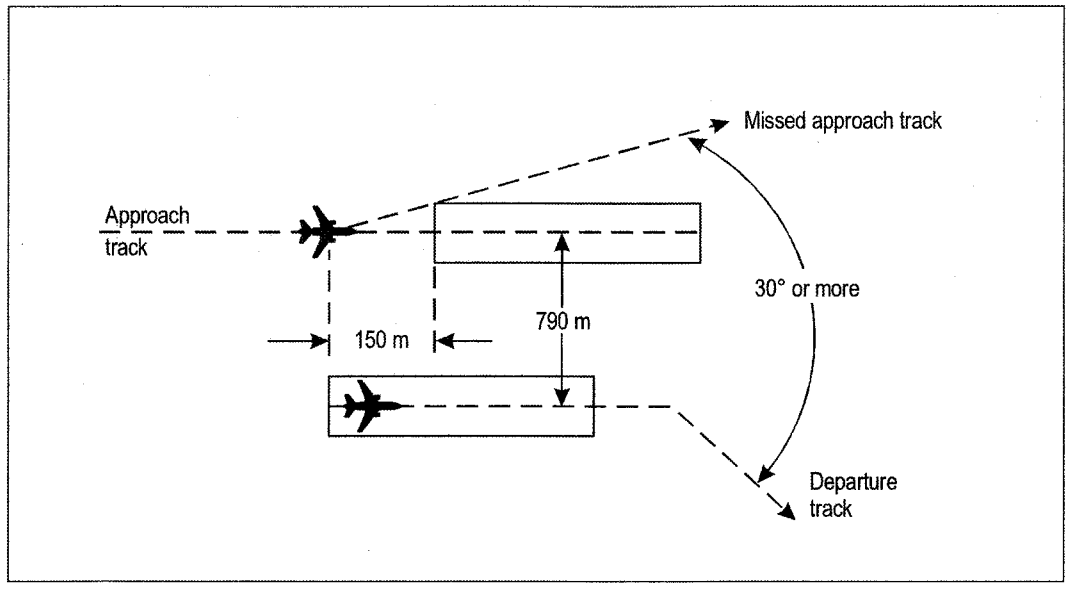



**Figure 6-3. Segregated parallel operations where runways are staggered (see 6.7.3.5.2)**

6.7.3.5.3 The following types of approaches may be conducted in segregated parallel operations provided suitable surveillance radar and the appropriate ground facilities conform to the standard necessary for the specific type of approach:

a) ILS and/or MLS precision approach;

b) surveillance radar approach (SRA) or precision approach radar (PAR) approach; and

c) visual approach.

*Note.— Guidance material is contained in the* Manual on Simultaneous Operations on Parallel or Near-Parallel Instrument Runways (SOIR) *(Doc 9643).*

# Chapter 7

# PROCEDURES FOR AERODROME CONTROL SERVICE

*Note.— This Chapter also includes procedures for the operation of aeronautical ground lights, see Section 7.15.*

## 7.1 FUNCTIONS OF AERODROME CONTROL TOWERS

### 7.1.1 General

7.1.1.1 Aerodrome control towers shall issue information and clearances to aircraft under their control to achieve a safe, orderly and expeditious flow of air traffic on and in the vicinity of an aerodrome with the object of preventing collision(s) between:

a) aircraft flying within the designated area of responsibility of the control tower, including the aerodrome traffic circuits;

b) aircraft operating on the manoeuvring area;

c) aircraft landing and taking off;

d) aircraft and vehicles operating on the manoeuvring area;

e) aircraft on the manoeuvring area and obstructions on that area.

7.1.1.2 Aerodrome controllers shall maintain a continuous watch on all flight operations on and in the vicinity of an aerodrome as well as vehicles and personnel on the manoeuvring area. Watch shall be maintained by visual observation, augmented in low visibility conditions by an ATS surveillance system when available. Traffic shall be controlled in accordance with the procedures set forth herein and all applicable traffic rules specified by the appropriate ATS authority. If there are other aerodromes within a control zone, traffic at all aerodromes within such a zone shall be coordinated so that traffic circuits do not conflict.

*Note.— Provisions for the use of an ATS surveillance system in the aerodrome control service are contained in Chapter 8, Section 8.10.*

7.1.1.3 The functions of an aerodrome control tower may be performed by different control or working positions, such as:

a) aerodrome controller, normally responsible for operations on the runway and aircraft flying within the area of responsibility of the aerodrome control tower;

b) ground controller, normally responsible for traffic on the manoeuvring area with the exception of runways;

c) clearance delivery position, normally responsible for delivery of start-up and ATC clearances to departing IFR flights.

7.1.1.4 Where parallel or near-parallel runways are used for simultaneous operations, individual aerodrome controllers should be responsible for operations on each of the runways.

### 7.1.2 Alerting service provided by aerodrome control towers

7.1.2.1 Aerodrome control towers are responsible for alerting the rescue and fire fighting services whenever:

a) an aircraft accident has occurred on or in the vicinity of the aerodrome; or

b) information is received that the safety of an aircraft which is or will come under the jurisdiction of the aerodrome control tower may have or has been impaired; or

c) requested by the flight crew; or

d) when otherwise deemed necessary or desirable.

7.1.2.2 Procedures concerning the alerting of the rescue and fire fighting services shall be contained in local instructions. Such instructions shall specify the type of information to be provided to the rescue and fire fighting services, including type of aircraft and type of emergency and, when available, number of persons on board, and any dangerous goods carried on the aircraft.

7.1.2.3 Aircraft which fail to report after having been transferred to an aerodrome control tower, or, having once reported, cease radio contact and in either case fail to land five minutes after the expected landing time, shall be reported to the approach control unit, ACC or flight information centre, or to the rescue coordination centre or rescue sub-centre, in accordance with local instructions.

### 7.1.3 Failure or irregularity of aids and equipment

Aerodrome control towers shall immediately report in accordance with local instructions any failure or irregularity of operation in any equipment, light or other device established at an aerodrome for the guidance of aerodrome traffic and flight crews or required for the provision of air traffic control service.

## 7.2 SELECTION OF RUNWAY-IN-USE

7.2.1 The term "runway-in-use" shall be used to indicate the runway or runways that, at a particular time, are considered by the aerodrome control tower to be the most suitable for use by the types of aircraft expected to land or take off at the aerodrome.

*Note.— Separate or multiple runways may be designated runway-in-use for arriving aircraft and departing aircraft.*

7.2.2 Normally, an aircraft will land and take off into wind unless safety, the runway configuration, meteorological conditions and available instrument approach procedures or air traffic conditions determine that a different direction is preferable. In selecting the runway-in-use, however, the unit providing aerodrome control service shall take into consideration, besides surface wind speed and direction, other relevant factors such as the aerodrome traffic circuits, the length of runways, and the approach and landing aids available.

7.2.3 A runway for take-off or landing, appropriate to the operation, may be nominated for noise abatement purposes, the objective being to utilize whenever possible those runways that permit aeroplanes to avoid noise-sensitive areas during the initial departure and final approach phases of flight.

7.2.4 Runways should not be selected for noise abatement purposes for landing operations unless they are equipped with suitable glide path guidance, e.g. ILS, or a visual approach slope indicator system for operations in visual meteorological conditions.

7.2.5 A pilot-in-command, prompted by safety concerns, can refuse a runway offered for noise-preferential reasons.

7.2.6 Noise abatement shall not be a determining factor in runway nomination under the following circumstances:

a) if the runway surface conditions are adversely affected (e.g. by snow, slush, ice, water, mud, rubber, oil or other substances);

b) for landing in conditions:

1) when the ceiling is lower than 150 m (500 ft) above aerodrome elevation, or the visibility is less than 1 900 m; or

2) when the approach requires use to be made of vertical minima greater than 100 m (300 ft) above aerodrome elevation and:

i) the ceiling is lower than 240 m (800 ft) above aerodrome elevation; or

ii) the visibility is less than 3 000 m;

c) for take-off when the visibility is less than 1 900 m;

d) when wind shear has been reported or forecast or when thunderstorms are expected to affect the approach or departure; and

e) when the crosswind component, including gusts, exceeds 28 km/h (15 kt), or the tailwind component, including gusts, exceeds 9 km/h (5 kt).

## 7.3 INITIAL CALL TO AERODROME CONTROL TOWER

For aircraft being provided with aerodrome control service, the initial call shall contain:

a) designation of the station being called;

b) call sign and, for aircraft in the heavy wake turbulence category, the word "Heavy";

c) position; and

d) additional elements, as required by the appropriate ATS authority.

*Note.— See also Chapter 4, 4.11.3.1, for aircraft in the air, making the first call to the aerodrome tower.*

## 7.4 INFORMATION TO AIRCRAFT BY AERODROME CONTROL TOWERS

### 7.4.1 Information related to the operation of aircraft

*Note.— See Chapter 11, 11.4.3, regarding flight information messages.*

#### 7.4.1.1 START-UP TIME PROCEDURES

7.4.1.1.1 When so requested by the pilot prior to engine start, an expected take-off time should be given, unless engine start-up time procedures are employed.

7.4.1.1.2 Start-up time procedures should be implemented where necessary to avoid congestion and excessive delays on the manoeuvring area or when warranted by ATFM regulations. Start-up time procedures should be contained in local instructions, and should specify the criteria and conditions for determining when and how start-up times shall be calculated and issued to departing flights.

7.4.1.1.3 When an aircraft is subject to ATFM regulations, it should be advised to start up in accordance with its allocated slot time.

7.4.1.1.4 When the delay for a departing aircraft is anticipated to be less than a time period specified by the appropriate ATS authority, an aircraft should be cleared to start up at its own discretion.

7.4.1.1.5 When the delay for a departing aircraft is anticipated to exceed a time period specified by the appropriate ATS authority, the aerodrome control tower should issue an expected start-up time to an aircraft requesting start-up.

7.4.1.1.6 A start-up clearance shall only be withheld under circumstances or conditions specified by the appropriate ATS authority.

7.4.1.1.7 If a start-up clearance is withheld, the flight crew shall be advised of the reason.

#### 7.4.1.2 AERODROME AND METEOROLOGICAL INFORMATION

7.4.1.2.1 Prior to taxiing for take-off, aircraft shall be advised of the following elements of information, in the order listed, with the exception of such elements which it is known the aircraft has already received:

a) the runway to be used;

b) the surface wind direction and speed, including significant variations therefrom;

c) the QNH altimeter setting and, either on a regular basis in accordance with local arrangements or if so requested by the aircraft, the QFE altimeter setting;

d) the air temperature for the runway to be used, in the case of turbine-engined aircraft;

e) the visibility representative of the direction of take-off and initial climb, if less than 10 km, or, when applicable, the RVR value(s) for the runway to be used;

f) the correct time.

*Note.— The meteorological information listed above is to follow the criteria used for meteorological local routine and special reports, in accordance with Chapter 11, 11.4.3.2.2 to 11.4.3.2.3.*

7.4.1.2.2 Prior to take-off aircraft shall be advised of:

a) any significant changes in the surface wind direction and speed, the air temperature, and the visibility or RVR value(s) given in accordance with 7.4.1.2.1;

b) significant meteorological conditions in the take-off and climb-out area, except when it is known that the information has already been received by the aircraft.

*Note.— Significant meteorological conditions in this context include the occurrence or expected occurrence of cumulonimbus or thunderstorm, moderate or severe turbulence, wind shear, hail, moderate or severe icing, severe squall line, freezing precipitation, severe mountain waves, sandstorm, duststorm, blowing snow, tornado or waterspout in the take-off and climb-out area.*

7.4.1.2.3 Prior to entering the traffic circuit or commencing its approach to land, an aircraft shall be provided with the following elements of information, in the order listed, with the exception of such elements which it is known the aircraft has already received:

a) the runway to be used;

b) the surface wind direction and speed, including significant variations therefrom;

c) the QNH altimeter setting and, either on a regular basis in accordance with local arrangements or if so requested by the aircraft, the QFE altimeter setting.

*Note.— The meteorological information listed above is to follow the criteria used for meteorological local routine and special reports, in accordance with Chapter 11, 11.4.3.2.2 to 11.4.3.2.3.*

### 7.4.1.3 ESSENTIAL LOCAL TRAFFIC INFORMATION

7.4.1.3.1 Information on essential local traffic shall be issued in a timely manner, either directly or through the unit providing approach control service when, in the judgement of the aerodrome controller, such information is necessary in the interests of safety, or when requested by aircraft.

7.4.1.3.2 Essential local traffic shall be considered to consist of any aircraft, vehicle or personnel on or near the manoeuvring area, or traffic operating in the vicinity of the aerodrome, which may constitute a hazard to the aircraft concerned.

7.4.1.3.3 Essential local traffic shall be described so as to be easily identified.

### 7.4.1.4 RUNWAY INCURSION OR OBSTRUCTED RUNWAY

7.4.1.4.1 In the event the aerodrome controller, after a take-off clearance or a landing clearance has been issued, becomes aware of a runway incursion or the imminent occurrence thereof, or the existence of any obstruction on or in close proximity to the runway likely to impair the safety of an aircraft taking off or landing, appropriate action shall be taken as follows:

a) cancel the take-off clearance for a departing aircraft;

b) instruct a landing aircraft to execute a go-around or missed approach;

c) in all cases inform the aircraft of the runway incursion or obstruction and its location in relation to the runway.

*Note.— Animals and flocks of birds may constitute an obstruction with regard to runway operations. In addition, an aborted take-off or a go-around executed after touchdown may expose the aeroplane to the risk of overrunning the runway. Moreover, a low altitude missed approach may expose the aeroplane to the risk of a tail strike. Pilots may, therefore, have to exercise their judgement in accordance with Annex 2, 2.4, concerning the authority of the pilot-in-command of an aircraft.*

7.4.1.4.2 Following any occurrence involving an obstruction on the runway or a runway incursion, pilots and controllers shall complete an air traffic incident report in accordance with the ICAO model air traffic incident report form.

### 7.4.1.5 UNCERTAINTY OF POSITION ON THE MANOEUVRING AREA

7.4.1.5.1 Except as provided for in 7.4.1.5.2, a pilot in doubt as to the position of the aircraft with respect to the manoeuvring area shall immediately:

a) stop the aircraft; and

b) simultaneously notify the appropriate ATS unit of the circumstances (including the last known position).

7.4.1.5.2 In those situations where a pilot is in doubt as to the position of the aircraft with respect to the manoeuvring area, but recognizes that the aircraft is on a runway, the pilot shall immediately:

a) notify the appropriate ATS unit of the circumstances (including the last known position);

b) if able to locate a nearby suitable taxiway, vacate the runway as expeditiously as possible, unless otherwise instructed by the ATS unit; and then,

c) stop the aircraft.

7.4.1.5.3 A vehicle driver in doubt as to the position of the vehicle with respect to the manoeuvring area shall immediately:

a) notify the appropriate ATS unit of the circumstances (including the last known position);

b) simultaneously, unless otherwise instructed by the ATS unit, vacate the landing area, taxiway, or other part of the manoeuvring area, to a safe distance as expeditiously as possible; and then,

c) stop the vehicle.

7.4.1.5.4 In the event the aerodrome controller becomes aware of an aircraft or vehicle that is lost or uncertain of its position on the manoeuvring area, appropriate action shall be taken immediately to safeguard operations and assist the aircraft or vehicle concerned to determine its position.

### 7.4.1.6 WAKE TURBULENCE AND JET BLAST HAZARDS

7.4.1.6.1 Aerodrome controllers shall, when applicable, apply the wake turbulence separation minima specified in Chapter 5, Section 5.8. Whenever the responsibility for wake turbulence avoidance rests with the pilot-in-command, aerodrome controllers shall, to the extent practicable, advise aircraft of the expected occurrence of hazards caused by turbulent wake.

*Note.— Occurrence of turbulent wake hazards cannot be accurately predicted and aerodrome controllers cannot assume responsibility for the issuance of advice on such hazards at all times, nor for its accuracy. Information on hazards due to wake vortices is contained in the* Air Traffic Services Planning Manual *(Doc 9426), Part II, Section 5. Wake turbulence categories of aircraft are specified in Chapter 4, 4.9.1.*

7.4.1.6.2 In issuing clearances or instructions, air traffic controllers should take into account the hazards caused by jet blast and propeller slipstream to taxiing aircraft, to aircraft taking off or landing, particularly when intersecting runways are being used, and to vehicles and personnel operating on the aerodrome.

*Note.— Jet blast and propeller slipstream can produce localized wind velocities of sufficient strength to cause damage to other aircraft, vehicles and personnel operating within the affected area.*

7.4.1.7 ABNORMAL AIRCRAFT CONFIGURATION AND CONDITION

7.4.1.7.1 Whenever an abnormal configuration or condition of an aircraft, including conditions such as landing gear not extended or only partly extended, or unusual smoke emissions from any part of the aircraft, is observed by or reported to the aerodrome controller, the aircraft concerned shall be advised without delay.

7.4.1.7.2 When requested by the flight crew of a departing aircraft suspecting damage to the aircraft, the departure runway used shall be inspected without delay and the flight crew advised in the most expeditious manner as to whether any aircraft debris or bird or animal remains have been found or not.

## 7.5 ESSENTIAL INFORMATION ON AERODROME CONDITIONS

*Note.— See Chapter 11, 11.4.3.4, regarding messages containing information on aerodrome conditions.*

7.5.1 Essential information on aerodrome conditions is information necessary to safety in the operation of aircraft, which pertains to the movement area or any facilities usually associated therewith. For example, construction work on a taxi strip not connected to the runway-in-use would not be essential information to any aircraft except one that might be taxied in the vicinity of the construction work. As another example, if all traffic must be confined to runways, that fact should be considered as essential aerodrome information to any aircraft not familiar with the aerodrome.

7.5.2 Essential information on aerodrome conditions shall include information relating to the following:

a) construction or maintenance work on, or immediately adjacent to the movement area;

b) rough or broken surfaces on a runway, a taxiway or an apron, whether marked or not;

c) snow, slush or ice on a runway, a taxiway or an apron;

d) water on a runway, a taxiway or an apron;

e) snow banks or drifts adjacent to a runway, a taxiway or an apron;

f) other temporary hazards, including parked aircraft and birds on the ground or in the air;

g) failure or irregular operation of part or all of the aerodrome lighting system;

h) any other pertinent information.

*Note.— Up-to-date information on the conditions on aprons may not always be available to the aerodrome control tower. The responsibility of the aerodrome control tower in relation to aprons is, with respect to the provisions of 7.5.1 and 7.5.2, limited to the transmission to aircraft of the information which is provided to it by the authority responsible for the aprons.*

7.5.3 Essential information on aerodrome conditions shall be given to every aircraft, except when it is known that the aircraft already has received all or part of the information from other sources. The information shall be given in sufficient time for the aircraft to make proper use of it, and the hazards shall be identified as distinctly as possible.

*Note.— "Other sources" include NOTAM, ATIS broadcasts, and the display of suitable signals.*

7.5.4 When a not previously notified condition pertaining to the safe use by aircraft of the manoeuvring area is reported to or observed by the controller, the appropriate aerodrome authority shall be informed and operations on that part of the manoeuvring area terminated until otherwise advised by the appropriate aerodrome authority.

## 7.6 CONTROL OF AERODROME TRAFFIC

### 7.6.1 General

As the view from the flight deck of an aircraft is normally restricted, the controller shall ensure that instructions and information which require the flight crew to employ visual detection, recognition and observation are phrased in a clear, concise and complete manner.

### 7.6.2 Designated positions of aircraft in the aerodrome traffic and taxi circuits

The following positions of aircraft in the traffic and taxi circuits are the positions where aircraft normally receive aerodrome control tower clearances. Aircraft should be watched closely as they approach these positions so that proper clearances may be issued without delay. Where practicable, all clearances should be issued without waiting for aircraft to initiate the call.

*Position 1.* Aircraft initiates call to taxi for departing flight. Runway-in-use information and taxi clearances given.

*Position 2.* If there is conflicting traffic, the departing aircraft will be held at this position. Engine run-up will, when required, normally be performed here.

*Position 3.* Take-off clearance is issued here, if not practicable at position 2.

*Position 4.* Clearance to land is issued here as practicable.

*Position 5.* Clearance to taxi to apron is issued here.

*Position 6.* Parking information issued here, if necessary.

*Note 1.— Arriving aircraft executing an instrument approach procedure will normally enter the traffic circuit on final except when visual manoeuvring to the landing runway is required.*

*Note 2.— See Figure 7-1.*

### 7.6.3 Traffic on the manoeuvring area

#### 7.6.3.1 CONTROL OF TAXIING AIRCRAFT

##### 7.6.3.1.1 *TAXI CLEARANCE*

7.6.3.1.1.1 Prior to issuing a taxi clearance, the controller shall determine where the aircraft concerned is parked. Taxi clearances shall contain concise instructions and adequate information so as to assist the flight crew to follow the correct taxi routes, to avoid collision with other aircraft or objects and to minimize the potential for the aircraft inadvertently entering an active runway.

7.6.3.1.1.2 When a taxi clearance contains a taxi limit beyond a runway, it shall contain an explicit clearance to cross or an instruction to hold short of that runway.

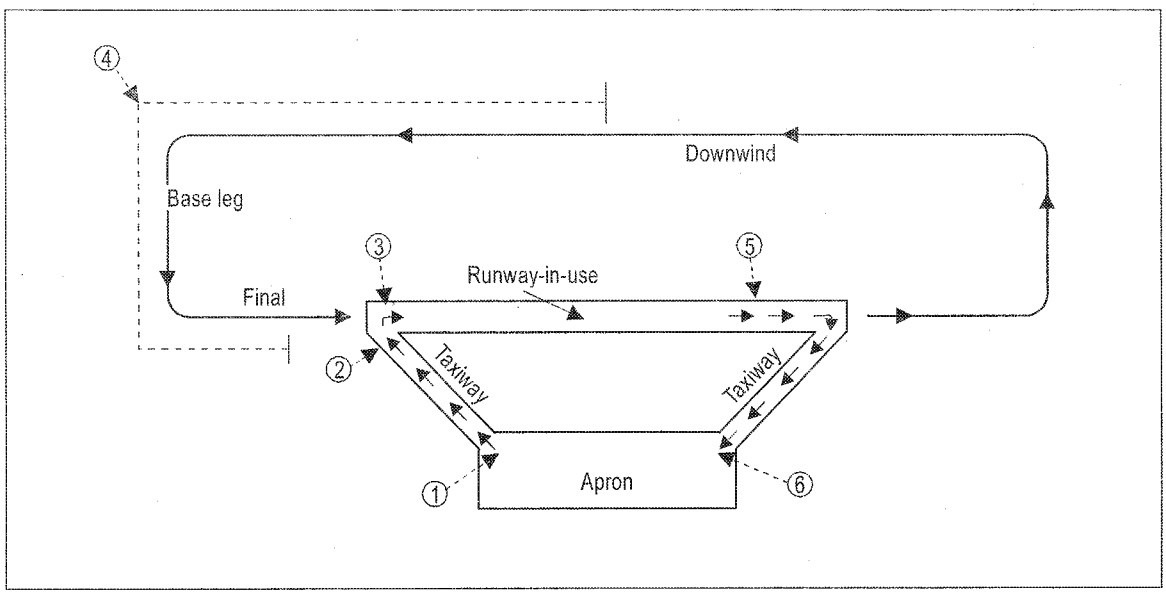



**Figure 7-1. Designated positions of aircraft from an aerodrome control tower viewpoint (see 7.6.2)**

7.6.3.1.1.3 The appropriate ATS authority should whenever practicable publish in the national AIP standard taxi routes to be used at an aerodrome. Standard taxi routes should be identified by appropriate designators and should be used in taxi clearances.

7.6.3.1.1.4 Where standard taxi routes have not been published, a taxi route should, whenever possible, be described by use of taxiway and runway designators. Other relevant information, such as an aircraft to follow or give way to, shall also be provided to a taxiing aircraft.

7.6.3.1.2 *TAXIING ON A RUNWAY-IN-USE*

7.6.3.1.2.1 For the purpose of expediting air traffic, aircraft may be permitted to taxi on the runway-in-use, provided no delay or risk to other aircraft will result. Where control of taxiing aircraft is provided by a ground controller and the control of runway operations by an aerodrome controller, the use of a runway by taxiing aircraft shall be coordinated with and approved by the aerodrome controller. Communication with the aircraft concerned should be transferred from the ground controller to the aerodrome controller prior to the aircraft entering the runway.

7.6.3.1.2.2 If the control tower is unable to determine, either visually or via an ATS surveillance system that a vacating or crossing aircraft has cleared the runway, the aircraft shall be requested to report when it has vacated the runway. The report shall be made when the entire aircraft is beyond the relevant runway-holding position.

7.6.3.1.3 *USE OF RUNWAY-HOLDING POSITIONS*

7.6.3.1.3.1 Except as provided in 7.6.3.1.3.2 or as prescribed by the appropriate ATS authority, aircraft shall not be held closer to a runway-in-use than at a runway-holding position.

*Note.— Runway-holding position locations in relation to runways are specified in Annex 14, Volume I, Chapter 5.*

7.6.3.1.3.2 Aircraft shall not be permitted to line up and hold on the approach end of a runway-in-use whenever another aircraft is effecting a landing, until the landing aircraft has passed the point of intended holding.

*Note.— See Figure 7-2.*

7.6.3.1.4 *HELICOPTER TAXIING OPERATIONS*

7.6.3.1.4.1 When necessary for a wheeled helicopter or vertical take-off and landing (VTOL) aircraft to taxi on the surface, the following provisions are applicable.

*Note.— Ground taxiing uses less fuel than air-taxiing and minimizes air turbulence. However, under certain conditions, such as rough, soft or uneven terrain, it may become necessary to air-taxi for safety considerations. Helicopters with articulating rotors (usually designs with three or more main rotor blades) are subject to "ground resonance" and may, on rare occasions, suddenly lift off the ground to avoid severe damage or destruction.*

7.6.3.1.4.2 When it is requested or necessary for a helicopter to proceed at a slow speed above the surface, normally below 37 km/h (20 kt) and in ground effect, air-taxiing may be authorized.

*Note.— Air-taxiing consumes fuel at a high burn rate, and helicopter downwash turbulence (produced in ground effect) increases significantly with larger and heavier helicopters.*

7.6.3.1.4.3 Instructions which require small aircraft or helicopters to taxi in close proximity to taxiing helicopters should be avoided and consideration should be given to the effect of turbulence from taxiing helicopters on arriving and departing light aircraft.

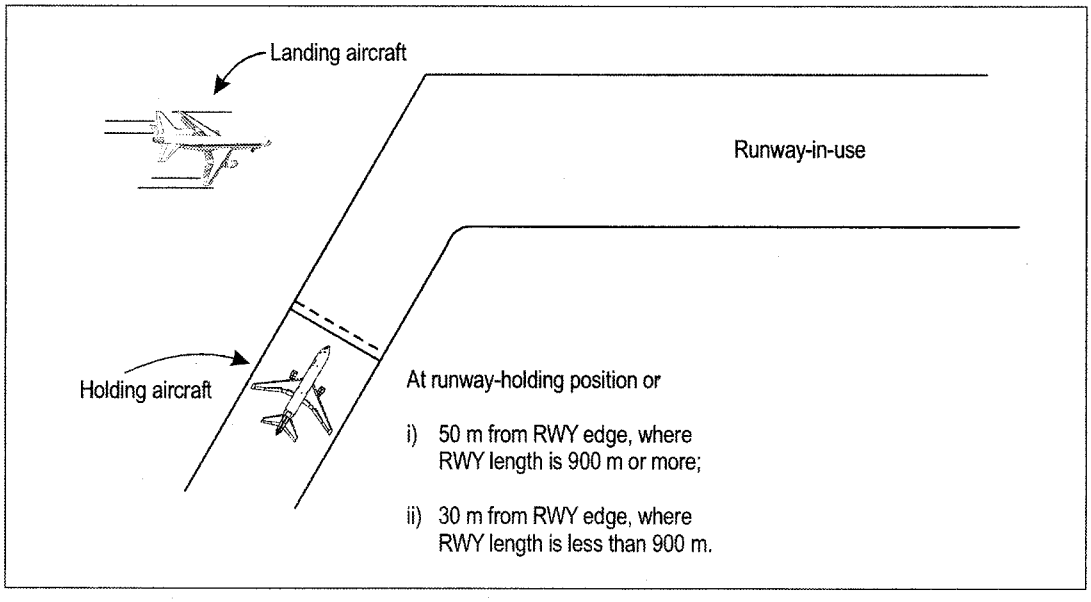



**Figure 7-2. Method of holding aircraft (see 7.6.3.1.3.2)**

7.6.3.1.4.4 A frequency change should not be issued to single-pilot helicopters hovering or air-taxiing. Whenever possible, control instructions from the next ATS unit should be relayed as necessary until the pilot is able to change frequency.

*Note.— Most light helicopters are flown by one pilot and require the constant use of both hands and feet to maintain control during low-altitude/low-level flight. Although flight control friction devices assist the pilot, changing frequency near the ground could result in inadvertent ground contact and consequent loss of control.*

### 7.6.3.2 CONTROL OF OTHER THAN AIRCRAFT TRAFFIC

#### 7.6.3.2.1 *ENTRY TO THE MANOEUVRING AREA*

The movement of pedestrians or vehicles on the manoeuvring area shall be subject to authorization by the aerodrome control tower. Persons, including drivers of all vehicles, shall be required to obtain authorization from the aerodrome control tower before entry to the manoeuvring area. Notwithstanding such an authorization, entry to a runway or runway strip or change in the operation authorized shall be subject to a further specific authorization by the aerodrome control tower.

#### 7.6.3.2.2 *PRIORITY ON THE MANOEUVRING AREA*

7.6.3.2.2.1 All vehicles and pedestrians shall give way to aircraft which are landing, taxiing or taking off, except that emergency vehicles proceeding to the assistance of an aircraft in distress shall be afforded priority over all other surface movement traffic. In the latter case, all movement of surface traffic should, to the extent practicable, be halted until it is determined that the progress of the emergency vehicles will not be impeded.

7.6.3.2.2.2 When an aircraft is landing or taking off, vehicles shall not be permitted to hold closer to the runway-in-use than:

a) at a taxiway/runway intersection — at a runway-holding position; and

b) at a location other than a taxiway/runway intersection — at a distance equal to the separation distance of the runway-holding position.

#### 7.6.3.2.3 *COMMUNICATION REQUIREMENTS AND VISUAL SIGNALS*

7.6.3.2.3.1 At controlled aerodromes all vehicles employed on the manoeuvring area shall be capable of maintaining two-way radiocommunication with the aerodrome control tower, except when the vehicle is only occasionally used on the manoeuvring area and is:

a) accompanied by a vehicle with the required communications capability; or

b) employed in accordance with a pre-arranged plan established with the aerodrome control tower.

7.6.3.2.3.2 When communications by a system of visual signals is deemed to be adequate, or in the case of radiocommunication failure, the signals given hereunder shall have the meaning indicated therein:

| *Light signal from aerodrome control* | *Meaning* |
|---|---|
| Green flashes | Permission to cross landing area or to move onto taxiway |
| Steady red | Stop |
| Red flashes | Move off the landing area or taxiway and watch out for aircraft |
| White flashes | Vacate manoeuvring area in accordance with local instructions |

7.6.3.2.3.3 In emergency conditions or if the signals in 7.6.3.2.3.2 are not observed, the signal given hereunder shall be used for runways or taxiways equipped with a lighting system and shall have the meaning indicated therein.

| *Light signal* | *Meaning* |
|---|---|
| Flashing runway or taxiway lights | Vacate the runway and observe the tower for light signal |

7.6.3.2.3.4 When employed in accordance with a plan prearranged with the aerodrome control tower, constructional and maintenance personnel should not normally be required to be capable of maintaining two-way radiocommunication with the aerodrome control tower.

## 7.7 CONTROL OF TRAFFIC IN THE TRAFFIC CIRCUIT

### 7.7.1 General

7.7.1.1 Aircraft in the traffic circuit shall be controlled to provide the separation minima outlined in 7.9.2, 7.10.1 and 7.11 and Chapter 5, Section 5.8, except that:

a) aircraft in formation are exempted from the separation minima with respect to separation from other aircraft of the same flight;

b) aircraft operating in different areas or different runways on aerodromes suitable for simultaneous landings or take-offs are exempted from the separation minima;

c) separation minima shall not apply to aircraft operating under military necessity in accordance with Chapter 16, Section 16.1.

7.7.1.2 Sufficient separation shall be effected between aircraft in flight in the traffic circuit to allow the spacing of arriving and departing aircraft as outlined in 7.9.2, 7.10.1 and 7.11 and Chapter 5, Section 5.8.

### 7.7.2 Entry of traffic circuit

7.7.2.1 The clearance to enter the traffic circuit should be issued to an aircraft whenever it is desired that the aircraft approach the landing area in accordance with current traffic circuits but traffic conditions do not yet allow a landing clearance to be issued. Depending on the circumstances and traffic conditions, an aircraft may be cleared to join at any position in the traffic circuit.

7.7.2.2 An arriving aircraft executing an instrument approach shall normally be cleared to land straight in unless visual manoeuvring to the landing runway is required.

### 7.7.3 Priority for landing

7.7.3.1 If an aircraft enters an aerodrome traffic circuit without proper authorization, it shall be permitted to land if its actions indicate that it so desires. If circumstances warrant, aircraft which are in contact with the controller may be instructed by the controller to give way so as to remove as soon as possible the hazard introduced by such unauthorized operation. In no case shall permission to land be withheld indefinitely.

7.7.3.2 In cases of emergency it may be necessary, in the interests of safety, for an aircraft to enter a traffic circuit and effect a landing without proper authorization. Controllers should recognize the possibilities of emergency action and render all assistance possible.

7.7.3.3 Priority shall be given to:

a) an aircraft which anticipates being compelled to land because of factors affecting the safe operation of the aircraft (engine failure, shortage of fuel, etc.);

b) hospital aircraft or aircraft carrying any sick or seriously injured persons requiring urgent medical attention;

c) aircraft engaged in search and rescue operations; and

d) other aircraft as may be determined by the appropriate authority.

*Note.— An aircraft which has encountered an emergency is handled as outlined in Chapter 15, Section 15.1.*

## 7.8 ORDER OF PRIORITY FOR ARRIVING AND DEPARTING AIRCRAFT

An aircraft landing or in the final stages of an approach to land shall normally have priority over an aircraft intending to depart from the same or an intersecting runway.

## 7.9 CONTROL OF DEPARTING AIRCRAFT

### 7.9.1 Departure sequence

Departures shall normally be cleared in the order in which they are ready for take-off, except that deviations may be made from this order of priority to facilitate the maximum number of departures with the least average delay. Factors which should be considered in relation to the departure sequence include, *inter alia*:

a) types of aircraft and their relative performance;

b) routes to be followed after take-off;

c) any specified minimum departure interval between take-offs;

d) need to apply wake turbulence separation minima;

e) aircraft which should be afforded priority; and

f) aircraft subject to ATFM requirements.

*Note 1.— See also Chapter 6, 6.3.3.*

*Note 2.— For aircraft subject to ATFM requirements, it is the responsibility of the pilot and the operator to ensure that the aircraft is ready to taxi in time to meet any required departure time, bearing in mind that once a departure sequence is established on the taxiway system, it can be difficult, and sometimes impossible, to change the order.*

### 7.9.2 Separation of departing aircraft

Except as provided in 7.11 and Chapter 5, Section 5.8, a departing aircraft will not normally be permitted to commence take-off until the preceding departing aircraft has crossed the end of the runway-in-use or has started a turn or until all preceding landing aircraft are clear of the runway-in-use.

*Note 1.— See Figure 7-3.*

*Note 2.— Wake turbulence categories and time-based wake turbulence longitudinal separation minima are contained in Chapter 4, Section 4.9 and Chapter 5, Section 5.8, respectively. Distance-based wake turbulence separation minima are contained in Chapter 8, Section 8.7.*

*Note 3.— See 7.6.3.1.2.2.*

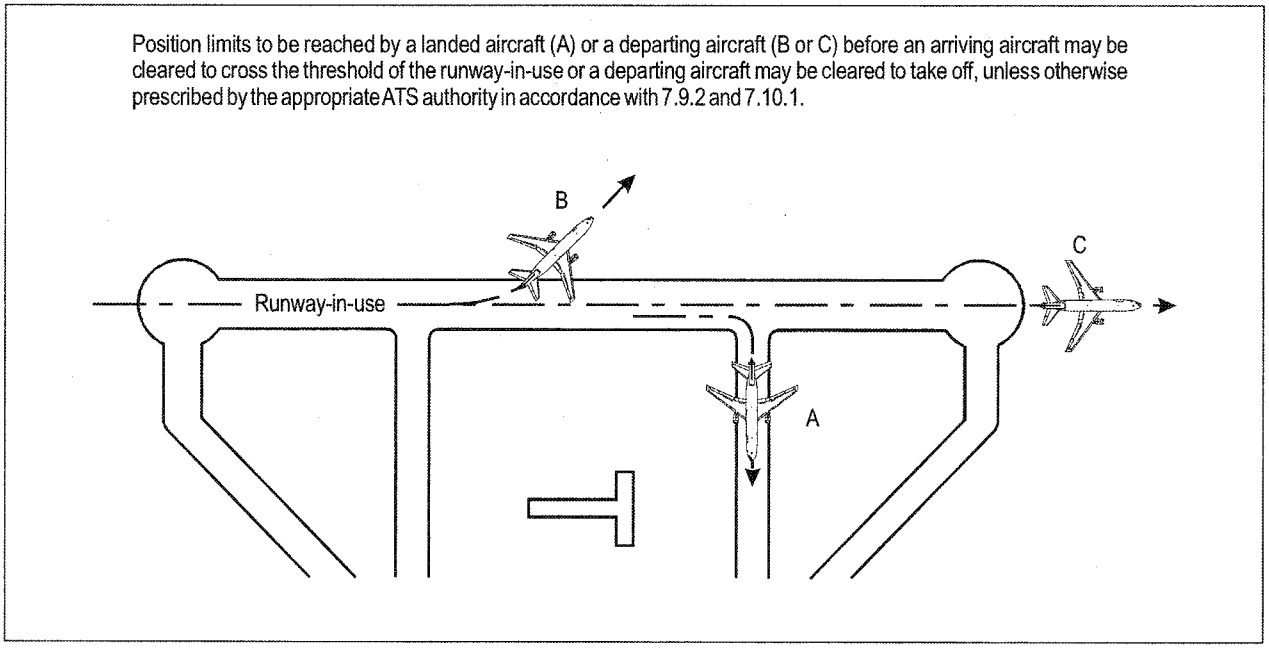



**Figure 7-3. Separation between departing and arriving aircraft (see 7.9.2 and 7.10.1)**

### 7.9.3 Take-off clearance

7.9.3.1 Take-off clearance may be issued to an aircraft when there is reasonable assurance that the separation in 7.9.2, or prescribed in accordance with 7.11, will exist when the aircraft commences take-off.

7.9.3.2 When an ATC clearance is required prior to take-off, the take-off clearance shall not be issued until the ATC clearance has been transmitted to and acknowledged by the aircraft concerned. The ATC clearance shall be forwarded to the aerodrome control tower with the least possible delay after receipt of a request made by the tower or prior to such request if practicable.

7.9.3.3 Subject to 7.9.3.2, the take-off clearance shall be issued when the aircraft is ready for take-off and at or approaching the departure runway, and the traffic situation permits. To reduce the potential for misunderstanding, the take-off clearance shall include the designator of the departure runway.

7.9.3.4 In the interest of expediting traffic, a clearance for immediate take-off may be issued to an aircraft before it enters the runway. On acceptance of such clearance the aircraft shall taxi out to the runway and take off in one continuous movement.

## 7.10 CONTROL OF ARRIVING AIRCRAFT

### 7.10.1 Separation of landing aircraft and preceding landing and departing aircraft using the same runway

Except as provided in 7.11 and Chapter 5, Section 5.8, a landing aircraft will not normally be permitted to cross the runway threshold on its final approach until the preceding departing aircraft has crossed the end of the runway-in-use, or has started a turn, or until all preceding landing aircraft are clear of the runway-in-use.

*Note 1.— See Figure 7-3.*

*Note 2.— Wake turbulence categories of aircraft and longitudinal separation minima are contained in Chapter 4, Section 4.9 and Chapter 5, Section 5.8, respectively.*

*Note 3.— See 7.6.3.1.2.2.*

### 7.10.2 Clearance to land

An aircraft may be cleared to land when there is reasonable assurance that the separation in 7.10.1, or prescribed in accordance with 7.11 will exist when the aircraft crosses the runway threshold, provided that a clearance to land shall not be issued until a preceding landing aircraft has crossed the runway threshold. To reduce the potential for misunderstanding, the landing clearance shall include the designator of the landing runway.

### 7.10.3 Landing and roll-out manoeuvres

7.10.3.1 When necessary or desirable in order to expedite traffic, a landing aircraft may be requested to:

a) hold short of an intersecting runway after landing;

b) land beyond the touchdown zone of the runway;

c) vacate the runway at a specified exit taxiway;

d) expedite vacating the runway.

7.10.3.2 In requesting a landing aircraft to perform a specific landing and/or roll-out manoeuvre, the type of aircraft, runway length, location of exit taxiways, reported braking action on runway and taxiway, and prevailing meteorological conditions shall be considered. A HEAVY aircraft shall not be requested to land beyond the touchdown zone of a runway.

7.10.3.3 If the pilot-in-command considers that he or she is unable to comply with the requested operation, the controller shall be advised without delay.

7.10.3.4 When necessary or desirable, e.g. due to low visibility conditions, a landing or a taxiing aircraft may be instructed to report when a runway has been vacated. The report shall be made when the entire aircraft is beyond the relevant runway-holding position.

## 7.11 REDUCED RUNWAY SEPARATION MINIMA BETWEEN AIRCRAFT USING THE SAME RUNWAY

7.11.1 Provided that an appropriate, documented safety assessment has shown that an acceptable level of safety can be met, lower minima than those in 7.9.2 and 7.10.1 may be prescribed by the appropriate ATS authority, after consultation with the operators. The safety assessment shall be carried out for each runway for which the reduced minima are intended, taking into account factors such as:

a) runway length;

b) aerodrome layout; and

c) types/categories of aircraft involved.

7.11.2 All applicable procedures related to the application of reduced runway separation minima shall be published in the Aeronautical Information Publication as well as in local air traffic control instructions. Controllers shall be provided with appropriate and adequate training in the use of the procedures.

7.11.3 Reduced runway separation minima shall only be applied during the hours of daylight from 30 minutes after local sunrise to 30 minutes before local sunset.

7.11.4 For the purpose of reduced runway separation, aircraft shall be classified as follows:

a) *Category 1 aircraft:* single-engine propeller aircraft with a maximum certificated take-off mass of 2 000 kg or less;

b) *Category 2 aircraft:* single-engine propeller aircraft with a maximum certificated take-off mass of more than 2 000 kg but less than 7 000 kg; and twin-engine propeller aircraft with a maximum certificated take-off mass of less than 7 000 kg;

c) *Category 3 aircraft:* all other aircraft.

7.11.5 Reduced runway separation minima shall not apply between a departing aircraft and a preceding landing aircraft.

7.11.6 Reduced runway separation minima shall be subject to the following conditions:

a) wake turbulence separation minima shall be applied;

b) visibility shall be at least 5 km and ceiling shall not be lower than 300 m (1 000 ft);

c) tailwind component shall not exceed 5 kt;

d) there shall be available means, such as suitable landmarks, to assist the controller in assessing the distances between aircraft. A surface surveillance system that provides the air traffic controller with position information on aircraft may be utilized, provided that approval for operational use of such equipment includes a safety assessment to ensure that all requisite operational and performance requirements are met;

e) minimum separation continues to exist between two departing aircraft immediately after take-off of the second aircraft;

f) traffic information shall be provided to the flight crew of the succeeding aircraft concerned; and

g) the braking action shall not be adversely affected by runway contaminants such as ice, slush, snow and water.

7.11.7 Reduced runway separation minima which may be applied at an aerodrome shall be determined for each separate runway. The separation to be applied shall in no case be less than the following minima:

a) landing aircraft:

1) a succeeding landing Category 1 aircraft may cross the runway threshold when the preceding aircraft is a Category 1 or 2 aircraft which either:

i) has landed and has passed a point at least 600 m from the threshold of the runway, is in motion and will vacate the runway without backtracking; or

ii) is airborne and has passed a point at least 600 m from the threshold of the runway;

2) a succeeding landing Category 2 aircraft may cross the runway threshold when the preceding aircraft is a Category 1 or 2 aircraft which either:

i) has landed and has passed a point at least 1 500 m from the threshold of the runway, is in motion and will vacate the runway without backtracking; or

ii) is airborne and has passed a point at least 1 500 m from the threshold of the runway;

3) a succeeding landing aircraft may cross the runway threshold when a preceding Category 3 aircraft:

i) has landed and has passed a point at least 2 400 m from the threshold of the runway, is in motion and will vacate the runway without backtracking; or

ii) is airborne and has passed a point at least 2 400 m from the threshold of the runway;

b) departing aircraft:

1) a Category 1 aircraft may be cleared for take-off when the preceding departing aircraft is a Category 1 or 2 aircraft which is airborne and has passed a point at least 600 m from the position of the succeeding aircraft;

2) a Category 2 aircraft may be cleared for take-off when the preceding departing aircraft is a Category 1 or 2 aircraft which is airborne and has passed a point at least 1 500 m from the position of the succeeding aircraft; and

3) an aircraft may be cleared for take-off when a preceding departing Category 3 aircraft is airborne and has passed a point at least 2 400 m from the position of the succeeding aircraft.

7.11.7.1 Consideration should be given to increased separation between high performance single-engine aircraft and preceding Category 1 or 2 aircraft.

## 7.12 PROCEDURES FOR LOW VISIBILITY OPERATIONS

### 7.12.1 Control of aerodrome surface traffic in conditions of low visibility

*Note.— These procedures apply whenever conditions are such that all or part of the manoeuvring area cannot be visually monitored from the control tower. Additional requirements which apply when category II/III approaches are being conducted are specified in Section 7.12.2.*

7.12.1.1 When there is a requirement for traffic to operate on the manoeuvring area in conditions of visibility which prevent the aerodrome control tower from applying visual separation between aircraft, and between aircraft and vehicles, the following shall apply:

7.12.1.1.1 At the intersection of taxiways, an aircraft or vehicle on a taxiway shall not be permitted to hold closer to the other taxiway than the holding position limit defined by a clearance bar, stop bar or taxiway intersection marking according to the specifications in Annex 14, Volume I, Chapter 5.

7.12.1.1.2 The longitudinal separation on taxiways shall be as specified for each particular aerodrome by the appropriate ATS authority. This separation shall take into account the characteristics of the aids available for surveillance and control of ground traffic, the complexity of the aerodrome layout and the characteristics of the aircraft using the aerodrome.

*Note.— The* Manual of Surface Movement Guidance and Control Systems (SMGCS) *(Doc 9476) provides guidance on surface movement guidance and control components and procedures for low visibility operations.*

### 7.12.2 Procedures for control of aerodrome traffic when category II/III approaches are in use

7.12.2.1 The appropriate ATS authority shall establish provisions applicable to the start and continuation of precision approach category II/III operations as well as departure operations in RVR conditions less than a value of 550 m.

7.12.3 Low visibility operations shall be initiated by or through the aerodrome control tower.

7.12.4 The aerodrome control tower shall inform the approach control unit concerned when procedures for precision approach category II/III and low visibility operations will be applied and also when such procedures are no longer in force.

7.12.5 Provisions regarding low visibility operations should specify:

a) the RVR value(s) at which the low visibility operations procedures shall be implemented;

b) the minimum ILS/MLS equipment requirements for category II/III operations;

c) other facilities and aids required for category II/III operations, including aeronautical ground lights, which shall be monitored for normal operation;

d) the criteria for and the circumstances under which downgrading of the ILS/MLS equipment from category II/III operations capability shall be made;

e) the requirement to report any relevant equipment failure and degradation, without delay, to the flight crews concerned, the approach control unit, and any other appropriate organization;

f) special procedures for the control of traffic on the manoeuvring area, including:

1) the runway-holding positions to be used;

2) the minimum distance between an arriving and a departing aircraft to ensure protection of the sensitive and critical areas;

3) procedures to verify that aircraft and vehicles have vacated the runway;

4) procedures applicable to the separation of aircraft and vehicles;

g) applicable spacing between successive approaching aircraft;

h) action(s) to be taken in the event low visibility operations need to be discontinued, e.g. due to equipment failures; and

i) any other relevant procedures or requirements.

*Note.— Further information regarding the requirements for low visibility operations can be found in the* Air Traffic Services Planning Manual *(Doc 9426) and the* All-Weather Operations Manual *(Doc 9365).*

7.12.6 The aerodrome control tower shall, prior to a period of application of low visibility procedures, establish a record of vehicles and persons currently on the manoeuvring area and maintain this record during the period of application of these procedures to assist in assuring the safety of operations on that area.

*Note.— See also 7.6.3.2.*

## 7.13 SUSPENSION OF VISUAL FLIGHT RULES OPERATIONS

7.13.1 Any or all VFR operations on and in the vicinity of an aerodrome may be suspended by any of the following units, persons or authorities whenever safety requires such action:

a) the approach control unit or the appropriate ACC;

b) the aerodrome control tower;

c) the appropriate ATS authority.

7.13.2 All such suspensions of VFR operations shall be accomplished through or notified to the aerodrome control tower.

7.13.3 The following procedures shall be observed by the aerodrome control tower whenever VFR operations are suspended:

a) hold all VFR departures;

b) recall all local flights operating under VFR or obtain approval for special VFR operations;

c) notify the approach control unit or ACC as appropriate of the action taken;

d) notify all operators, or their designated representatives, of the reason for taking such action, if necessary or requested.

## 7.14 AUTHORIZATION OF SPECIAL VFR FLIGHTS

7.14.1 When traffic conditions permit, special VFR flights may be authorized subject to the approval of the unit providing approach control service and the provisions of 7.14.1.3.

7.14.1.1 Requests for such authorization shall be handled individually.

7.14.1.2 Separation shall be effected between all IFR flights and special VFR flights in accordance with separation minima in Chapters 5 and 6 and, when so prescribed by the appropriate ATS authority, between all special VFR flights in accordance with separation minima prescribed by that authority.

7.14.1.3 When the ground visibility is not less than 1 500 m, special VFR flights may be authorized to: enter a control zone for the purpose of landing, take off and depart from a control zone, cross a control zone or operate locally within a control zone.

*Note.— Requirements for two-way communications between controlled flights and the appropriate air traffic control unit are contained in Annex 2, 3.6.5.*

## 7.15 AERONAUTICAL GROUND LIGHTS

### 7.15.1 Operation

*Note.— The procedures in this Section apply to all aerodromes, whether or not aerodrome control service is provided. In addition, the procedures in 7.15.2.1 apply to all aeronautical ground lights, whether or not they are on or in the vicinity of an aerodrome.*

### 7.15.2 General

7.15.2.1 All aeronautical ground lights shall be operated, except as provided in 7.15.2.2 and 7.15.3:

a) continuously during the hours of darkness or during the time the centre of the sun's disc is more than 6 degrees below the horizon, whichever requires the longer period of operation, unless otherwise provided hereafter or otherwise required for the control of air traffic;

b) at any other time when their use, based on meteorological conditions, is considered desirable for the safety of air traffic.

7.15.2.2 Lights on and in the vicinity of aerodromes that are not intended for en-route navigation purposes may be turned off, subject to further provisions hereafter, if no likelihood of either regular or emergency operation exists, provided that they can be again brought into operation at least one hour before the expected arrival of an aircraft.

7.15.2.3 At aerodromes equipped with lights of variable intensity a table of intensity settings, based on conditions of visibility and ambient light, should be provided for the guidance of air traffic controllers in effecting adjustment of these lights to suit the prevailing conditions. When so requested by an aircraft, further adjustment of the intensity shall be made whenever possible.

### 7.15.3 Approach lighting

*Note.— Approach lighting includes such lights as simple approach lighting systems, precision approach lighting systems, visual approach slope indicator systems, circling guidance lights, approach light beacons and runway alignment indicators.*

7.15.3.1 In addition to 7.15.2.1 approach lighting shall also be operated:

a) by day when requested by an approaching aircraft;

b) when the associated runway lighting is operated.

7.15.3.2 The lights of a visual approach slope indicator system shall be operated during the hours of daylight as well as of darkness and irrespective of the visibility conditions when the associated runway is being used.

### 7.15.4 Runway lighting

*Note.— Runway lighting includes such lights as edge, threshold, centre line, end, touchdown zone and wing bar lights.*

7.15.4.1 Runway lighting shall not be operated if that runway is not in use for landing, take-off or taxiing purposes, unless required for runway inspections or maintenance.

7.15.4.2 If runway lighting is not operated continuously, lighting following a take-off shall be provided as specified below:

a) at aerodromes where air traffic control service is provided and where lights are centrally controlled, the lights of one runway shall remain lighted after take-off as long as is considered necessary for the return of the aircraft due to an emergency occurring during or immediately after take-off;

b) at aerodromes without air traffic control service or without centrally controlled lights, the lights of one runway shall remain lighted until such time as would normally be required to reactivate the lights in the likelihood of the departing aircraft returning for an emergency landing, and in any case not less than fifteen minutes after take-off.

*Note.— Where obstacle lighting is operated simultaneously with runway lighting as provided in 7.15.8.1, particular care should be taken to ensure that it is not turned off until no longer required by the aircraft.*

### 7.15.5 Stopway lighting

Stopway lights shall be operated whenever the associated runway lights are operated.

### 7.15.6 Taxiway lighting

*Note.— Taxiway lighting includes such lights as edge lights, centre line lights, stop bars and clearance bars.*

Where required to provide taxi guidance, taxiway lighting shall be turned on in such order that a continuous indication of the taxi path is presented to taxiing aircraft. Taxiway lighting or any portion thereof may be turned off when no longer needed.

### 7.15.7 Stop bars

Stop bars shall be switched on to indicate that all traffic shall stop and switched off to indicate that traffic may proceed.

*Note.— Stop bars are located across taxiways at the point where it is desired that traffic stop, and consist of lights, showing red, spaced across the taxiway.*

### 7.15.8 Obstacle lighting

*Note.— Obstacle lighting includes such lights as obstacle and unserviceability lights and hazard beacons.*

7.15.8.1 Obstacle lighting associated with the approach to or departure from a runway or channel, where the obstacle does not project through the inner horizontal surface, as described in Annex 14, Volume I, Chapter 6, may be turned off and on simultaneously with the runway or channel lights.

7.15.8.2 Unserviceability lights may not be turned off as permitted under 7.15.2.2 while the aerodrome is open.

### 7.15.9 Monitoring of visual aids

7.15.9.1 Aerodrome controllers shall make use of automatic monitoring facilities, when provided, to ascertain whether the lighting is in good order and functioning according to selection.

7.15.9.2 In the absence of an automatic monitoring system or to supplement such a system, the aerodrome controller shall visually observe such lighting as can be seen from the aerodrome control tower and use information from other sources such as visual inspections or reports from aircraft to maintain awareness of the operational status of the visual aids.

7.15.9.3 On receipt of information indicating a lighting fault, the aerodrome controller shall take such action as is warranted to safeguard any affected aircraft or vehicles, and initiate action to have the fault rectified.

## 7.16 DESIGNATION OF HOT SPOT(S)

The aerodrome operator shall designate, whenever necessary, a location or several locations on the movement area of the aerodrome as hot spot(s). The hot spot(s) shall be charted in accordance with Annex 4, 13.6, 14.6, 15.6 and Appendix 2.

*Note.— Guidance material related to hot spots is contained in the* Manual on the Prevention of Runway Incursions *(Doc 9870).*

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# Chapter 8

# ATS SURVEILLANCE SERVICES

*Note.— ADS-contract (ADS-C), at this time used wholly to provide procedural separation, is covered in Chapter 13.*

## 8.1 ATS SURVEILLANCE SYSTEMS CAPABILITIES

8.1.1 ATS surveillance systems used in the provision of air traffic services shall have a very high level of reliability, availability and integrity. The possibility of system failures or significant system degradations which may cause complete or partial interruptions of service shall be very remote. Backup facilities shall be provided.

*Note 1.— An ATS surveillance system will normally consist of a number of integrated elements, including sensor(s), data transmission links, data-processing systems and situation displays.*

*Note 2.— Guidance material pertaining to use of radar and to system performance is contained in the* Manual on Testing of Radio Navigation Aids *(Doc 8071), the* Manual on the Secondary Surveillance Radar (SSR) Systems *(Doc 9684) and the* Air Traffic Services Planning Manual *(Doc 9426).*

*Note 3.— Guidance material pertaining to use of ADS-B and to system performance is contained in the* Assessment of ADS-B to Support Air Traffic Services and Guidelines for Implementation *(Cir 311).*

8.1.2 ATS surveillance systems should have the capability to receive, process and display, in an integrated manner, data from all the connected sources.

8.1.3 ATS surveillance systems should be capable of integration with other automated systems used in the provision of ATS, and should provide for an appropriate level of automation with the objectives of improving the accuracy and timeliness of data displayed to the controller and reducing controller workload and the need for verbal coordination between adjacent control positions and ATC units.

8.1.4 ATS surveillance systems should provide for the display of safety-related alerts and warnings, including conflict alert, minimum safe altitude warning, conflict prediction and unintentionally duplicated SSR codes and aircraft identification.

8.1.5 States should, to the extent possible, facilitate the sharing of information derived from ATS surveillance systems in order to extend and improve surveillance coverage in adjacent control areas.

8.1.6 States should, on the basis of regional air navigation agreements, provide for the automated exchange of coordination data relevant to aircraft being provided with ATS surveillance services, and establish automated coordination procedures.

8.1.7 ATS surveillance systems, such as primary surveillance radar (PSR), secondary surveillance radar (SSR) and automatic dependent surveillance — broadcast (ADS-B) may be used either alone or in combination in the provision of air traffic services, including in the provision of separation between aircraft, provided:

a) reliable coverage exists in the area;

b) the probability of detection, the accuracy and the integrity of the ATS surveillance system(s) are satisfactory; and

c) in the case of ADS-B, the availability of data from participating aircraft is adequate.

8.1.8 PSR systems should be used in circumstances where SSR and/or ADS-B alone would not meet the air traffic services requirements.

8.1.9 SSR systems, especially those utilizing monopulse technique or having Mode S capability, may be used alone, including in the provision of separation between aircraft, provided:

a) the carriage of SSR transponders is mandatory within the area; and

b) identification is established and maintained.

8.1.10 ADS-B shall only be used for the provision of air traffic control service provided the quality of the information contained in the ADS-B message exceeds the values specified by the appropriate ATS authority.

*Note.— An assessment of the use of ADS-B for the application of 9.3 km (5.0 NM) separation minimum has been performed based on a comparison of the technical characteristics of ADS-B and a single monopulse SSR. This comparison, including performance values, is contained in the* Assessment of ADS-B to Support Air Traffic Services and Guidelines for Implementation *(Cir 311).*

8.1.11 ADS-B may be used alone, including in the provision of separation between aircraft, provided:

a) identification of ADS-B-equipped aircraft is established and maintained;

b) the data integrity measure in the ADS-B message is adequate to support the separation minimum;

c) there is no requirement for detection of aircraft not transmitting ADS-B; and

d) there is no requirement for determination of aircraft position independent of the position-determining elements of the aircraft navigation system.

8.1.12 The provision of ATS surveillance services shall be limited to specified areas of coverage and shall be subject to such other limitations as have been specified by the appropriate ATS authority. Adequate information on the operating methods used shall be published in aeronautical information publications, as well as operating practices and/or equipment limitations having direct effects on the operation of the air traffic services.

*Note.— States will provide information on the area or areas where PSR, SSR and ADS-B are in use as well as ATS surveillance services and procedures in accordance with Annex 15, 4.1.1 and Appendix 1.*

8.1.12.1 The provision of ATS surveillance services shall be limited when position data quality degrades below a level specified by the appropriate ATS authority.

8.1.13 Where PSR and SSR are required to be used in combination, SSR alone may be used in the event of PSR failure to provide separation between identified transponder-equipped aircraft, provided the accuracy of the SSR position indications has been verified by monitor equipment or other means.

## 8.2 SITUATION DISPLAY

8.2.1 A situation display providing surveillance information to the controller shall, as a minimum, include position indications, map information required to provide ATS surveillance services and, where available, information concerning the identity of the aircraft and the aircraft level.

8.2.2 The ATS surveillance system shall provide for a continuously updated presentation of surveillance information, including position indications.

8.2.3 Position indications may be displayed as:

a) individual position symbols, e.g. PSR, SSR and ADS-B symbols, or combined symbols;

b) PSR blips;

c) SSR responses.

8.2.4 When applicable, distinct symbols should be used for presentation of:

a) unintentionally duplicated SSR codes and/or aircraft identification that are unintentionally duplicated;

b) predicted positions for a non-updated track; and

c) plot and track data.

8.2.5 Where surveillance data quality degrades such that services need to be limited, symbology or other means shall be used to provide the controller with an indication of the condition.

8.2.6 Reserved SSR codes, including 7500, 7600 and 7700, operation of IDENT, ADS-B emergency and/or urgency modes, safety-related alerts and warnings as well as information related to automated coordination shall be presented in a clear and distinct manner, providing for ease of recognition.

8.2.7 Labels associated with displayed targets should be used to provide, in alphanumeric form, relevant information derived from the means of surveillance and, where necessary, the flight data processing system.

8.2.8 Labels shall, as a minimum, include information relating to the identity of the aircraft, e.g. SSR code or aircraft identification and, if available, pressure-altitude-derived level information. This information may be obtained from SSR Mode A, SSR Mode C, SSR Mode S and/or ADS-B.

8.2.9 Labels shall be associated with their position indications in a manner precluding erroneous identification by or confusion on the part of the controller. All label information shall be presented in a clear and concise manner.

## 8.3 COMMUNICATIONS

8.3.1 The level of reliability and availability of communications systems shall be such that the possibility of system failures or significant degradations is very remote. Adequate backup facilities shall be provided.

*Note.— Guidance material and information pertaining to system reliability and availability are contained in Annex 10, Volume I, and the* Air Traffic Services Planning Manual *(Doc 9426).*

8.3.2 Direct pilot-controller communications shall be established prior to the provision of ATS surveillance services, unless special circumstances, such as emergencies, dictate otherwise.

## 8.4 PROVISION OF ATS SURVEILLANCE SERVICES

8.4.1 Information derived from ATS surveillance systems, including safety-related alerts and warnings such as conflict alert and minimum safe altitude warning, should be used to the extent possible in the provision of air traffic control service in order to improve capacity and efficiency as well as to enhance safety.

8.4.2 The number of aircraft simultaneously provided with ATS surveillance services shall not exceed that which can safely be handled under the prevailing circumstances, taking into account:

a) the structural complexity of the control area or sector concerned;

b) the functions to be performed within the control area or sector concerned;

c) assessments of controller workloads, taking into account different aircraft capabilities, and sector capacity; and

d) the degree of technical reliability and availability of the primary and backup communications, navigation and surveillance systems, both in the aircraft and on the ground.

## 8.5 USE OF SSR TRANSPONDERS AND ADS-B TRANSMITTERS

### 8.5.1 General

To ensure the safe and efficient use of SSR and ADS-B, pilots and controllers shall strictly adhere to published operating procedures and standard radiotelephony phraseology shall be used. The correct setting of transponder codes and/or aircraft identification shall be ensured at all times.

### 8.5.2 SSR code management

8.5.2.1 Codes 7700, 7600 and 7500 shall be reserved internationally for use by pilots encountering a state of emergency, radiocommunication failure or unlawful interference, respectively.

8.5.2.2 SSR codes are to be allocated and assigned in accordance with the following principles.

8.5.2.2.1 Codes should be allocated to States or areas in accordance with regional air navigation agreements, taking into account overlapping radar coverage over adjacent airspaces.

8.5.2.2.2 The appropriate ATS authority shall establish a plan and procedures for the allocation of codes to ATS units.

8.5.2.2.3 The plan and procedures should be compatible with those practised in adjacent States.

8.5.2.2.4 The allocation of a code should preclude the use of this code for any other function within the area of coverage of the same SSR for a prescribed time period.

8.5.2.2.5 To reduce pilot and controller workload and the need for controller/pilot communications, the number of code changes required of the pilot should be kept to the minimum.

8.5.2.2.6 Codes shall be assigned to aircraft in accordance with the plan and procedures laid down by the appropriate ATS authority.

8.5.2.2.7 Where there is a need for individual aircraft identification, each aircraft shall be assigned a discrete code which should, whenever possible, be retained throughout the flight.

8.5.2.2.8 Except for aircraft in a state of emergency, or during communication failure or unlawful interference situations, and unless otherwise agreed by regional air navigation agreement or between a transferring and an accepting ATC unit, the transferring unit shall assign Code A2000 to a controlled flight prior to transfer of communications.

8.5.2.3 SSR codes shall be reserved, as necessary, for exclusive use by medical aircraft operating in areas of international armed conflict. SSR codes shall be allocated by ICAO through its Regional Offices in coordination with States concerned and should be assigned to aircraft for use within the area of conflict.

*Note.— The term "medical aircraft" refers to aircraft protected under the Geneva Conventions of 1949 and under the Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the protection of victims of international armed conflicts (Protocol I).*

### 8.5.3 Operation of SSR transponders

*Note.— SSR transponder operating procedures are contained in* Procedures for Air Navigation Services — Aircraft Operations *(PANS-OPS, Doc 8168), Volume I, Part III, Section 3.*

8.5.3.1 When it is observed that the Mode A code shown on the situation display is different to what has been assigned to the aircraft, the pilot shall be requested to confirm the code selected and, if the situation warrants (e.g. not being a case of unlawful interference), to reselect the correct code.

8.5.3.2 If the discrepancy between assigned and displayed Mode A codes still persists, the pilot may be requested to stop the operation of the aircraft's transponder. The next control position and any other affected unit using SSR in the provision of ATS shall be informed accordingly.

8.5.3.3 Aircraft equipped with Mode S having an aircraft identification feature shall transmit the aircraft identification as specified in Item 7 of the ICAO flight plan or, when no flight plan has been filed, the aircraft registration.

*Note.— All Mode S-equipped aircraft engaged in international civil aviation are required to have an aircraft identification feature (Annex 10, Volume IV, Chapter 2, 2.1.5.2, refers).*

8.5.3.4 Whenever it is observed on the situation display that the aircraft identification transmitted by a Mode S-equipped aircraft is different from that expected from the aircraft, the pilot shall be requested to confirm and, if necessary, re-enter the correct aircraft identification.

8.5.3.5 If, following confirmation by the pilot that the correct aircraft identification has been set on the Mode S identification feature, the discrepancy continues to exist, the following actions shall be taken by the controller:

a) inform the pilot of the persistent discrepancy;

b) where possible, correct the label showing the aircraft identification on the situation display; and

c) notify the erroneous aircraft identification transmitted by the aircraft to the next control position and any other interested unit using Mode S for identification purposes.

### 8.5.4 Operation of ADS-B transmitters

*Note.— To indicate that it is in a state of emergency or to transmit other urgent information, an aircraft equipped with ADS-B might operate the emergency and/or urgency mode as follows:*

*a) emergency;*

*b) communication failure;*

*c) unlawful interference;*

*d) minimum fuel; and/or*

*e) medical.*

8.5.4.1 Aircraft equipped with ADS-B having an aircraft identification feature shall transmit the aircraft identification as specified in Item 7 of the ICAO flight plan or, when no flight plan has been filed, the aircraft registration.

8.5.4.2 Whenever it is observed on the situation display that the aircraft identification transmitted by an ADS-B-equipped aircraft is different from that expected from the aircraft, the pilot shall be requested to confirm and, if necessary, re-enter the correct aircraft identification.

8.5.4.3 If, following confirmation by the pilot that the correct aircraft identification has been set on the ADS-B identification feature, the discrepancy continues to exist, the following actions shall be taken by the controller:

a) inform the pilot of the persistent discrepancy;

b) where possible, correct the label showing the aircraft identification on the situation display; and

c) notify the next control position and any other unit concerned of the erroneous aircraft identification transmitted by the aircraft.

### 8.5.5 Level information based on the use of pressure-altitude information

#### 8.5.5.1 VERIFICATION OF LEVEL INFORMATION

8.5.5.1.1 The tolerance value used to determine that pressure-altitude-derived level information displayed to the controller is accurate shall be ±60 m (±200 ft) in RVSM airspace. In other airspace, it shall be ±90 m (±300 ft), except that the appropriate ATS authority may specify a smaller criterion, but not less than ±60 m (±200 ft), if this is found to be more practical. Geometric height information shall not be used for separation.

8.5.5.1.2 Verification of pressure-altitude-derived level information displayed to the controller shall be effected at least once by each suitably equipped ATC unit on initial contact with the aircraft concerned or, if this is not feasible, as soon as possible thereafter. The verification shall be effected by simultaneous comparison with altimeter-derived level information received from the same aircraft by radiotelephony. The pilot of the aircraft whose pressure-altitude-derived level information is within the approved tolerance value need not be advised of such verification. Geometric height information shall not be used to determine if altitude differences exist.

8.5.5.1.3 If the displayed level information is not within the approved tolerance value or when a discrepancy in excess of the approved tolerance value is detected subsequent to verification, the pilot shall be advised accordingly and requested to check the pressure setting and confirm the aircraft's level.

8.5.5.1.4 If, following confirmation of the correct pressure setting the discrepancy continues to exist, the following action should be taken according to circumstances:

a) request the pilot to stop Mode C or ADS-B altitude data transmission, provided this does not cause the loss of position and identity information, and notify the next control positions or ATC unit concerned with the aircraft of the action taken; or

b) inform the pilot of the discrepancy and request that the relevant operation continue in order to prevent loss of position and identity information of the aircraft and, when authorized by the appropriate ATS authority, override the label-displayed level information with the reported level. Notify the next control position or ATC unit concerned with the aircraft of the action taken.

8.5.5.2 DETERMINATION OF LEVEL OCCUPANCY

8.5.5.2.1 The criterion which shall be used to determine that a specific level is occupied by an aircraft shall be ±60 m (±200 ft) in RVSM airspace. In other airspace, it shall be ±90 m (±300 ft), except that the appropriate ATS authority may specify a smaller criterion, but not less than ±60 m (±200 ft), if this is found to be more practical.

*Note.— For a brief explanation of the considerations underlying this value, see the* Air Traffic Services Planning Manual *(Doc 9426).*

8.5.5.2.2 *Aircraft maintaining a level.* An aircraft is considered to be maintaining its assigned level as long as the pressure-altitude-derived level information indicates that it is within the appropriate tolerances of the assigned level, as specified in 8.5.5.2.1.

8.5.5.2.3 *Aircraft vacating a level.* An aircraft cleared to leave a level is considered to have commenced its manoeuvre and vacated the previously occupied level when the pressure-altitude-derived level information indicates a change of more than 90 m (300 ft) in the anticipated direction from its previously assigned level.

8.5.5.2.4 *Aircraft passing a level in climb or descent.* An aircraft in climb or descent is considered to have crossed a level when the pressure-altitude-derived level information indicates that it has passed this level in the required direction by more than 90 m (300 ft).

8.5.5.2.5 *Aircraft reaching a level.* An aircraft is considered to have reached the level to which it has been cleared when the elapsed time of three display updates, three sensor updates or 15 seconds, whichever is the greater, has passed since the pressure-altitude-derived level information has indicated that it is within the appropriate tolerances of the assigned level, as specified in 8.5.5.2.1.

8.5.5.2.6 Intervention by a controller shall only be required if differences in level information between that displayed to the controller and that used for control purposes are in excess of the values stated above.

## 8.6 GENERAL PROCEDURES

### 8.6.1 Performance checks

8.6.1.1 The controller shall adjust the situation display(s) and carry out adequate checks on the accuracy thereof, in accordance with the technical instructions prescribed by the appropriate authority for the equipment concerned.

8.6.1.2 The controller shall be satisfied that the available functional capabilities of the ATS surveillance system as well as the information presented on the situation display(s) is adequate for the functions to be performed.

8.6.1.3 The controller shall report, in accordance with local procedures, any fault in the equipment, or any incident requiring investigation, or any circumstances which make it difficult or impractical to provide ATS surveillance services.

### 8.6.2 Identification of aircraft

8.6.2.1 ESTABLISHMENT OF IDENTIFICATION

8.6.2.1.1 Before providing an ATS surveillance service to an aircraft, identification shall be established and the pilot informed. Thereafter, identification shall be maintained until termination of the ATS surveillance service.

8.6.2.1.2 If identification is subsequently lost, the pilot shall be informed accordingly and, when applicable, appropriate instructions issued.

8.6.2.1.3 Identification shall be established by at least one of the methods specified in 8.6.2.2, 8.6.2.3, 8.6.2.4 and 8.6.2.5.

### 8.6.2.2 ADS-B IDENTIFICATION PROCEDURES

Where ADS-B is used for identification, aircraft may be identified by one or more of the following procedures:

a) direct recognition of the aircraft identification in an ADS-B label;

b) transfer of ADS-B identification (see 8.6.3);

c) observation of compliance with an instruction to TRANSMIT ADS-B IDENT.

*Note.— In automated systems, the "IDENT" feature may be presented in different ways, e.g. as a flashing of all or part of the position indication and associated label.*

### 8.6.2.3 SSR IDENTIFICATION PROCEDURES

8.6.2.3.1 Where SSR is used for identification, aircraft may be identified by one or more of the following procedures:

a) recognition of the aircraft identification in a radar label;

*Note.— The use of this procedure requires that the code/call sign correlation is achieved successfully, taking into account the Note following b) below.*

b) recognition of an assigned discrete code, the setting of which has been verified, in a radar label; and

*Note.— The use of this procedure requires a system of code assignment which ensures that each aircraft in a given portion of airspace is assigned a discrete code (see 8.5.2.2.7).*

c) direct recognition of the aircraft identification of a Mode S-equipped aircraft in a radar label;

*Note.— The aircraft identification feature available in Mode S transponders provides the means to identify directly individual aircraft on situation displays and thus offers the potential to eliminate ultimately the recourse to Mode A discrete codes for individual identification. This elimination will only be achieved in a progressive manner depending on the state of deployment of suitable ground and airborne installations.*

d) by transfer of identification (see 8.6.3);

e) observation of compliance with an instruction to set a specific code;

f) observation of compliance with an instruction to squawk IDENT.

*Note 1.— In automated radar systems, the "IDENT" feature may be presented in different ways, e.g. as a flashing of all or part of the position indication and associated label.*

*Note 2.— Garbling of transponder replies may produce "IDENT"-type of indications. Nearly simultaneous "IDENT" transmissions within the same area may give rise to errors in identification.*

8.6.2.3.2 When a discrete code has been assigned to an aircraft, a check shall be made at the earliest opportunity to ensure that the code set by the pilot is identical to that assigned for the flight. Only after this check has been made shall the discrete code be used as a basis for identification.

### 8.6.2.4 PSR IDENTIFICATION PROCEDURES

8.6.2.4.1 Where PSR is used for identification, aircraft may be identified by one or more of the following procedures:

a) by correlating a particular radar position indication with an aircraft reporting its position over, or as bearing and distance from, a point shown on the situation display, and by ascertaining that the track of the particular radar position is consistent with the aircraft path or reported heading;

*Note 1.— Caution must be exercised when employing this method since a position reported in relation to a point may not coincide precisely with the radar position indication of the aircraft on the situation display. The appropriate ATS authority may, therefore, prescribe additional conditions for the application of this method, e.g.:*

*i) a level or levels above which this method may not be applied in respect of specified navigation aids; or*

*ii) a distance from the radar site beyond which this method may not be applied.*

*Note 2.— The term "a point" refers to a geographical point suitable for the purposes of identification. It is normally a reporting point defined by reference to a radio navigation aid or aids.*

b) by correlating an observed radar position indication with an aircraft which is known to have just departed, provided that the identification is established within 2 km (1 NM) from the end of the runway used. Particular care should be taken to avoid confusion with aircraft holding over or overflying the aerodrome, or with aircraft departing from or making a missed approach over adjacent runways;

c) by transfer of identification (see 8.6.3);

d) by ascertaining the aircraft heading, if circumstances require, and following a period of track observation:

— instructing the pilot to execute one or more changes of heading of 30 degrees or more and correlating the movements of one particular radar position indication with the aircraft's acknowledged execution of the instructions given; or

— correlating the movements of a particular radar position indication with manoeuvres currently executed by an aircraft having so reported.

When using these methods, the controller shall:

i) verify that the movements of not more than one radar position indication correspond with those of the aircraft; and

ii) ensure that the manoeuvre(s) will not carry the aircraft outside the coverage of the radar or the situation display.

*Note 1.— Caution must be exercised when employing these methods in areas where route changes normally take place.*

*Note 2.— With reference to ii) above, see also 8.6.5.1 regarding vectoring of controlled aircraft.*

8.6.2.4.2 Use may be made of direction-finding bearings to assist in identification of an aircraft. This method, however, shall not be used as the sole means of establishing identification, unless so prescribed by the appropriate ATS authority for particular cases under specified conditions.

8.6.2.5 ADDITIONAL IDENTIFICATION METHOD

When two or more position indications are observed in close proximity, or are observed to be making similar movements at the same time, or when doubt exists as to the identity of a position indication for any other reason, changes of heading should be prescribed or repeated as many times as necessary, or additional methods of identification should be employed, until all risk of error in identification is eliminated.

### 8.6.3 Transfer of identification

8.6.3.1 Transfer of identification from one controller to another should only be attempted when it is considered that the aircraft is within the accepting controller's surveillance coverage.

8.6.3.2 Transfer of identification shall be effected by one of the following methods:

a) designation of the position indication by automated means, provided that only one position indication is thereby indicated and there is no possible doubt of correct identification;

b) notification of the aircraft's discrete SSR code or aircraft address;

*Note 1.— The use of a discrete SSR code requires a system of code assignment which ensures that each aircraft in a given portion of airspace is assigned a discrete code (see 8.5.2.2.7).*

*Note 2.— Aircraft address would be expressed in the form of the alphanumerical code of six hexadecimal characters.*

c) notification that the aircraft is SSR Mode S-equipped with an aircraft identification feature when SSR Mode S coverage is available;

d) notification that the aircraft is ADS-B-equipped with an aircraft identification feature when compatible ADS-B coverage is available;

e) direct designation (pointing with the finger) of the position indication, if the two situation displays are adjacent, or if a common "conference" type of situation display is used;

*Note.— Attention must be given to any errors which might occur due to parallax effects.*

f) designation of the position indication by reference to, or in terms of bearing and distance from, a geographical position or navigational facility accurately indicated on both situation displays, together with the track of the observed position indication if the route of the aircraft is not known to both controllers;

*Note.— Caution must be exercised before transferring identification using this method, particularly if other position indications are observed on similar headings and in close proximity to the aircraft under control. Inherent radar deficiencies, such as inaccuracies in bearing and distance of the radar position indications displayed on individual situation displays and parallax errors, may cause the indicated position of an aircraft in relation to the known point to differ between the two situation displays. The appropriate ATS authority may, therefore, prescribe additional conditions for the application of this method, e.g.:*

*i) a maximum distance from the common reference point used by the two controllers; and*

*ii) a maximum distance between the position indication as observed by the accepting controller and the one stated by the transferring controller.*

g) where applicable, issuance of an instruction to the aircraft by the transferring controller to change SSR code and the observation of the change by the accepting controller; or

h) issuance of an instruction to the aircraft by the transferring controller to squawk/transmit IDENT and observation of this response by the accepting controller.

*Note.— Use of procedures g) and h) requires prior coordination between the controllers, since the indications to be observed by the accepting controller are of short duration.*

### 8.6.4 Position information

8.6.4.1 An aircraft provided with ATS surveillance service should be informed of its position in the following circumstances:

a) upon identification, except when the identification is established:

i) based on the pilot's report of the aircraft position or within one nautical mile of the runway upon departure and the observed position on the situation display is consistent with the aircraft's time of departure; or

ii) by use of ADS-B aircraft identification, SSR Mode S aircraft identification or assigned discrete SSR codes and the location of the observed position indication is consistent with the current flight plan of the aircraft; or

iii) by transfer of identification;

b) when the pilot requests this information;

c) when a pilot's estimate differs significantly from the controller's estimate based on the observed position;

d) when the pilot is instructed to resume own navigation after vectoring if the current instructions had diverted the aircraft from a previously assigned route (see 8.6.5.5);

e) immediately before termination of ATS surveillance service, if the aircraft is observed to deviate from its intended route.

8.6.4.2 Position information shall be passed to aircraft in one of the following forms:

a) as a well-known geographical position;

b) magnetic track and distance to a significant point, an en-route navigation aid, or an approach aid;

c) direction (using points of the compass) and distance from a known position;

d) distance to touchdown, if the aircraft is on final approach; or

e) distance and direction from the centre line of an ATS route.

8.6.4.3 Whenever practicable, position information shall relate to positions or routes pertinent to the navigation of the aircraft concerned and shown on the situation display map.

8.6.4.4 When so informed, the pilot may omit position reports at compulsory reporting points or report only over those reporting points specified by the air traffic services unit concerned, including points at which air-reports are required for meteorological purposes. Unless automated position reporting is in effect (e.g. ADS-C), pilots shall resume voice or CPDLC position reporting:

a) when so instructed;

b) when advised that the ATS surveillance service has been terminated; or

c) when advised that identification is lost.

### 8.6.5 Vectoring

8.6.5.1 Vectoring shall be achieved by issuing to the pilot specific headings which will enable the aircraft to maintain the desired track. When vectoring an aircraft, a controller shall comply with the following:

a) whenever practicable, the aircraft shall be vectored along tracks on which the pilot can monitor the aircraft position with reference to pilot-interpreted navigation aids (this will minimize the amount of navigational assistance required and alleviate the consequences resulting from an ATS surveillance system failure);

b) when an aircraft is given its initial vector diverting it from a previously assigned route, the pilot shall be informed what the vector is to accomplish, and the limit of the vector shall be specified (e.g. to ... position, for ... approach);

c) except when transfer of control is to be effected, aircraft shall not be vectored closer than 4.6 km (2.5 NM) or, where the minimum permissible separation is greater than 9.3 km (5 NM), a distance equivalent to one-half of the prescribed separation minimum, from the limit of the airspace for which the controller is responsible, unless local arrangements have been made to ensure that separation will exist with aircraft operating in adjoining areas;

d) controlled flights shall not be vectored into uncontrolled airspace except in the case of emergency or in order to circumnavigate adverse meteorological conditions (in which case the pilot should be so informed), or at the specific request of the pilot; and

e) when an aircraft has reported unreliable directional instruments, the pilot shall be requested, prior to the issuance of manoeuvring instructions, to make all turns at an agreed rate and to carry out the instructions immediately upon receipt.

8.6.5.2 When vectoring an IFR flight and when giving an IFR flight a direct routing which takes the aircraft off an ATS route, the controller shall issue clearances such that the prescribed obstacle clearance will exist at all times until the aircraft reaches the point where the pilot will resume own navigation. When necessary, the relevant minimum vectoring altitude shall include a correction for low temperature effect.

*Note 1.— When an IFR flight is being vectored, the pilot may be unable to determine the aircraft's exact position in respect to obstacles in this area and consequently the altitude which provides the required obstacle clearance. Detailed obstacle clearance criteria are contained in PANS-OPS (Doc 8168), Volumes I and II. See also 8.6.8.2.*

*Note 2.— It is the responsibility of the ATS authority to provide the controller with minimum altitudes corrected for temperature effect.*

8.6.5.3 Whenever possible, minimum vectoring altitudes should be sufficiently high to minimize activation of aircraft ground proximity warning systems.

*Note.— Activation of such systems will induce aircraft to pull up immediately and climb steeply to avoid hazardous terrain, possibly compromising separation between aircraft.*

8.6.5.4 States shall encourage operators to report incidents involving activations of aircraft ground proximity warning systems so that their locations can be identified and altitude, routing and/or aircraft operating procedures can be altered to prevent recurrences.

8.6.5.5 In terminating vectoring of an aircraft, the controller shall instruct the pilot to resume own navigation, giving the pilot the aircraft's position and appropriate instructions, as necessary, in the form prescribed in 8.6.4.2 b), if the current instructions had diverted the aircraft from a previously assigned route.

### 8.6.6 Navigation assistance

8.6.6.1 An identified aircraft observed to deviate significantly from its intended route or designated holding pattern shall be advised accordingly. Appropriate action shall also be taken if, in the opinion of the controller, such deviation is likely to affect the service being provided.

8.6.6.2 The pilot of an aircraft requesting navigation assistance from an air traffic control unit providing ATS surveillance services shall state the reason (e.g. to avoid areas of adverse weather or unreliable navigational instruments) and shall give as much information as possible in the circumstances.

### 8.6.7 Interruption or termination of ATS surveillance service

8.6.7.1 An aircraft which has been informed that it is provided with ATS surveillance service should be informed immediately when, for any reason, the service is interrupted or terminated.

*Note.— The transition of an aircraft across adjoining areas of radar and/or ADS-B coverage will not normally constitute an interruption or termination of the ATS surveillance service.*

8.6.7.2 When the control of an identified aircraft is to be transferred to a control sector that will provide the aircraft with procedural separation, the transferring controller shall ensure that appropriate procedural separation is established between that aircraft and any other controlled aircraft before the transfer is effected.

### 8.6.8 Minimum levels

8.6.8.1 The controller shall at all times be in possession of full and up-to-date information regarding:

a) established minimum flight altitudes within the area of responsibility;

b) the lowest usable flight level or levels determined in accordance with Chapters 4 and 5; and

c) established minimum altitudes applicable to procedures based on tactical vectoring.

8.6.8.2 Unless otherwise specified by the appropriate ATS authority, minimum altitudes for procedures based on tactical vectoring with any ATS surveillance system shall be determined using the criteria applicable to tactical radar vectoring.

*Note.— Criteria for the determination of minimum altitudes applicable to procedures based on tactical radar vectoring are contained in* Procedures for Air Navigation Services — Aircraft Operations *(PANS-OPS, Doc 8168), Volume II.*

### 8.6.9 Information regarding adverse weather

8.6.9.1 Information that an aircraft appears likely to penetrate an area of adverse weather should be issued in sufficient time to permit the pilot to decide on an appropriate course of action, including that of requesting advice on how best to circumnavigate the adverse weather area, if so desired.

*Note.— Depending on the capabilities of the ATS surveillance system, areas of adverse weather may not be presented on the situation display. An aircraft's weather radar will normally provide better detection and definition of adverse weather than radar sensors in use by ATS.*

8.6.9.2 In vectoring an aircraft for circumnavigating any area of adverse weather, the controller should ascertain that the aircraft can be returned to its intended or assigned flight path within the coverage of the ATS surveillance system and, if this does not appear possible, inform the pilot of the circumstances.

*Note.— Attention must be given to the fact that under certain circumstances the most active area of adverse weather may not be displayed.*

### 8.6.10 Reporting of significant meteorological information to meteorological offices

Although a controller is not required to keep a special watch for heavy precipitation, etc., information on the position, intensity, extent and movement of significant meteorological conditions (i.e. heavy showers or well-defined frontal surfaces) as observed on situation displays should, when practicable, be reported to the associated meteorological office.

## 8.7 USE OF ATS SURVEILLANCE SYSTEMS IN THE AIR TRAFFIC CONTROL SERVICE

*Note.— The procedures in this Section are general procedures applicable when an ATS surveillance system is used in the provision of area control service or approach control service. Additional procedures applicable in the provision of approach control service are detailed in Section 8.9.*

### 8.7.1 Functions

The information provided by ATS surveillance systems and presented on a situation display may be used to perform the following functions in the provision of air traffic control service:

a) provide ATS surveillance services as necessary in order to improve airspace utilization, reduce delays, provide for direct routings and more optimum flight profiles, as well as to enhance safety;

b) provide vectoring to departing aircraft for the purpose of facilitating an expeditious and efficient departure flow and expediting climb to cruising level;

c) provide vectoring to aircraft for the purpose of resolving potential conflicts;

d) provide vectoring to arriving aircraft for the purpose of establishing an expeditious and efficient approach sequence;

e) provide vectoring to assist pilots in their navigation, e.g. to or from a radio navigation aid, away from or around areas of adverse weather;

f) provide separation and maintain normal traffic flow when an aircraft experiences communication failure within the area of coverage;

g) maintain flight path monitoring of air traffic;

*Note.— Where tolerances regarding such matters as adherence to track, speed or time have been prescribed by the appropriate ATS authority, deviations are not considered significant until such tolerances are exceeded.*

h) when applicable, maintain a watch on the progress of air traffic, in order to provide a procedural controller with:

i) improved position information regarding aircraft under control;

ii) supplementary information regarding other traffic; and

iii) information regarding any significant deviations by aircraft from the terms of their respective air traffic control clearances, including their cleared routes as well as levels, when appropriate.

### 8.7.2 Separation application

*Note.— Factors which the controller using an ATS surveillance system must take into account in determining the spacing to be applied in particular circumstances in order to ensure that the separation minimum is not infringed include aircraft relative headings and speeds, ATS surveillance system technical limitations, controller workload and any difficulties caused by communication congestion. Guidance material on this subject is contained in the* Air Traffic Services Planning Manual *(Doc 9426).*

8.7.2.1 Except as provided for in 8.7.2.8, 8.7.2.9 and 8.8.2.2, the separation minima specified in 8.7.3 shall only be applied between identified aircraft when there is reasonable assurance that identification will be maintained.

8.7.2.2 When control of an identified aircraft is to be transferred to a control sector that will provide the aircraft with procedural separation, such separation shall be established by the transferring controller before the aircraft reaches the limits of the transferring controller's area of responsibility, or before the aircraft leaves the relevant area of surveillance coverage.

8.7.2.3 When authorized by the appropriate ATS authority, separation based on the use of ADS-B, SSR and/or PSR position symbols and/or PSR blips shall be applied so that the distance between the centres of the position symbols and/or PSR blips, representing the positions of the aircraft concerned, is never less than a prescribed minimum.

8.7.2.4 Separation based on the use of PSR blips and SSR responses shall be applied so that the distance between the centre of the PSR blip and the nearest edge of the SSR response (or centre, when authorized by the appropriate ATS authority) is never less than a prescribed minimum.

8.7.2.5 Separation based on the use of ADS-B position symbols and SSR responses shall be applied so that the distance between the centre of the ADS-B position symbol and the nearest edge of the SSR response (or the centre, when authorized by the appropriate ATS authority) is never less than a prescribed minimum.

8.7.2.6 Separation based on the use of SSR responses shall be applied so that the distance between the closest edges of the SSR responses (of the centres, when authorized by the appropriate ATS authority) is never less than a prescribed minimum.

8.7.2.7 In no circumstances shall the edges of the position indications touch or overlap unless vertical separation is applied between the aircraft concerned, irrespective of the type of position indication displayed and separation minimum applied.

8.7.2.8 In the event that the controller has been notified of a controlled flight entering or about to enter the airspace within which the separation minima specified in 8.7.3 is applied, but has not identified the aircraft, the controller may, if so prescribed by the appropriate ATS authority, continue to provide an ATS surveillance service to identified aircraft provided that:

a) reasonable assurance exists that the unidentified controlled flight will be identified using SSR or ADS-B or the flight is being operated by an aircraft of a type which may be expected to give an adequate return on primary radar in the airspace within which the separation is applied; and

b) the separation is maintained between identified flights and any other observed ADS-B and/or radar position indications until either the unidentified controlled flight has been identified or procedural separation has been established.

8.7.2.9 The separation minima specified in 8.7.3 may be applied between an aircraft taking off and a preceding departing aircraft or other identified traffic provided there is reasonable assurance that the departing aircraft will be identified within 2 km (1 NM) from the end of the runway, and that, at the time, the required separation will exist.

8.7.2.10 The separation minima specified in 8.7.3 shall not be applied between aircraft holding over the same holding fix. Application of separation minima based on radar and/or ADS-B between holding aircraft and other flights shall be subject to requirements and procedures prescribed by the appropriate ATS authority.

### 8.7.3 Separation minima based on ATS surveillance systems

8.7.3.1 Unless otherwise prescribed in accordance with 8.7.3.2 (with respect to radar), 8.7.3.3 or 8.7.3.4, or Chapter 6 (with respect to independent and dependent parallel approaches), the horizontal separation minimum based on radar and/or ADS-B shall be 9.3 km (5.0 NM).

8.7.3.2 The radar separation minimum in 8.7.3.1 may, if so prescribed by the appropriate ATS authority, be reduced, but not below:

a) 5.6 km (3.0 NM) when radar capabilities at a given location so permit; and

b) 4.6 km (2.5 NM) between succeeding aircraft which are established on the same final approach track within 18.5 km (10 NM) of the runway end. A reduced separation minimum of 4.6 km (2.5 NM) may be applied, provided:

   i) the average runway occupancy time of landing aircraft is proven, by means such as data collection and statistical analysis and methods based on a theoretical model, not to exceed 50 seconds;

   ii) braking action is reported as good and runway occupancy times are not adversely affected by runway contaminants such as slush, snow or ice;

   iii) a radar system with appropriate azimuth and range resolution and an update rate of 5 seconds or less is used in combination with suitable radar displays;

   iv) the aerodrome controller is able to observe, visually or by means of surface movement radar (SMR) or a surface movement guidance and control system (SMCGS), the runway-in-use and associated exit and entry taxiways;

v) distance-based wake turbulence separation minima in 8.7.3.4, or as may be prescribed by the appropriate ATS authority (e.g. for specific aircraft types), do not apply;

vi) aircraft approach speeds are closely monitored by the controller and when necessary adjusted so as to ensure that separation is not reduced below the minimum;

vii) aircraft operators and pilots have been made fully aware of the need to exit the runway in an expeditious manner whenever the reduced separation minimum on final approach is applied; and

viii) procedures concerning the application of the reduced minimum are published in AIPs.

8.7.3.3 The separation minimum or minima based on radar and/or ADS-B to be applied shall be prescribed by the appropriate ATS authority according to the capability of the particular ADS-B or radar system or sensor to accurately identify the aircraft position in relation to the centre of a position symbol, PSR blip, SSR response and taking into account factors which may affect the accuracy of the ADS-B and/or radar-derived information, such as aircraft range from the radar site and the range scale of the situation display in use.

8.7.3.4 The following distance-based wake turbulence separation minima shall be applied to aircraft being provided with an ATS surveillance service in the approach and departure phases of flight in the circumstances given in 8.7.3.4.1.

| *Aircraft category* | | |
|---|---|---|
| *Preceding aircraft* | *Succeeding aircraft* | *Distance-based wake turbulence separation minima* |
| HEAVY | HEAVY | 7.4 km (4.0 NM) |
| | MEDIUM | 9.3 km (5.0 NM) |
| | LIGHT | 11.1 km (6.0 NM) |
| MEDIUM | LIGHT | 9.3 km (5.0 NM) |

*Note.— The provisions governing wake turbulence aircraft categorization are set forth in Chapter 4, Section 4.9.*

8.7.3.4.1 The minima set out in 8.7.3.4 shall be applied when:

a) an aircraft is operating directly behind another aircraft at the same altitude or less than 300 m (1 000 ft) below; or

b) both aircraft are using the same runway, or parallel runways separated by less than 760 m (2 500 ft); or

c) an aircraft is crossing behind another aircraft, at the same altitude or less than 300 m (1 000 ft) below.

*Note.— See Figures 8-1A and 8-1B.*

### 8.7.4 Transfer of control

8.7.4.1 Where an ATS surveillance service is being provided, transfer of control should be effected, whenever practicable, so as to enable the uninterrupted provision of the ATS surveillance service.

8.7.4.2 Where SSR and/or ADS-B is used and the display of position indications with associated labels is provided for, transfer of control of aircraft between adjacent control positions or between adjacent ATC units may be effected without prior coordination, provided that:

a) updated flight plan information on the aircraft about to be transferred, including the discrete assigned SSR code or, with respect to SSR Mode S and ADS-B, the aircraft identification, is provided to the accepting controller prior to transfer;

b) ADS-B or radar coverage provided to the accepting controller is such that the aircraft concerned is presented on the situation display before the transfer is effected and is identified on, but preferably before, receipt of the initial call;

c) when the controllers are not physically adjacent, two-way direct speech facilities, which permit communications to be established instantaneously, are available between them at all times;

*Note.— "Instantaneous" refers to communications which effectively provide for immediate access between controllers.*

d) the transfer point or points and all other conditions of application, such as direction of flight, specified levels, transfer of communication points, and especially an agreed minimum separation between aircraft, including that applicable to succeeding aircraft on the same route, about to be transferred as observed on the situation display, have been made the subject of specific instructions (for intra-unit transfer) or of a specific letter of agreement between two adjacent ATC units;

e) the instructions or letter of agreement specify explicitly that the application of this type of transfer of control may be terminated at any time by the accepting controller, normally with an agreed advance notice;

f) the accepting controller is informed of any level, speed or vectoring instructions given to the aircraft prior to its transfer and which modify its anticipated flight progress at the point of transfer.

8.7.4.3 The minimum agreed separation between aircraft about to be transferred (8.7.4.2 d) refers) and the advance notice (8.7.4.2 e) refers) shall be determined taking into account all relevant technical, operational and other circumstances. If circumstances arise in which these agreed conditions can no longer be satisfied, controllers shall revert to the procedure in 8.7.4.4 until the situation is resolved.

8.7.4.4 Where primary radar is being used, and where SSR and/or ADS-B is employed but the provisions of 8.7.4.2 are not applied, the transfer of control of aircraft between adjacent control positions or between two adjacent ATS units may be effected, provided that:

a) identification has been transferred to or has been established directly by the accepting controller;

b) when the controllers are not physically adjacent, two-way direct-speech facilities between them are at all times available which permit communications to be established instantaneously;

c) separation from other controlled flights conforms to the minima authorized for use during transfer of control between the sectors or units concerned;

d) the accepting controller is informed of any level, speed or vectoring instructions applicable to the aircraft at the point of transfer;

e) radiocommunication with the aircraft is retained by the transferring controller until the accepting controller has agreed to assume responsibility for providing the ATS surveillance service to the aircraft. Thereafter, the aircraft should be instructed to change over to the appropriate channel and from that point is the responsibility of the accepting controller.

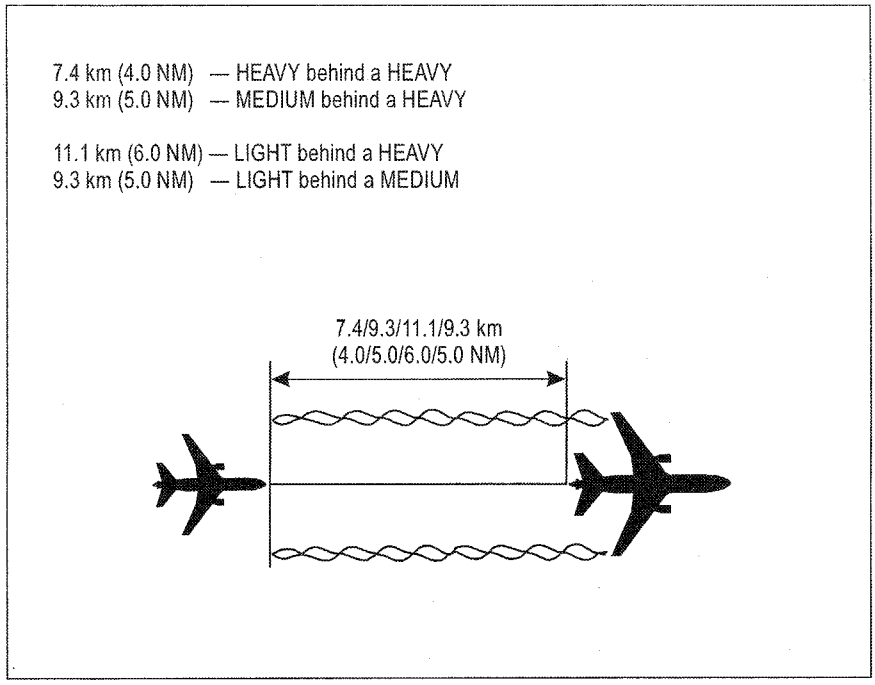


**Figure 8-1A. Operating directly behind (see 8.7.3.4 and 8.7.3.4.1)**

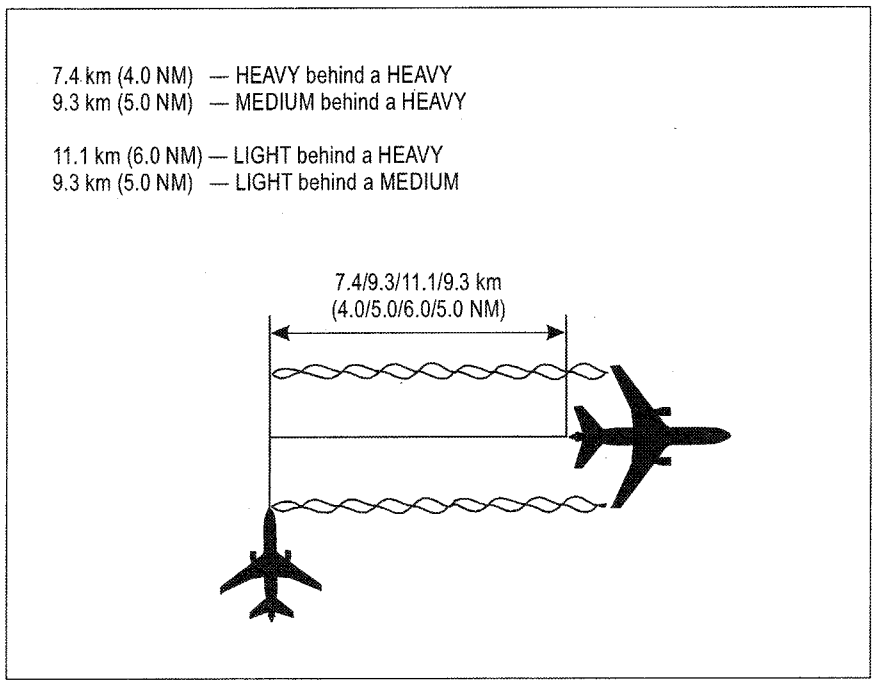


**Figure 8-1B. Crossing behind (see 8.7.3.4 and 8.7.3.4.1)**

### 8.7.5 Speed control

Subject to conditions specified by the appropriate ATS authority, including consideration of aircraft performance limitations, a controller may, in order to facilitate sequencing or to reduce the need for vectoring, request aircraft to adjust their speed in a specified manner.

*Note.— Procedures for speed control instructions are contained in Chapter 4, Section 4.6.*

## 8.8 EMERGENCIES, HAZARDS AND EQUIPMENT FAILURES

*Note.— See also Chapter 15.*

### 8.8.1 Emergencies

8.8.1.1 In the event of an aircraft in, or appearing to be in, any form of emergency, every assistance shall be provided by the controller, and the procedures prescribed herein may be varied according to the situation.

8.8.1.2 The progress of an aircraft in emergency shall be monitored and (whenever possible) plotted on the situation display until the aircraft passes out of coverage of the ATS surveillance system, and position information shall be provided to all air traffic services units which may be able to give assistance to the aircraft. Transfer to adjacent sectors shall also be effected when appropriate.

*Note.— If the pilot of an aircraft encountering a state of emergency has previously been directed by ATC to select a specific transponder code and/or an ADS-B emergency mode, that code/mode will normally be maintained unless, in special circumstances, the pilot has decided or has been advised otherwise. Where ATC has not requested a code or emergency mode to be set, the pilot will set the transponder to Mode A Code 7700 and/or the appropriate ADS-B emergency mode.*

### 8.8.2 Collision hazard information

8.8.2.1 When an identified controlled flight is observed to be on a conflicting path with an unknown aircraft deemed to constitute a collision hazard, the pilot of the controlled flight shall, whenever practicable:

a) be informed of the unknown aircraft, and if so requested by the controlled flight or if, in the opinion of the controller, the situation warrants, a course of avoiding action should be suggested; and

b) be notified when the conflict no longer exists.

8.8.2.2 When an identified IFR flight operating outside controlled airspace is observed to be on a conflicting path with another aircraft, the pilot should:

a) be informed as to the need for collision avoidance action to be initiated, and if so requested by the pilot or if, in the opinion of the controller, the situation warrants, a course of avoiding action should be suggested; and

b) be notified when the conflict no longer exists.

8.8.2.3 Information regarding traffic on a conflicting path should be given, whenever practicable, in the following form:

a) relative bearing of the conflicting traffic in terms of the 12-hour clock;

b) distance from the conflicting traffic in kilometres (nautical miles);

c) direction in which the conflicting traffic appears to be proceeding;

d) level and type of aircraft or, if unknown, relative speed of the conflicting traffic, e.g. slow or fast.

8.8.2.4 Pressure-altitude-derived level information, even when unverified, should be used in the provision of collision hazard information because such information, particularly if available from an otherwise unknown aircraft (e.g. a VFR flight) and given to the pilot of a known aircraft, could facilitate the location of a collision hazard.

8.8.2.4.1 When the pressure-altitude-derived level information has been verified, the information shall be passed to pilots in a clear and unambiguous manner. If the level information has not been verified, the accuracy of the information should be considered uncertain and the pilot shall be informed accordingly.

### 8.8.3 Failure of equipment

#### 8.8.3.1 AIRCRAFT RADIO TRANSMITTER FAILURE

8.8.3.1.1 If two-way communication is lost with an aircraft, the controller should determine whether or not the aircraft's receiver is functioning by instructing the aircraft on the channel so far used to acknowledge by making a specified manoeuvre and by observing the aircraft's track, or by instructing the aircraft to operate IDENT or to make SSR code and/or ADS-B transmission changes.

*Note 1.— Transponder-equipped aircraft experiencing radiocommunication failure will operate the transponder on Mode A Code 7600.*

*Note 2.— ADS-B-equipped aircraft experiencing radiocommunication failure may transmit the appropriate ADS-B emergency and/or urgency mode.*

8.8.3.1.2 If the action prescribed in 8.8.3.1.1 is unsuccessful, it shall be repeated on any other available channel on which it is believed that the aircraft might be listening.

8.8.3.1.3 In both the cases covered by 8.8.3.1.1 and 8.8.3.1.2, any manoeuvring instructions shall be such that the aircraft would regain its current cleared track after having complied with the instructions received.

8.8.3.1.4 Where it has been established by the action in 8.8.3.1.1 that the aircraft's radio receiver is functioning, continued control can be effected using SSR code/ADS-B transmission changes or IDENT transmissions to obtain acknowledgement of clearances issued to the aircraft.

#### 8.8.3.2 COMPLETE AIRCRAFT COMMUNICATION FAILURE

When a controlled aircraft experiencing complete communication failure is operating or expected to operate in an area and at flight levels where an ATS surveillance service is applied, separation specified in 8.7.3 may continue to be used. However, if the aircraft experiencing the communication failure is not identified, separation shall be applied between identified aircraft and all unidentified aircraft observed along the expected route of the aircraft with the communication failure, until such time as it is known, or can safely be assumed, that the aircraft with radiocommunication failure has passed through the airspace concerned, has landed, or has proceeded elsewhere.

#### 8.8.3.3 AIRCRAFT TRANSPONDER FAILURE IN AREAS WHERE THE CARRIAGE OF A FUNCTIONING TRANSPONDER IS MANDATORY

8.8.3.3.1 When an aircraft experiencing transponder failure after departure is operating or expected to operate in an area where the carriage of a functioning transponder with specified capabilities is mandatory, the ATC units concerned should endeavour to provide for continuation of the flight to the aerodrome of first intended landing in accordance with the flight plan. However, in certain traffic situations, either in terminal areas or en-route, continuation of the flight may not be possible, particularly when failure is detected shortly after take-off. The aircraft may then be required to return to the departure aerodrome or to land at the nearest suitable aerodrome acceptable to the operator concerned and to ATC.

8.8.3.3.2 In case of a transponder failure which is detected before departure from an aerodrome where it is not practicable to effect a repair, the aircraft concerned should be permitted to proceed, as directly as possible, to the nearest suitable aerodrome where repair can be made. When granting clearance to such aircraft, ATC should take into consideration the existing or anticipated traffic situation and may have to modify the time of departure, flight level or route of the intended flight. Subsequent adjustments may become necessary during the course of the flight.

### 8.8.4 ATS surveillance system failure

8.8.4.1 In the event of complete failure of the ATS surveillance system where air-ground communications remain, the controller shall plot the positions of all aircraft already identified, take the necessary action to establish procedural separation between the aircraft and, if necessary, limit the number of aircraft permitted to enter the area.

8.8.4.2 As an emergency measure, use of flight levels spaced by half the applicable vertical separation minimum may be resorted to temporarily if standard procedural separation cannot be provided immediately.

### 8.8.5 Degradation of aircraft position source data

In order to reduce the impact of a degradation of aircraft position source data, for example, a receiver autonomous integrity monitoring (RAIM) outage for GNSS, the appropriate ATS authority shall establish contingency procedures to be followed by control positions and ATC units in the event of data degradation.

### 8.8.6 Ground radio failure

8.8.6.1 In the event of complete failure of the ground radio equipment used for control, the controller shall, unless able to continue to provide the ATS surveillance service by means of other available communication channels, proceed as follows:

a) without delay inform all adjacent control positions or ATC units, as applicable, of the failure;

b) apprise such positions or units of the current traffic situation;

c) request their assistance, in respect of aircraft which may establish communications with those positions or units, in establishing and maintaining separation between such aircraft; and

d) instruct adjacent control positions or ATC units to hold or re-route all controlled flights outside the area of responsibility of the position or ATC unit that has experienced the failure until such time that the provision of normal services can be resumed.

8.8.6.2 In order to reduce the impact of complete ground radio equipment failure on the safety of air traffic, the appropriate ATS authority should establish contingency procedures to be followed by control positions and ATC units in

the event of such failures. Where feasible and practicable, such contingency procedures should provide for the delegation of control to an adjacent control position or ATC unit in order to permit a minimum level of services to be provided as soon as possible, following the ground radio failure and until normal operations can be resumed.

## 8.9 USE OF ATS SURVEILLANCE SYSTEMS IN THE APPROACH CONTROL SERVICE

### 8.9.1 General provisions

8.9.1.1 ATS surveillance systems used in the provision of approach control service shall be appropriate to the functions and level of service to be provided.

8.9.1.2 ATS surveillance systems used to monitor parallel ILS approaches shall meet the requirements for such operations specified in Chapter 6.

### 8.9.2 Functions

The position indications presented on a situation display may be used to perform the following additional functions in the provision of approach control service:

a) provide vectoring of arriving traffic on to pilot-interpreted final approach aids;

b) provide flight path monitoring of parallel ILS approaches and instruct aircraft to take appropriate action in the event of possible or actual penetrations of the no transgression zone (NTZ);

*Note.— See Chapter 6, Section 6.7.*

c) provide vectoring of arriving traffic to a point from which a visual approach can be completed;

d) provide vectoring of arriving traffic to a point from which a precision radar approach or a surveillance radar approach can be made;

e) provide flight path monitoring of other pilot-interpreted approaches;

f) in accordance with prescribed procedures, conduct:

i) surveillance radar approaches;

ii) precision radar (PAR) approaches; and

g) provide separation between:

i) succeeding departing aircraft;

ii) succeeding arriving aircraft; and

iii) a departing aircraft and a succeeding arriving aircraft.

### 8.9.3 General approach control procedures using ATS surveillance systems

8.9.3.1 The appropriate ATS authority shall establish procedures to ensure that the aerodrome controller is kept informed of the sequence of arriving aircraft, as well as any instructions and restrictions which have been issued to such aircraft in order to maintain separation after transfer of control to the aerodrome controller.

8.9.3.2 Prior to, or upon commencement of, vectoring for approach, the pilot shall be advised of the type of approach as well as the runway to be used.

8.9.3.3 The controller shall advise an aircraft being vectored for an instrument approach of its position at least once prior to commencement of final approach.

8.9.3.4 When giving distance information, the controller shall specify the point or navigation aid to which the information refers.

8.9.3.5 The initial and intermediate approach phases of an approach executed under the direction of a controller comprise those parts of the approach from the time vectoring is initiated for the purpose of positioning the aircraft for a final approach, until the aircraft is on final approach and:

a) established on the final approach path of a pilot-interpreted aid; or

b) reports that it is able to complete a visual approach; or

c) ready to commence a surveillance radar approach; or

d) transferred to the precision radar approach controller.

8.9.3.6 Aircraft vectored for final approach should be given a heading or a series of headings calculated to close with the final approach track. The final vector shall enable the aircraft to be established in level flight on the final approach track prior to intercepting the specified or nominal glide path if an MLS, ILS or radar approach is to be made, and should provide an intercept angle with the final approach track of 45 degrees or less.

*Note.— See Chapter 6, Section 6.7.3.2, concerning vectoring of independent parallel approaches.*

8.9.3.7 Whenever an aircraft is assigned a vector which will take it through the final approach track, it should be advised accordingly, stating the reason for the vector.

### 8.9.4 Vectoring to pilot-interpreted final approach aid

8.9.4.1 An aircraft vectored to intercept a pilot-interpreted final approach aid shall be instructed to report when established on the final approach track. Clearance for the approach should be issued prior to when the aircraft reports established, unless circumstances preclude the issuance of the clearance at such time. Vectoring will normally terminate at the time the aircraft leaves the last assigned heading to intercept the final approach track.

8.9.4.2 The controller shall be responsible for maintaining separation specified in 8.7.3 between succeeding aircraft on the same final approach, except that the responsibility may be transferred to the aerodrome controller in accordance with procedures prescribed by the appropriate ATS authority and provided an ATS surveillance system is available to the aerodrome controller.

8.9.4.3 Transfer of control of succeeding aircraft on final approach to the aerodrome controller shall be effected in accordance with procedures prescribed by the appropriate ATS authority.

8.9.4.4 Transfer of communications to the aerodrome controller should be effected at such a point or time that clearance to land or alternative instructions can be issued to the aircraft in a timely manner.

### 8.9.5 Vectoring for visual approach

*Note.— See also Chapter 6, Section 6.5.3.*

8.9.5.1 The controller may initiate vectoring of an aircraft for visual approach provided the reported ceiling is above the minimum altitude applicable to vectoring and meteorological conditions are such that, with reasonable assurance, a visual approach and landing can be completed.

8.9.5.2 Clearance for visual approach shall be issued only after the pilot has reported the aerodrome or the preceding aircraft in sight, at which time vectoring would normally be terminated.

### 8.9.6 Radar approaches

#### 8.9.6.1 GENERAL PROVISIONS

8.9.6.1.1 During the period that a controller is engaged in giving surveillance radar or precision radar approaches, he or she should not be responsible for any duties other than those directly connected with such approaches.

8.9.6.1.2 Controllers conducting radar approaches shall be in possession of information regarding the obstacle clearance altitudes/heights established for the types of approach to be conducted.

8.9.6.1.3 Prior to commencement of a radar approach, the aircraft shall be informed of:

a) the runway to be used;

b) the applicable obstacle clearance altitude/height;

c) the angle of the nominal glide path and, if so prescribed by the appropriate ATS authority or requested by the aircraft, the approximate rate of descent to be maintained;

*Note.— See the* Air Traffic Services Planning Manual *(Doc 9426) regarding calculation of approximate rates of descent.*

d) the procedure to be followed in the event of radiocommunication failure, unless the procedure has been published in AIPs.

8.9.6.1.4 When a radar approach cannot be continued due to any circumstance, the aircraft should be immediately informed that a radar approach or continuation thereof is not possible. The approach should be continued if this is possible using non-radar facilities or if the pilot reports that the approach can be completed visually; otherwise an alternative clearance should be given.

8.9.6.1.5 Aircraft making a radar approach should be reminded, when on final approach, to check that the wheels are down and locked.

8.9.6.1.6 Unless otherwise prescribed by the appropriate ATS authority, the controller conducting the approach should notify the aerodrome controller or, when applicable, the procedural controller when an aircraft making a radar approach is approximately 15 km (8 NM) from touchdown. If landing clearance is not received at this time, a subsequent notification should be made at approximately 8 km (4 NM) from touchdown and landing clearance requested.

8.9.6.1.7 Clearance to land or any alternative clearance received from the aerodrome controller or, when applicable, the procedural controller should normally be passed to the aircraft before it reaches a distance of 4 km (2 NM) from touchdown.

8.9.6.1.8 An aircraft making a radar approach should:

a) be directed to execute a missed approach in the following circumstances:

i) when the aircraft appears to be dangerously positioned on final approach; or

ii) for reasons involving traffic conflictions; or

iii) if no clearance to land has been received from the procedural controller by the time the aircraft reaches a distance of 4 km (2 NM) from touchdown or such other distance as has been agreed with the aerodrome control tower; or

iv) on instructions by the aerodrome controller; or

b) be advised to consider executing a missed approach in the following circumstances:

i) when the aircraft reaches a position from which it appears that a successful approach cannot be completed; or

ii) if the aircraft is not visible on the situation display for any significant interval during the last 4 km (2 NM) of the approach; or

iii) if the position or identification of the aircraft is in doubt during any portion of the final approach.

In all such cases, the reason for the instruction or the advice should be given to the pilot.

8.9.6.1.9 Unless otherwise required by exceptional circumstances, radar instructions concerning a missed approach should be in accordance with the prescribed missed approach procedure and should include the level to which the aircraft is to climb and heading instructions to keep the aircraft within the missed approach area during the missed approach procedure.

## 8.9.7 Final approach procedures

### 8.9.7.1 SURVEILLANCE RADAR APPROACH

8.9.7.1.1 A final approach using solely surveillance radar should not be carried out if precision approach radar is available, unless meteorological conditions are such as to indicate with reasonable certainty that a surveillance radar approach can be completed successfully.

8.9.7.1.2 A surveillance radar approach shall only be performed with equipment suitably sited and a situation display specifically marked to provide information on position relative to the extended centre line of the runway to be used and distance from touchdown, and which is specifically approved for the purpose by the appropriate ATS authority.

8.9.7.1.3 When conducting a surveillance radar approach, the controller shall comply with the following:

a) at or before the commencement of the final approach, the aircraft shall be informed of the point at which the surveillance radar approach will be terminated;

b) the aircraft shall be informed when it is approaching the point at which it is computed that descent should begin, and just before reaching that point it shall be informed of the obstacle clearance altitude/height and instructed to descend and check the applicable minima;

c) azimuth instructions shall be given in accordance with the precision approach technique (see 8.9.7.2.4);

d) except as provided in 8.9.7.1.4, distance from touchdown shall normally be passed at every 2 km (each NM);

e) pre-computed levels through which the aircraft should be passing to maintain the glide path shall also be transmitted at every 2 km (each NM) at the same time as the distance;

f) the surveillance radar approach shall be terminated:

i) at a distance of 4 km (2 NM) from touchdown, except as provided in 8.9.7.1.4; or

ii) before the aircraft enters an area of continuous radar clutter; or

iii) when the pilot reports that a visual approach can be effected;

whichever is the earliest.

8.9.7.1.4 When, as determined by the appropriate ATS authority, the accuracy of the radar equipment permits, surveillance radar approaches may be continued to the threshold of the runway, or to a prescribed point less than 4 km (2 NM) from touchdown, in which case:

a) distance and level information shall be given at each km (each half NM);

b) transmission should not be interrupted for intervals of more than five seconds while the aircraft is within a distance of 8 km (4 NM) from touchdown;

c) the controller should not be responsible for any duties other than those directly connected with a particular approach.

8.9.7.1.5 Levels through which the aircraft should pass to maintain the required glide path, and the associated distances from touchdown, shall be pre-computed and displayed in such a manner as to be readily available to the controller concerned.

*Note.— See the* Air Traffic Services Planning Manual *(Doc 9426) regarding pre-computation of levels.*

### 8.9.7.2 PRECISION RADAR APPROACH

#### 8.9.7.2.1 *DUTIES OF PRECISION APPROACH CONTROLLER*

During the period the controller is engaged in giving a precision approach, the controller should not be responsible for any duties other than those directly connected with that particular approach.

#### 8.9.7.2.2 *TRANSFER OF CONTROL*

Aircraft to be provided with a precision radar approach shall have been transferred to the controller in charge of the precision approach at a distance of not less than 2 km (1 NM) from the point of interception of the glide path, unless otherwise provided by the appropriate ATS authority.

8.9.7.2.3 *COMMUNICATIONS*

When control of the aircraft is assumed by the controller in charge of the precision approach, a communications check shall be made on the channel to be used during the precision approach and the pilot shall be advised that no further acknowledgement of transmission is required. Thereafter, transmission should not be interrupted for intervals of more than five seconds while the aircraft is on final approach.

8.9.7.2.4 *AZIMUTH INFORMATION AND CORRECTIONS*

8.9.7.2.4.1 The pilot shall be informed at regular intervals of the aircraft's position in relation to the extended centre line of the runway. Heading corrections shall be given as necessary to bring the aircraft back on to the extended centre line.

8.9.7.2.4.2 In the case of azimuth deviations, the pilot should not take corrective action unless specifically instructed to do so.

8.9.7.2.5 *ELEVATION INFORMATION AND ADJUSTMENTS*

8.9.7.2.5.1 The aircraft shall be informed when it is approaching the point of interception of the glide path and, just before intercepting the glide path, it shall be instructed to begin its descent and to check the applicable decision altitude/height. Thereafter, the aircraft shall be informed at regular intervals of its position in relation to the glide path. When no corrections are required, the aircraft should be informed at regular intervals that it is on the glide path. Deviations from the glide path shall be given to the aircraft, together with instructions to adjust the rate of descent if the corrective action taken by the aircraft does not appear to be sufficient. The aircraft shall be informed when it starts to regain the glide path, and immediately before it reaches the glide path.

8.9.7.2.5.2 In the case of deviations from the glide path, the pilot should take corrective action on the basis of the information given by the controller, even though not specifically instructed to do so.

8.9.7.2.5.3 Prior to the aircraft reaching a point 4 km (2 NM) from touchdown, or a greater distance as necessary for faster aircraft, a certain degree of tolerance should be allowed with regard to deviations from the glide path, and elevation information need not specify the actual number of metres (or feet) above or below the glide path unless it is required to emphasize the rate of change or the extent of the displacement. Thereafter, any deviations from the glide path should be given to the aircraft, preferably in terms of specific distances (metres or feet) above or below the glide path. The use of emphasis in the manner in which the information is transmitted should normally be sufficient to expedite action by the pilot when necessary (e.g. "*STILL* 20 metres (60 feet) too low").

8.9.7.2.5.4 Should the elevation element fail during a precision radar approach, the controller shall inform the aircraft immediately. If possible, the controller shall change to a surveillance radar approach, informing the aircraft of the revised obstacle clearance altitude/height. Alternatively, instructions should be given for a missed approach.

8.9.7.2.6 *DISTANCE INFORMATION*

The distance from touchdown should be transmitted at intervals of 2 km (1 NM) until the aircraft reaches a distance of 8 km (4 NM) from touchdown. Thereafter distance information should be transmitted at more frequent intervals, priority being given, however, to the provision of azimuth and elevation information and guidance.

8.9.7.2.7 *TERMINATION OF A PRECISION RADAR APPROACH*

A precision radar approach is terminated when the aircraft reaches the point at which the glide path intercepts the obstacle clearance altitude/height. Nevertheless, information shall continue to be given until the aircraft is over the threshold, or at such distance therefrom as may be specified by the appropriate ATS authority, taking into account the capability of the

equipment concerned. The approach may be monitored to touchdown and information may continue to be provided as necessary at the discretion of the controller in charge of the precision approach in which case the aircraft shall be informed when it is over the threshold.

8.9.7.2.8 *MISSED APPROACHES*

When information provided by the elevation element indicates that the aircraft may be initiating a missed approach, the controller shall take the following action:

a) when there is sufficient time to obtain a reply from the pilot (e.g. when the aircraft is more than 4 km (2 NM) from touchdown), the controller shall transmit the aircraft's height above the glide path and ask if the pilot intends to make a missed approach. If this is confirmed by the pilot, the controller shall pass missed approach instructions (see 8.9.6.1.8);

b) when there is not sufficient time to obtain a reply from the pilot (e.g. when the aircraft is at 4 km (2 NM) or less from touchdown), the precision approach should be continued, emphasizing the aircraft's displacement, and terminated at the normal termination point. If it is apparent from elevation information that the aircraft is making a missed approach, either before or after the normal termination point, the controller shall pass missed approach instructions (see 8.9.6.1.8).

## 8.10 USE OF ATS SURVEILLANCE SYSTEMS IN THE AERODROME CONTROL SERVICE

### 8.10.1 Functions

8.10.1.1 When authorized by and subject to conditions prescribed by the appropriate ATS authority, ATS surveillance systems may be used in the provision of aerodrome control service to perform the following functions:

a) flight path monitoring of aircraft on final approach;

b) flight path monitoring of other aircraft in the vicinity of the aerodrome;

c) establishing separation specified in 8.7.3 between succeeding departing aircraft; and

d) providing navigation assistance to VFR flights.

8.10.1.2 Special VFR flights shall not be vectored unless special circumstances, such as emergencies, dictate otherwise.

8.10.1.3 Caution shall be exercised when vectoring VFR flights so as to ensure that the aircraft concerned does not inadvertently enter instrument meteorological conditions.

8.10.1.4 In prescribing conditions and procedures for the use of ATS surveillance systems in the provision of aerodrome control service, the appropriate ATS authority shall ensure that the availability and use of an ATS surveillance system will not be detrimental to visual observation of aerodrome traffic.

*Note.— Control of aerodrome traffic is in the main based on visual observation of the manoeuvring area and the vicinity of the aerodrome by the aerodrome controller.*

### 8.10.2 Use of surface movement radar (SMR)

*Note.— Requirements concerning the provision of SMR are contained in Annex 14, Volume I, Chapter 9. Guidance material on the use of SMR is contained in the* Air Traffic Services Planning Manual *(Doc 9426), Part II.*

#### 8.10.2.1 GENERAL PROVISIONS

8.10.2.1.1 The use of SMR should be related to the operational conditions and requirements of the particular aerodrome (i.e. visibility conditions, traffic density and aerodrome layout).

8.10.2.1.2 SMR systems shall to the extent possible enable the detection and display of the movement of all aircraft and vehicles on the manoeuvring area in a clear and unambiguous manner.

8.10.2.1.3 Aircraft and vehicle position indications may be displayed in symbolic or non-symbolic form. Where labels are available for display, the capability should be provided for inclusion of aircraft and vehicle identification by manual or automated means.

#### 8.10.2.2 FUNCTIONS

8.10.2.2.1 SMR should be used to augment visual observation of traffic on the manoeuvring area and to provide surveillance of traffic on those parts of the manoeuvring area which cannot be observed visually.

8.10.2.2.2 The information displayed on an SMR display may be used to assist in:

a) monitoring of aircraft and vehicles on the manoeuvring area for compliance with clearances and instructions;

b) determining that a runway is clear of traffic prior to a landing or take-off;

c) providing information on essential local traffic on or near the manoeuvring area;

d) determining the location of aircraft and vehicles on the manoeuvring area;

e) providing directional taxi information to aircraft when requested by the pilot or deemed necessary by the controller. Except under special circumstances, e.g. emergencies, such information should not be issued in the form of specific heading instructions; and

f) providing assistance and advice to emergency vehicles.

#### 8.10.2.3 IDENTIFICATION OF AIRCRAFT

Where SMR is used, aircraft may be identified by one or more of the following procedures:

a) by correlating a particular position indication with:

   i) an aircraft position visually observed by the controller;

   ii) an aircraft position reported by the pilot; or

   iii) an identified position indication displayed on a situation display;

b) by transfer of identification when authorized by the appropriate ATS authority; and

c) by automated identification procedures when authorized by the appropriate ATS authority.

## 8.11 USE OF ATS SURVEILLANCE SYSTEMS IN THE FLIGHT INFORMATION SERVICE

*Note.— The use of an ATS surveillance system in the provision of flight information service does not relieve the pilot-in-command of an aircraft of any responsibilities, including the final decision regarding any suggested alteration of the flight plan.*

### 8.11.1 Functions

The information presented on a situation display may be used to provide identified aircraft with:

a) information regarding any aircraft observed to be on a conflicting path with the identified aircraft and suggestions or advice regarding avoiding action;

b) information on the position of significant weather and, as practicable, advice to the aircraft on how best to circumnavigate any such areas of adverse weather (see 8.6.9.2, Note);

c) information to assist the aircraft in its navigation.