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Doc 8168

PROCEDURES FOR AIR NAVIGATION SERVICES

Aircraft Operations

Volume III – Aircraft Operating Procedures
First Edition, 2018



This first edition of Doc 8168, Volume III, was approved by the President of the Council on behalf of the Council on 28 August 2018 and becomes applicable on 8 November 2018.

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AMENDMENTS

Amendments are announced in the supplements to the *Products and Services Catalogue*; the Catalogue and its supplements are available on the ICAO website at www.icao.int. The space below is provided to keep a record of such amendments.

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FOREWORD

1. INTRODUCTION

1.1 The *Procedures for Air Navigation Services — Aircraft Operations* (PANS-OPS) consists of three volumes as follows:

Volume I — *Flight Procedures*

Volume II — *Construction of Visual and Instrument Flight Procedures*

Volume III — *Aircraft Operating Procedures*

The division of the PANS-OPS into the two volumes was accomplished in 1979 as a result of an extensive amendment to the obstacle clearance criteria and the construction of approach-to-land procedures. Prior to 1979, all PANS-OPS material was contained in a single document. Table A shows the origin of amendments together with a list of the principal subjects involved and the dates on which the PANS-OPS and the amendments were approved by the Council and when they became applicable. PANS-OPS, Volume III, applicable in 2018, was created from Part III of Volume I with the intention to separate the provisions related to aircraft operating procedures from the requirements for flying the procedures designed in accordance with the criteria provided in Volume II.

1.2 Volume I — *Flight Procedures* describes the operational requirements for flying the procedures designed in accordance with the criteria provided in Volume II.

1.3 Volume II — *Construction of Visual and Instrument Flight Procedures* is intended for the guidance of procedures specialists and describes the essential areas and obstacle clearance requirements for the achievement of safe, regular instrument flight operations. It provides the basic guidelines to States, and those operators and organizations producing instrument flight charts that will result in uniform practices at all aerodromes where instrument flight procedures are carried out.

1.4 Volume III — *Aircraft Operating Procedures* describes operational procedures recommended for the guidance of flight operations personnel and flight crew.

1.5 All three volumes present coverage of operational practices that are beyond the scope of Standards and Recommended Practices (SARPs) but with respect to which a measure of international uniformity is desirable.

1.6 The design of procedures in accordance with PANS-OPS criteria assumes normal operations. It is the responsibility of the operator to provide contingency procedures for abnormal and emergency operations.

2. COMMENTARY ON THE MATERIAL CONTAINED IN VOLUME III

2.1 Section 2 — *Altimeter setting procedures*

The altimeter setting procedures were developed from the basic principles established by the third session of the Operations Division in 1949 and are the result of evolution through the recommendations of a number of Regional Air Navigation Meetings. They formerly appeared as Part 1 of the *Regional Supplementary Procedures* (Doc 7030) and had previously been approved by the Council for use in the majority of ICAO regions as supplementary procedures.

Part 1 of Doc 7030 now contains only regional procedures which are supplementary to the procedures contained in this document. The incorporation of these procedures in the PANS-OPS was approved by the Council in 1961 on the understanding that this action was not to be construed as a decision of principle on the question of flight levels or on the relative merits of metres or feet for altimetry purposes. Subsequently the Council approved the definitions of flight level and transition altitude. To comply with Amendment 13 to Annex 5, the primary unit of atmospheric pressure was changed to hectopascal (hPa) in 1979.

2.2 Section 3 — *Simultaneous operations on parallel or near-parallel instrument runways*

In 1990 as a result of the work of an air navigation study group, new material was included concerning specifications, procedures and guidance material relating to simultaneous operations on parallel or near-parallel instrument runways, including the minimum distances between runways.

2.3 Section 4 — *Secondary surveillance radar (SSR) transponder operating procedures*

These procedures were originally developed at the Sixth Air Navigation Conference in 1969. The operating procedures are intended to provide international standardization for the safe and efficient use of SSR and to minimize the workload and voice procedures for pilots and controllers.

2.4 Section 5 — *Operational flight information*

Material related to Operational Flight Information was added to the PANS-OPS as a result of conclusion 9/30 of ASIA/PAC Air Navigation Planning and Implementation Regional Group.

2.5 Section 6 — *Standard operating procedures (SOPs) and checklists*

Material related to standard operating procedures was added to the PANS-OPS as result of conclusion 9/30 of ASIA/PAC Air Navigation Planning and Implementation Regional Group.

2.6 Section 7 — *Voice communication procedures and controller-pilot data link communications procedures*

Note.— This material is under development and while no text is presently available in this document, provisions and procedures relevant to aircraft operations have been combined with those concerning the provision of air traffic services in Annex 10, Volume II, and the Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM) (Doc 4444).

2.7 Section 8 — *Airborne surveillance*

Information related to the operation of ADS-B IN traffic display.

2.8 Section 9 — *Noise abatement procedures*

Noise abatement procedures were developed by the Operations Panel (OPSP) and approved by the Council for inclusion in the PANS-OPS in 1983. These procedures were amended in 2001 by the Committee on Aviation Environmental Protection (CAEP). For related provisions, see Annex 16, Volume I, and Annex 6, Part I.

3. STATUS

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

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 a language which will permit direct use by operations personnel. While uniform application of the basic procedures in this document is very desirable, latitude is permitted for the development of detailed procedures which may be needed to satisfy local conditions.

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

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

7. UNITS OF MEASUREMENT

Units of measurement are given in accordance with the provisions contained in Annex 5, Fourth Edition. In those cases where the use of an alternative non-SI unit is permitted, the non-SI unit is shown in brackets immediately following the primary SI unit. In all cases the value of the non-SI unit is considered to be operationally equivalent to the primary SI unit in the context in which it is applied. Unless otherwise indicated, the allowable tolerances (accuracy) are indicated by the number of significant figures given and, in this regard, it is to be understood in this document that all zero digits, either to the right or left of the decimal marker, are significant figures.

Table A. Amendments to the PANS-OPS

<i>Amendment</i>	<i>Source(s)</i>	<i>Subject(s)</i>	<i>Approved Applicable</i>
First edition (2018)	Third meeting of the Flight Operations Panel (FLTOSP/3) Twelfth meeting of the Aeronautical Information Service (AIS) to Aeronautical Information Management (AIM) Study Group (AIS-AIMSG/12) First meeting of the Separation and Airspace Safety Panel (SASP/1)	Operating procedures transferred from PANS-OPS, Volume I, Parts I and II.	28 August 2018 8 November 2018

Section 1

DEFINITIONS, ABBREVIATIONS AND ACRONYMS AND UNITS OF MEASUREMENT

I-(i)



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Chapter 1

DEFINITIONS

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

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

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.

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 where the necessary services and facilities are available, where aircraft performance requirements can be met and which is operational at the expected time of use. Alternate aerodromes include the following:

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

En-route alternate. An alternate aerodrome at which an aircraft would be able to land in the event that a diversion becomes necessary while en route.

Destination alternate. An alternate aerodrome at which an aircraft would be able to land 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).

Continuous climb operation (CCO). An operation, enabled by airspace design, procedure design and ATC, in which a departing aircraft climbs continuously, to the greatest possible extent, by employing optimum climb engine thrust and climb speeds until reaching the cruise flight level.

Continuous descent final approach (CDFA). A technique, consistent with stabilized approach procedures, for flying the final approach segment of a non-precision instrument approach procedure as a continuous descent, without level-off, from an altitude/height at or above the final approach fix altitude/height to a point approximately 15 m (50 ft) above the landing runway threshold or the point where the flare manoeuvre should begin for the type of aircraft flown.

Continuous descent operation (CDO). An operation, enabled by airspace design, procedure design and ATC, in which an arriving aircraft descends continuously, to the greatest possible extent, by employing minimum engine thrust, ideally in a low drag configuration, prior to the final approach fix/final approach point.

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.

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

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

Flight level (FL). 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 a QFE altimeter setting, will indicate height above the QFE reference datum; and*
- 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.

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.

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.

Independent parallel approaches. Simultaneous approaches to parallel or near-parallel instrument runways where ATS surveillance system 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.

Instrument approach operations. An approach and landing using instruments for navigation guidance based on an instrument approach procedure. There are two methods for executing instrument approach operations:

- a) a two-dimensional (2D) instrument approach operation, using lateral navigation guidance only; and
- b) a three-dimensional (3D) instrument approach operation, using both lateral and vertical navigation guidance.

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

- a) *a ground-based radio navigation aid; or*
- b) *computer-generated navigation data from ground-based, space-based, self-contained navigation aids or a combination of these.*

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 designed for 2D instrument approach operations Type A.

Note.— Non-precision approach procedures may be flown using a continuous descent final approach (CDFA) technique. CDFAs with advisory VNAV guidance calculated by on-board equipment are considered 3D instrument approach operations. CDFAs with manual calculation of the required rate of descent are considered 2D instrument approach operations. For more information on CDFAs, refer to PANS-OPS, (Doc 8168) Volume I, Part II, Section 5.

Approach procedure with vertical guidance (APV). A performance-based navigation (PBN) instrument approach procedure designed for 3D instrument approach operations Type A.

Precision approach (PA) procedure. An instrument approach procedure based on navigation systems (ILS, MLS, GLS and SBAS CAT I) designed for 3D instrument approach operations Type A or B.

Note.— Refer to Annex 6 for instrument approach operation types.

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

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

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

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.

Normal operating zone (NOZ). Airspace of defined dimensions extending to either side of a published instrument approach procedure final approach course or track. Only that half of the normal operating zone adjacent to a no transgression zone (NTZ) is taken into account in independent parallel approaches.

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.

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.

Threshold (THR). The beginning of that portion of the runway usable for landing.

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).

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.

Chapter 2

ABBREVIATIONS AND ACRONYMS

(used in this document)

AC	Advisory Circular
ACAS	Airborne collision avoidance system
ADS-B	Automatic dependent surveillance — broadcast
AGL	Above ground level
AHRS	Attitude and heading reference system
AIRAC	Aeronautical information regulation and control
APV	Approach procedure with vertical guidance
ATC	Air traffic control
ATIS	Automatic terminal information service
ATM	Air traffic management
ATS	Air traffic services
CAT	Category
CBT	Computer-based training
CCO	Continuous climb operation
CDFA	Continuous descent final approach
CDO	Continuous descent operation
CPA	Closest point of approach
CRC	Cyclic redundancy check
CRM	Collision risk model
CRM	Crew resource management
DME	Distance measuring equipment
ESDU	Engineering Sciences Data Unit
EUROCAE	European Organization for Civil Aviation Equipment
FAA	Federal Aviation Administration
FAF	Final approach fix
FHP	Fictitious helipoint
FL	Flight level
ft	Foot (feet)
FTP	Fictitious threshold point
GPIP	Glide path intercept point
GPWS	Ground proximity warning system
HP	Helipoint
hPa	Hectopascal(s)
HPL	Horizontal protection level
HVR	High vertical rate
IFR	Instrument flight rules
ILS	Instrument landing system
IMC	Instrument meteorological conditions
INS	Inertial navigation system
IRS	Inertial reference system
ISA	International standard atmosphere

JAA	Joint Aviation Authorities
kt	Knot(s)
km	Kilometre(s)
LORAN	Long range air navigation system
LTP	Landing threshold point
m	Metre(s)
MLS	Microwave landing system
MOC	Minimum obstacle clearance
MOPS	Minimum operational performance standards
NADP	Noise abatement departure procedure
NM	Nautical mile(s)
NOZ	Normal operating zone
NTZ	No transgression zone
OAS	Obstacle assessment surface
OCA/H	Obstacle clearance altitude/height
OIS	Obstacle identification surface
OLS	Obstacle limitation surface
PA	Precision approach
PAOAS	Parallel approach obstacle assessment surface
QFE	Atmospheric pressure at aerodrome elevation (or at runway threshold)
QNH	Altimeter sub-scale setting to obtain elevation when on the ground
RA	Resolution advisory
RSR	En-route surveillance radar
RSS	Root sum square
SI	International system of units
SOPs	Standard operating procedures
SPI	Special position indicator
SSR	Secondary surveillance radar
SST	Supersonic transport
TA	Traffic advisory
TSO	Technical Standard Order
VAL	Vertical alarm limit
VPL	Vertical protection level
VTF	Vector to final

Chapter 3

UNITS OF MEASUREMENT

3.1 Units of measurement are expressed in conformance with Annex 5.

3.2 The values of the parameters are usually shown in integers. Where this does not provide the required accuracy, the parameter is shown with the required number of decimal places. Where the parameter directly affects the flight crew in its control of the aircraft, it is normally rounded as a multiple of five. In addition, slope gradients are normally expressed in percentages, but may be expressed in other units.

3.3 The rounding of values to be published on aeronautical charts meets the corresponding chart resolution requirements in Annex 4, Appendix 6.

Section 2

ALTIMETER SETTING PROCEDURES

2-(i)



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Chapter 1

INTRODUCTION TO ALTIMETER SETTING PROCEDURES

1.1 These procedures describe the method for providing adequate vertical separation between aircraft and for providing adequate terrain clearance during all phases of a flight. This method is based on the following basic principles:

- a) States may specify a fixed altitude known as the transition altitude. In flight, when an aircraft is at or below the transition altitude, its vertical position is expressed in terms of altitude, which is determined from an altimeter set to sea level pressure (QNH).
- b) In flight above the transition altitude, the vertical position of an aircraft is expressed in terms of flight levels, which are surfaces of constant atmospheric pressure based on an altimeter setting of 1 013.2 hPa.
- c) The change in reference from altitude to flight levels, and vice versa, is made:
 - 1) at the transition *altitude*, when climbing; and
 - 2) at the transition *level*, when descending.
- d) The transition level may be nearly coincident with the transition altitude to maximize the number of flight levels available. Alternatively, the transition level may be located 300 m (or 1 000 ft) above the transition altitude to permit the transition altitude and the transition level to be used concurrently in cruising flight, with vertical separation ensured. The airspace between the transition level and the transition altitude is called the transition layer.
- e) Where no transition altitude has been established for the area, aircraft in the en-route phase shall be flown at a flight level.
- f) The adequacy of terrain clearance during any phase of a flight may be maintained in any of several ways, depending upon the facilities available in a particular area. The recommended methods in the order of preference are:
 - 1) the use of current QNH reports from an adequate network of QNH reporting stations;
 - 2) the use of such QNH reports as are available, combined with other meteorological information such as forecast lowest mean sea level pressure for the route or portions thereof; and
 - 3) where relevant current information is not available, the use of values of the lowest altitudes or flight levels, derived from climatological data.
- g) During the approach to land, terrain clearance may be determined by using:
 - 1) the QNH altimeter setting (giving altitude); or

- 2) under specified circumstances (see Chapter 2, 2.4.2 and Chapter 3, 3.5.4), a QFE setting (giving height above the QFE datum).

1.2 This method provides flexibility to accommodate variations in local procedures without compromising the fundamental principles.

1.3 These procedures apply to all IFR flights and to other flights which are operating at specific cruising levels in accordance with Annex 2 — *Rules of the Air* or the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444) or the *Regional Supplementary Procedures* (Doc 7030).

Chapter 2

BASIC ALTIMETER SETTING REQUIREMENTS

2.1 GENERAL

2.1.1 System of flight levels

2.1.1.1 Flight level zero shall be located at the atmospheric pressure level of 1 013.2 hPa. Consecutive flight levels shall be separated by a pressure interval corresponding to at least 500 ft (152.4 m) in the standard atmosphere.

Note.— This does not preclude reporting intermediate levels in increments of 30 m (100 ft). (Refer to Section 4, Chapter 1, 1.2, “Use of Mode C”.)

2.1.1.2 Flight levels shall be numbered according to Table 2-2-1 which indicates the corresponding height in the standard atmosphere in feet and the approximate equivalent height in metres.

2.1.2 Transition altitude

2.1.2.1 A transition altitude shall normally be specified for each aerodrome by the State in which the aerodrome is located.

2.1.2.2 Where two or more closely spaced aerodromes are located so that coordinated procedures are required, a common transition altitude shall be established. This common transition altitude shall be the highest that would be required if the aerodromes were considered separately.

2.1.2.3 As far as possible, a common transition altitude should be established:

- a) for groups of aerodromes of a State or all aerodromes of that State;
- b) on the basis of an agreement, for:
 - 1) aerodromes of adjacent States;
 - 2) States of the same flight information region; and
 - 3) States of two or more adjacent flight information regions or one ICAO region; and
- c) for aerodromes of two or more ICAO regions when agreement can be obtained between these regions.

2.1.2.4 The height above the aerodrome of the transition altitude shall be as low as possible but normally not less than 900 m (3 000 ft).

2.1.2.5 The calculated height of the transition altitude shall be rounded up to the next full 300 m (1 000 ft).

2.1.2.6 Despite the provisions in 2.1.2, “Transition altitude”, a transition altitude may be established for a specified area on the basis of regional air navigation agreements.

2.1.2.7 Transition altitudes shall be published in aeronautical information publications and shown on the appropriate charts.

2.1.3 Transition level

2.1.3.1 States shall make provision for the determination of the transition level to be used at any given time at each of their aerodromes.

2.1.3.2 Where two or more closely spaced aerodromes are located so that coordinated procedures and a common transition altitude are required, a common transition level shall also be used at those aerodromes.

2.1.3.3 Appropriate personnel shall have available at all times the number of the flight level representing the current transition level for an aerodrome.

Note.— The transition level is normally passed to aircraft in the approach and landing clearances.

2.1.4 References to vertical position

2.1.4.1 The vertical position of aircraft operating at or below the transition altitude shall be expressed in terms of altitude. Vertical position at or above the transition level shall be expressed in terms of flight levels. This terminology applies during:

- a) climb;
- b) en-route flight; and
- c) approach and landing (except as provided for in 2.4.3, “References to vertical positioning after approach clearance”).

Note.— This does not preclude a pilot using a QFE setting for terrain clearance purposes during the final approach to the runway.

2.1.4.2 Passing through the transition layer

While passing through the transition layer, vertical position shall be expressed in terms of:

- a) flight levels when climbing; and
- b) altitude when descending.

2.2 TAKE-OFF AND CLIMB

A QNH altimeter setting shall be made available to aircraft in taxi clearances prior to take-off.

2.3 EN ROUTE

2.3.1 When complying with the specifications of Annex 2, an aircraft shall be flown at altitudes or flight levels (as applicable) corresponding to the magnetic tracks shown in the table of cruising levels in Appendix 3 to Annex 2.

2.3.2 Terrain clearance

2.3.2.1 QNH altimeter setting reports should be provided from sufficient locations to permit determination of terrain clearance with an acceptable degree of accuracy.

2.3.2.2 For areas where adequate QNH altimeter setting reports cannot be provided, the appropriate authorities shall provide the information required to determine the lowest flight level which will ensure adequate terrain clearance. This information shall be made available in the most usable form.

2.3.2.3 Appropriate services shall at all times have available the information required to determine the lowest flight level which will ensure adequate terrain clearance for specific routes or segments of routes. This information shall be made available for flight planning purposes and for transmission to aircraft in flight, on request.

2.4 APPROACH AND LANDING

2.4.1 The QNH altimeter setting shall be made available to aircraft in approach clearances and in clearances to enter the traffic circuit.

2.4.2 A QFE altimeter setting, clearly identified as such, should be made available in approach and landing clearances. This should be available on request or on a regular basis, in accordance with local arrangements.

2.4.3 References to vertical positioning after approach clearance

After approach clearance has been issued and the descent to land is begun, the vertical positioning of an aircraft above the transition level may be by reference to altitudes (QNH) provided that level flight above the transition altitude is not indicated or anticipated.

Note.— This applies primarily to turbine engine aircraft for which an uninterrupted descent from a high altitude is desirable and to aerodromes equipped to control such aircraft by reference to altitudes throughout the descent.

2.5 MISSED APPROACH

The relevant parts of 2.2, “Take-off and climb”, 2.3, “En route”, and 2.4, “Approach and landing” shall apply in the event of a missed approach.

Table 2-2-1. Flight level numbers

<i>Flight level number</i>	<i>Height in standard atmosphere</i>		<i>Flight level number</i>	<i>Height in standard atmosphere</i>	
	<i>Metres</i>	<i>Feet</i>		<i>Metres</i>	<i>Feet</i>
10	300	1 000	50	1 500	5 000
15	450	1 500	...	...	...
20	600	2 000	100	3 050	10 000
25	750	2 500	...	...	...
30	900	3 000	150	4 550	15 000
35	1 050	3 500	...	...	...
40	1 200	4 000	200	6 100	20 000
45	1 350	4 500	...	...	...
			500	15 250	50 000

Note.— The heights shown in metres correspond to those in the table of cruising levels given in Appendix 3 to Annex 2.

Chapter 3

PROCEDURES FOR OPERATORS AND PILOTS

3.1 FLIGHT PLANNING

3.1.1 The levels at which a flight is to be conducted shall be specified in a flight plan:

- a) as flight levels if the flight is to be conducted at or above the transition level (or the lowest usable flight level, if applicable); and
- b) as altitudes if the flight is to be conducted at or below the transition altitude.

3.1.2 The altitudes or flight levels selected for flight:

- a) should ensure adequate terrain clearance at all points along the route;
- b) should satisfy air traffic control requirements; and
- c) should be compatible with the table of cruising levels in Appendix 3 to Annex 2, if relevant.

Note 1.— The information required to determine the lowest altitude or flight level which ensures adequate terrain clearance may be obtained from the appropriate services unit (e.g. aeronautical information, air traffic or meteorological).

Note 2.— The choice of altitudes or flight levels depends upon how accurately their vertical position relative to the terrain can be estimated. This in turn depends upon the type of meteorological information available. A lower altitude or flight level may be used with confidence when its position is based on current information which is relevant to the particular route to be flown and when it is known that amendments to this information will be available in flight. See 3.4.2, "Terrain clearance". A higher altitude or flight level will be used when based on information less relevant to the particular route to be flown and the time of the flight. The latter type of information may be provided in chart or table form and may be applicable to a large area and any period of time.

Note 3.— Flights over level terrain may often be conducted at one altitude or flight level. On the other hand, flights over mountainous terrain may require several changes in altitudes or flight levels to account for changes in the elevation of the terrain. The use of several altitudes or flight levels may also be required to comply with air traffic services requirements.

3.2 PRE-FLIGHT OPERATIONAL TEST

The following test should be carried out in an aircraft by flight crew members before flight. Flight crews should be advised of the purpose of the test and the manner in which it should be carried out. They should also be given specific instructions on the action to be taken based on the test results.

QNH setting

1. With the aircraft at a known elevation on the aerodrome, set the altimeter pressure scale to the current QNH setting.
2. Vibrate the instrument by tapping unless mechanical vibration is provided.

A serviceable altimeter indicates the elevation of the point selected, plus the height of the altimeter above this point, within a tolerance of:

- a) ± 20 m or 60 ft for altimeters with a test range of 0 to 9 000 m (0 to 30 000 ft); and
- b) ± 25 m or 80 ft for altimeters with a test range of 0 to 15 000 m (0 to 50 000 ft).

QFE setting

1. With the aircraft at a known elevation on the aerodrome, set altimeter pressure scale to the current QFE setting.
2. Vibrate the instrument by tapping unless mechanical vibration is provided.

A serviceable altimeter indicates the height of the altimeter in relation to the QFE reference point, within a tolerance of:

- a) ± 20 m or 60 ft for altimeters with a test range of 0 to 9 000 m (0 to 30 000 ft); and
- b) ± 25 m or 80 ft for altimeters with a test range of 0 to 15 000 m (0 to 50 000 ft).

Note 1.— If the altimeter does not indicate the reference elevation or height exactly but is within the specified tolerances, no adjustment of this indication should be made at any stage of a flight. Also, any error which was within tolerance on the ground should be ignored by the pilot during flight.

Note 2.— The tolerance of 20 m or 60 ft for altimeters with a test range of 0 to 9 000 m (0 to 30 000 ft) is considered acceptable for aerodromes having elevations up to 1 100 m (3 500 ft) (Standard atmospheric pressure). Table 2-3-1 indicates the permissible range for aerodromes at different elevations when the atmospheric pressure at an aerodrome is lower than the standard, i.e. when the QNH setting is as low as 950 hPa.

Note 3.— The tolerance of 25 m or 80 ft for altimeters with a test range of 0 to 15 000 m (0 to 50 000 ft) is considered acceptable for aerodromes having elevations up to 1 100 m (3 500 ft) (Standard atmospheric pressure). Table 2-3-2 indicates the permissible range for aerodromes at different elevations when the atmospheric pressure at an aerodrome is lower than the standard, i.e. when the QNH setting is as low as 950 hPa.

3.3 TAKE-OFF AND CLIMB

3.3.1 Before taking off, one altimeter shall be set on the latest QNH altimeter setting for the aerodrome.

3.3.2 During climb to, and while at the transition altitude, references to the vertical position of the aircraft in air-ground communications shall be expressed in terms of altitudes.

3.3.3 On climbing through the transition altitude, the reference for the vertical position of the aircraft shall be changed from altitudes (QNH) to flight levels (1 013.2 hPa), and thereafter the vertical position shall be expressed in terms of flight levels.

3.4 EN ROUTE

3.4.1 Vertical separation

3.4.1.1 During en-route flight at or below the transition altitude, an aircraft shall be flown at altitudes. References to the vertical position of the aircraft in air-ground communications shall be expressed in terms of altitudes.

3.4.1.2 During en-route flight at or above transition levels or the lowest usable flight level, whichever is applicable, an aircraft shall be flown at flight levels. References to the vertical position of the aircraft in air-ground communications shall be expressed in terms of flight levels.

3.4.2 Terrain clearance

3.4.2.1 Where adequate QNH altimeter setting reports are available, the latest and most appropriate reports shall be used for assessing terrain clearance.

3.4.2.2 Where the adequacy of terrain clearance cannot be assessed with an acceptable degree of accuracy by means of the QNH reports available or forecast lowest mean sea level pressure, other information shall be obtained for checking the adequacy of terrain clearance.

3.5 APPROACH AND LANDING

3.5.1 Before beginning the initial approach to an aerodrome, the number of the transition level shall be obtained.

Note.— The transition level is normally obtained from the appropriate air traffic services unit.

3.5.2 Before descending below the transition level, the latest QNH altimeter setting for the aerodrome shall be obtained.

Note.— The latest QNH altimeter setting for the aerodrome is normally obtained from the appropriate air traffic services unit.

3.5.3 As the aircraft descends through the transition level, the reference for the vertical position of the aircraft shall be changed from flight levels (1 013.2 hPa) to altitudes (QNH). From this point on, the vertical position of the aircraft shall be expressed in terms of altitudes.

Note.— This does not preclude a pilot using a QFE setting for terrain clearance purposes during the final approach to the runway in accordance with 3.5.4.

3.5.4 When an aircraft which has been given a clearance as number one to land is completing its approach using QFE, the vertical position of the aircraft shall be expressed in terms of the height above the aerodrome datum which was used in establishing obstacle clearance height (OCH) (see PANS-OPS, Volume I, Part I, Section 4, Chapter 1, 1.5, “Obstacle clearance altitude/height (OCA/H)”). All subsequent references to vertical position shall be made in terms of height.

Table 2-3-1. Tolerance range for altimeters with a test range of 0 to 9 000 m (0 to 30 000 ft)

<i>Elevation of the aerodrome (metres)</i>	<i>Permissible range</i>	<i>Elevation of the aerodrome (feet)</i>	<i>Permissible range</i>
600	581.5 to 618.5		1 940 to 2 060
900	878.5 to 921.5	3 000	2 930 to 3 070
1 200	1 177 to 1 223	4 000	3 925 to 4 075
1 500	1 475.5 to 1 524.5	5 000	4 920 to 5 080
1 850	1 824 to 1 876	6 000	5 915 to 6 085
2 150	2 121 to 2 179	7 000	6 905 to 7 095
2 450	2 418 to 2 482	8 000	7 895 to 8 105
2 750	2 715 to 2 785	9 000	8 885 to 9 115
3 050	3 012 to 3 088	10 000	9 875 to 10 125
3 350	3 309 to 3 391	11 000	10 865 to 11 135
3 650	3 606 to 3 694	12 000	11 855 to 12 145
3 950	3 903 to 3 997	13 000	12 845 to 13 155
4 250	4 199.5 to 4 300.5	14 000	13 835 to 14 165
4 550	4 496.5 to 4 603.5	15 000	14 825 to 15 175

Table 2-3-2. Tolerance range for altimeters with a test range of 0 to 15 000 m (0 to 50 000 ft)

<i>Elevation of the aerodrome (metres)</i>	<i>Permissible range</i>	<i>Elevation of the aerodrome (feet)</i>	<i>Permissible range</i>
600	569.5 to 630.5	2 000	1 900 to 2 100
900	868 to 932	3 000	2 895 to 3 105
1 200	1 165 to 1 235	4 000	3 885 to 4 115
1 500	1 462 to 1 538	5 000	4 875 to 5 125
1 850	1 809 to 1 891	6 000	5 865 to 6 135
2 150	2 106 to 2 194	7 000	6 855 to 7 145
2 450	2 403 to 2 497	8 000	7 845 to 8 155
2 750	2 699.5 to 2 800.5	9 000	8 835 to 9 165
3 050	2 996.5 to 3 103.5	10 000	9 825 to 10 175
3 350	3 293.5 to 3 406.5	11 000	10 815 to 11 185
3 650	3 590.5 to 3 709.5	12 000	11 805 to 12 195
3 950	3 887.5 to 4 012.5	13 000	12 795 to 13 205
4 250	4 184.5 to 4 315.5	14 000	13 785 to 14 215
4 550	4 481.5 to 4 618.5	15 000	14 775 to 15 225

Chapter 4

ALTIMETER CORRECTIONS

Note.— This chapter deals with altimeter corrections for pressure, temperature and, where appropriate, wind and terrain effects. The pilot is responsible for these corrections, except when under vectoring. In that case, the controller issues clearances such that the prescribed obstacle clearance will exist at all times, taking the cold temperature correction into account.

4.1 RESPONSIBILITY

4.1.1 Pilot's responsibility

The pilot-in-command is responsible for the safety of the operation and the safety of the aeroplane and of all persons on board during flight time (Annex 6, 4.5.1). This includes responsibility for obstacle clearance, except when an IFR flight is being vectored.

Note.— When an IFR flight is being vectored, air traffic control (ATC) may assign minimum vectoring altitudes which are below the minimum sector altitude. Minimum vectoring altitudes provide obstacle clearance at all times until the aircraft reaches the point where the pilot will resume own navigation. The pilot-in-command should closely monitor the aircraft's position with reference to pilot-interpreted navigation aids to minimize the amount of navigation assistance required and to alleviate the consequences resulting from a failure of the ATS surveillance system. The pilot-in-command should also continuously monitor communications with ATC while being vectored, and should immediately climb the aircraft to the minimum sector altitude if ATC does not issue further instructions within a suitable interval, or if a communications failure occurs.

4.1.2 Operator's responsibility

The operator is responsible for establishing minimum flight altitudes, which may not be less than those established by States that are flown over (Annex 6, 4.2.6). The operator is responsible for specifying a method for determining these minimum altitudes (Annex 6, 4.2.6). Annex 6 recommends that the method should be approved by the State of the Operator and also recommends the factors to be taken into account.

4.1.3 State's responsibility

PANS-AIM, Appendix 2 (Contents of Aeronautical Information Publication), indicates that States should publish in Section GEN 3.3.5, "The criteria used to determine minimum flight altitudes". If nothing is published, it should be assumed that no corrections have been applied by the State.

Note.— The determination of lowest usable flight levels by air traffic control units within controlled airspace does not relieve the pilot-in-command of the responsibility for ensuring that adequate terrain clearance exists, except when an IFR flight is being vectored.