6 Procedures for Air Navigation - Aircraft Operations (DOC 8168/ Vol.1)

6.1 Foreword

6.1.1 Introduction

The Procedures for Air Navigation Services Aircraft Operations (PANS-OPS) consists of two volumes as follows:

Volume I Flight Procedures

Describes operational procedures recommended for the guidance of flight operations personnel. It also outlines the various parameters on which the criteria in Volume II are based so as to illustrate the need for operational personnel including flight crew to adhere strictly to the published procedures in order to achieve and maintain an acceptable level of safety in operations.

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.

6.2 Essential Abbreviations

(See tables AL 6.1)

6.3 Departure Procedures

6.3.1 General Criteria

Obstacle clearance is the primary safety consideration in the development of instrument flight procedures. All such procedures depict tracks and pilots should attempt to maintain the track by applying corrections to heading for known wind.

These procedures assume that all engines are operating. In order to ensure acceptable clearance above obstacles during the departure phase, instrument departure procedures may be published as specific routes to be followed or as omnidirectional departures, together with procedure design gradients and details of significant obstacles. Omnidirectional departures may specify sectors to be avoided.

6.3.2 Standard Instrument Departures General

A SID is normally developed to accommodate as many aircraft categories as possible. Departures which are limited to specific aircraft categories are clearly annotated.

Abbreviations			
AAIM	Aircraft autonomous integrity monitoring	FMC	Flight management computer
AC	Advisory Circular	FMS	Flight management system
ACAS	Airborne collision avoidance system	FSD	Full-scale deflection
AGL	Above ground level	ft	Foot (feet)
AHRS	Attitude and heading reference system	FTE	Flight technical error
AIP	Aeronautical Information Publication	FTP	Fictitious threshold point
AIRAC	Aeronaut. information regulation and control	FTT	Flight technical tolerance
APV	Approach procedure with vertical guidance	GBAS	Ground-based augmentation system
ATC	Air traffic control	GLS	GBAS landing system
ATIS	Automatic terminal information service	GNSS	Global navigation satellite system
ATS	Air traffic services	GP	Glide path
ATTCS	Automatic take-off thrust control systems	GPIP	Glide path intercept point
baro-VNAV	Barometric vertical navigation	GPWS	Ground proximity warning system
CAT	Category	HAL	Horizontal alarm limit
CBT	Computer-based training	HP	Helipoint
CDFA	Continuous descent final approach	hPa	Hectopascal(s)
CD!	Course deviation indicator	HPL	Horizontal protection level
CIL	Centre line	HRP	Heliport reference point
CPA	Closest point of approach	HSI	Horizontal situation indicator
CRC	Cyclic redundancy check	HVR	High vertical rate
CRM	Collision risk model	IAC	Instrument approach chart
CRM	Crew resource management	IAF	Initial approach fix·
DAIH	Decision altitudelheight	IAP	Instrument approach procedure
DER	Departure end of the runway	IAS	Indicated airspeed
Direct-VS	Direct visual segment	IF	Intermediate fix
DME	Distance measuring equipment	IFR	Instrument flight rules
DP	Descent point	ILS	Instrument landing system
DR	Dead reckoning	IMC	Instrument meteorological conditions
EFIS	Electronic flight instrument system	INS	Inertial navigation system
EGPWS	Enhanced ground proximity warning system	IRS	Inertial reference system
ESDU	Engineering Sciences Data Unit	ISA	International standard atmosphere
EUROCAE	Euro-Organization for Civil Aviation Equipment	JAA	Joint Aviation Authorities
FAA	Federal Aviation Administration	KIAS	Knots indicated airspeed
FAP	Final approach flx	kt	Knot(s)
FAP	Final approach point	km	Kilometre(s)
FAS	Final approach segment	LNAV	Lateral navigation
FATO	Final approach and take-off area	LORAN	Long range air navigation system
FHP	Fictitious helipoint	LPV	Localizer performance with vertical guidance
FL	Flight level	LTP	Landing threshold point

Table AL 6.1 Abbreviations part 1

Abbreviations			
m	Metre(s)	RA	Resolution advisory
MAHF	Missed approach holding fix	RAIM	Receiver autonomous integrity monitoring
MAPt	Missed approach point	RDH	Reference datum height
MDAIH	Minimum descent altitudelheight	RNAV	Area navigation
MEA	Minimum en-route altitude	RNP	Required navigation performance
MLS	Microwave landing system	RSR	En-route surveillance radar
MOC	Minimum obstacle clearance	RSS	Root sum square
MOCA	Minimum obstacle clearance altitude	RVR	Runway visual range
MOPS	Minimum operational performance standards	RWY	Runway
MSA	Minimum sector altitude	SBAS	Satellite-based augmentation system
.MSD	Minimum stabilization distance	SD	Standard deviation
MSL	Mean sea level	SI	International system of units
NADP	Noise abatement departure procedure	SID	Standard instrument departure
NDB	Non-directional beacon	SOC	Start of climb
NM	Nautical mile(s)	SOPs	Standard Operating Procedures
NOTAM	Notice to airmen	SPI	Special position indicator
NOZ	Normal operating zone	SSR	Secondary surveillance radar
NPA	Non-precision approach	SST	Supersonic transport
NSE	Navigation system error	STAR	Standard instrument arrival
NTZ	No transgression zone	TA	Traffic advisory
OAS	Obstacle assessment surface	TAA	Terminal arrival altitude
OCAIH	Obstacle clearance altitude/height	TAR	Terminal area surveillance radar
OCS	Obstacle clearance surface	TAS	True airspeed
OFZ	Obstacle free zone	TCH	Threshold crossing height
OIS	Obstacle identification surface	TF	Track to fix
OLS	Obstacle limitation surface	THR	Threshold
OM	Outer marker	TMA	Terminal control area
PA	Precision approach	TP	Turuing point
PAOAS	Parallel approach obstacle assessment surface	TSO	Technical Standard Order
PAPI	Precision approach path indicator	VAL	Vertical alarm limit
PAR	Precision approach radar	VASIS	Visual approach slope indicator system
PDG	Procedure design gradient	VOR	Very high frequency omnidirectional radio range
PinS	Point-in-space	VPA	Vertical path angle
PRP	Point-in-space reference point	VPL	Vertical protection level
PVT	Position, velocity and time	VSDA	Visual segment descent angle
QFE	Atmospheric pressure at aerodrome elevation (or at runway threshold)	VTF	Vector to fmal
		WD	Waypoint distance
QNH	Altimeter sub-scale setting to obtain elevation when on the ground	WGS	World geodetic system

Table AL 6.1 Abbreviations part 2

The SID terminates at the first fix/facility/ way-point of the en-route phase following the departure procedure.

There are two basic types of departure route: straight and turning. Departure routes are based on track guidance acquired within 20.0 km (10.8 NM) from the departure end of the runway (DER) on straight departures and within 10.0 km (5.4 NM) after completion of turns on departures requiring turns. The design of instrument departure routes and the associated obstacle clearance criteria are based on the definition of tracks to be followed by the aeroplane. When flying the published track, the pilot is expected to correct for known wind to remain within the protected airspace.

The design of an instrument departure procedure is, in general, dictated by the terrain surrounding the aerodrome, but may also be required to cater for ATC requirements. These factors in turn influence the type and siting of navigation aids in relation to the departure route. Airspace restrictions may also affect the routing and siting of navigation aids.

At many aerodromes, a prescribed departure route is not required for ATC purposes. Nevertheless, there may be obstacles in the vicinity of the aerodrome that will have to be considered in determining whether restrictions to departures are to be prescribed. In such cases, departure procedures may be restricted to a given sector or may be restricted to an aircraft minimum net climb gradient in the sector containing the obstacle.

The use of automatic take-off thrust control systems (ATTCS) and noise abatement procedures will need to be taken into consideration by the pilot and the operator. In the case of an obstacle critical take-off the thrust reduction should be limited so that the specified minimum net climb gradient will be achieved.

Where no suitable navigation aid is available for track guidance, the criteria for omnidirectional departures are applied. However, where obstacles cannot be cleared by the appropriate margin when the aeroplane is flown on instruments, cloud base and visibility minima are established to permit visual flight to clear obstacles, or a departure route is approved.

When a departure route requires a turn of more than 15° to avoid an obstacle, a turning departure is constructed. (A straight departure route is one in which the initial departure track is within 15° of the alignment of the runway centre line), *see fig. AL 6.1 and fig. AL 6.2.*

Establishment of a Departure Procedure

A departure procedure will be established for each runway where instrument departures are expected to be used and will define:

- A departure procedure for the various types of aircraft based on all-engines minimum net climb gradient of 3.3%
- An acceleration segment; and
- An increased minimum net climb gradient, if required, to achieve minimum obstacle clearance.

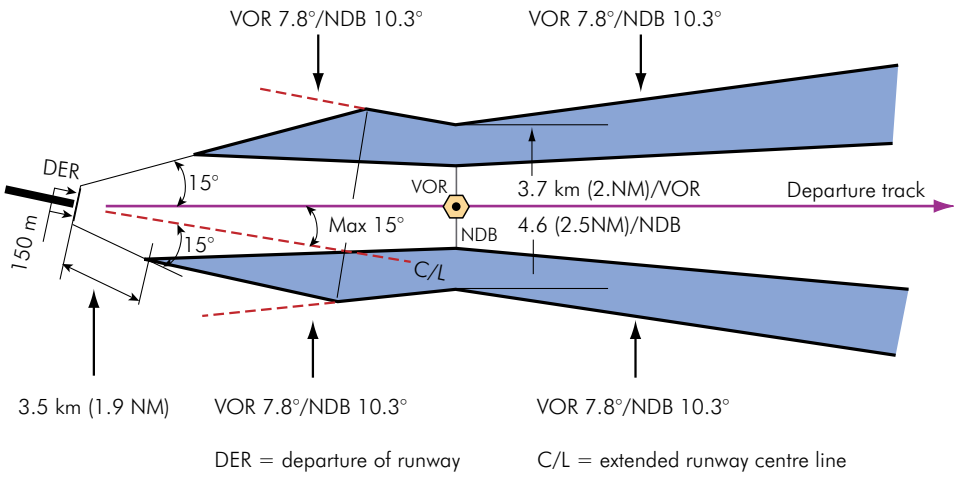

Fig. AL 6.1 Area for straight departure with track guidance

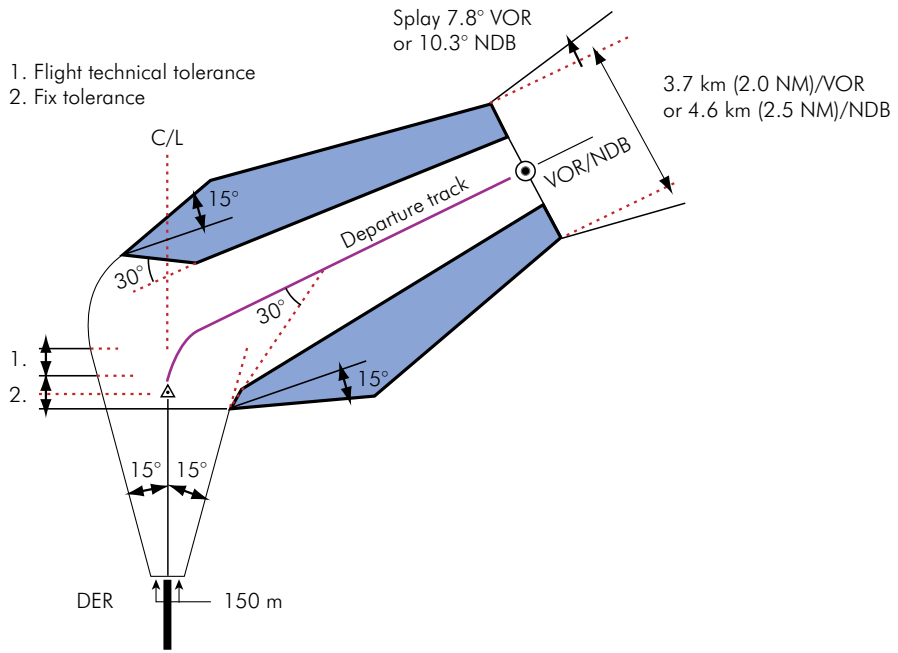

Fig. AL 6.2 Turning departure - turn at fix

The procedures will assume that pilots will not compensate for wind effects when being radar vectored; and will compensate for known/or estimated wind effects when flying departure routes which are expressed as tracks to be made good.

Note
Development of contingency procedures, when required to cover a case of engine failure or an emergency in flight which occurs after V_1 and before the acceleration segment, is the responsibility of the operator.

Obstacle Clearance

Obstacle clearance is a primary safety consideration in the development of instrument departure procedures. The criteria used and the detailed method of calculation are covered in PANS-OPS, Volume II.

Unless otherwise promulgated, a PDG of 3.3 per cent is assumed. The PDG is made up of:

- 2.5 per cent gradient of obstacle identification surfaces or the gradient base on the most critical obstacle penetrating these surfaces, whichever is the higher; and
- 0.8 per cent increasing obstacle clearance, *see fig. AL. 6.3.*

Gradients published will be specified to an altitude/height after which the minimum gradient of 3.3 per cent is considered to prevail (see the controlling obstacle in *fig. AL 6.3.* The final PDG continues until obstacle clearance is ensured for the next phase of flight (i.e. en-route, holding or approach).

At this point the departure procedure ends and is marked by a significant point.

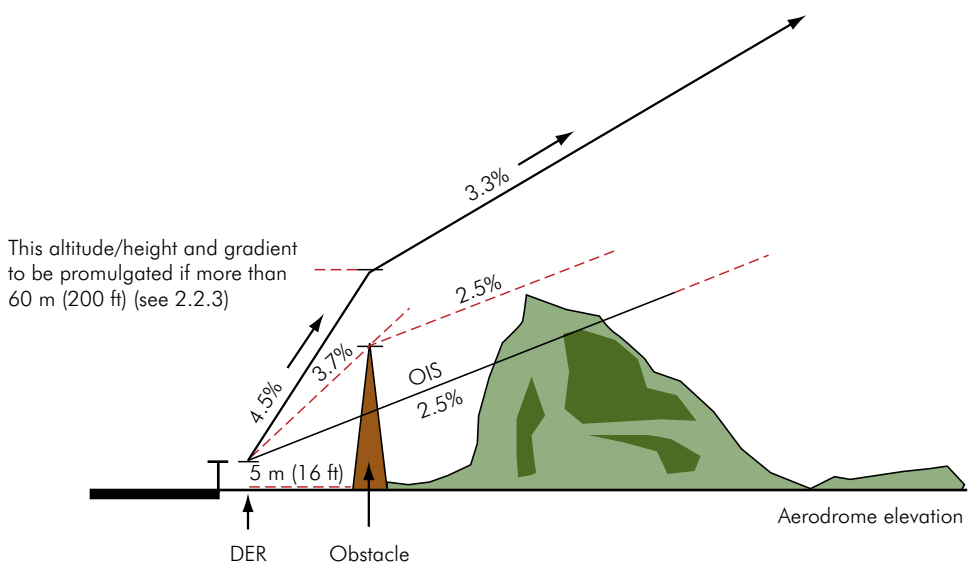

Fig. AL 6.3 Procedure design gradient (PDG)