

Preliminary Height Assessment

Planning Proposal
2– 4 Guess Avenue,
Wolli Creek, NSW

Client

FPD Pty Ltd on behalf of Bayside Council

LB00276

Final Version 002
8 February 2019

Landrum & Brown Worldwide (Aust) Pty Ltd, 2019

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1 Introduction

FPD Pty Ltd on behalf of Bayside Council has tasked Landrum & Brown Worldwide (Australia) Pty Ltd to prepare a Preliminary Height Assessment (PHA) for a Planning Proposal to rezone a site at 2 - 4 Guess Avenue, Wolli Creek, NSW.

The assessment has considered the following points in the preparation of the PHA:

- Consideration of relevant Acts and Regulations applicable to developments in the vicinity of airports and air traffic routes. The major relevant documents include:
 - The Airports Act 1996;
 - Airports (Protection of Airspace) Regulations 1996; and
 - CASR Part 139 Manual of Standards – Aerodromes.
- Analysis of Obstacle Limitation Surfaces (OLS);
- Analysis of Procedures for Air Navigation Services – Aircraft Operations (PANS OPS);
- Radar Terrain Clearance Charts (RTCC);
- Impacts on Navigation Aids, Communications and Airspace Surveillance facilities; and
- Aviation activity in the vicinity of the site, including VFR and helicopter operations.

1.1 The Site

The site is located approximately 2.8 km North West of Sydney Airport's Aerodrome Reference Point (ARP), 1.7 km west of the threshold for Runway 16R and 1.7 km North West of the threshold of Runway 07.

Whilst other airports in the Sydney area have PANS OPS surfaces overhead the site, they are at heights significantly above those of Sydney Airport and have not been considered in detail in this report as they will not be impacted by any planning proposal at Wolli Creek.

Figure 1 shows the site in relation to Sydney Airport.



Figure 1: Location in relation to Sydney Airport

2 Prescribed Airspace

2.1 Overview

Prescribed Airspace for an airport is the airspace above any facet of the Obstacle Limitation Surfaces (OLS), the Procedures for Air Navigation Services – Aircraft Operations (PANS OPS) surfaces for an airport, or the Radar Terrain Clearance Chart (RTCC) protection surfaces.

The OLS are conceptual surfaces associated with runways that are designed to protect aircraft operations from unrestricted obstacle growth.

The OLS comprises the following:

- outer horizontal surface (OHS);
- conical surface;
- inner horizontal surface (IHS);
- approach surface;
- inner approach surface;
- transitional surface;
- inner transitional surface;
- baulked landing surface; and
- take-off climb surface.

The PANS OPS surfaces exist beneath instrument approach and departure flight paths to and from a runway that provides a prescribed minimum obstacle clearance margin above the obstacles or terrain within the lateral limits of the flight path protection area. They provide an obstacle free flight path to enable safe and efficient aircraft operations in Instrument Meteorological Conditions (IMC).

The RTCC provides Air Traffic Control (ATC) with a minimum safe altitude above terrain and obstacles to which they can provide surveillance services to aircraft in the area around major airports.

Infringement by a building or crane into Prescribed Airspace requires the approval of the aerodrome operator, the Civil Aviation Safety Authority (CASA), and the Department of Infrastructure, Regional Development and Cities (DIRDC) where the airport is on federally leased land.

Infringement of PANS OPS or RTCC protection surfaces are not supported by the aviation authorities, except in exceptional circumstances and following a detailed Aeronautical Study accepted by the aviation authorities.

2.2 PANS OPS

All Sydney basin airports' PANS OPS surfaces were assessed for this site referencing the aeronautical information contained within the Aeronautical Information Publication Australia, Departure and Approach Procedures, Amendment 158 effective 29 February 2019.

The PANS OPS surfaces for all airports, other than Sydney Airport, are well above the maximum height of this site and are not detailed in this report.

A detailed assessment of Sydney Airport's PANS OPS surfaces has discovered two relevant PANS OPS surfaces above the site.

The lowest PANS OPS surface above the eastern corner of the site is 62.62 m AHD. It relates to the RNAV-Z (GNSS) RWY 16R approach surfaces.

The other PANS OPS surface, above the remainder of the site, relates to the RNAV-Z (GNSS) RWY 07 approach surfaces. This PANS OPS surface is at 95.55 m AHD.

Figure 2 depicts the layout considered in this report. Point A is the eastern corner referred to above.

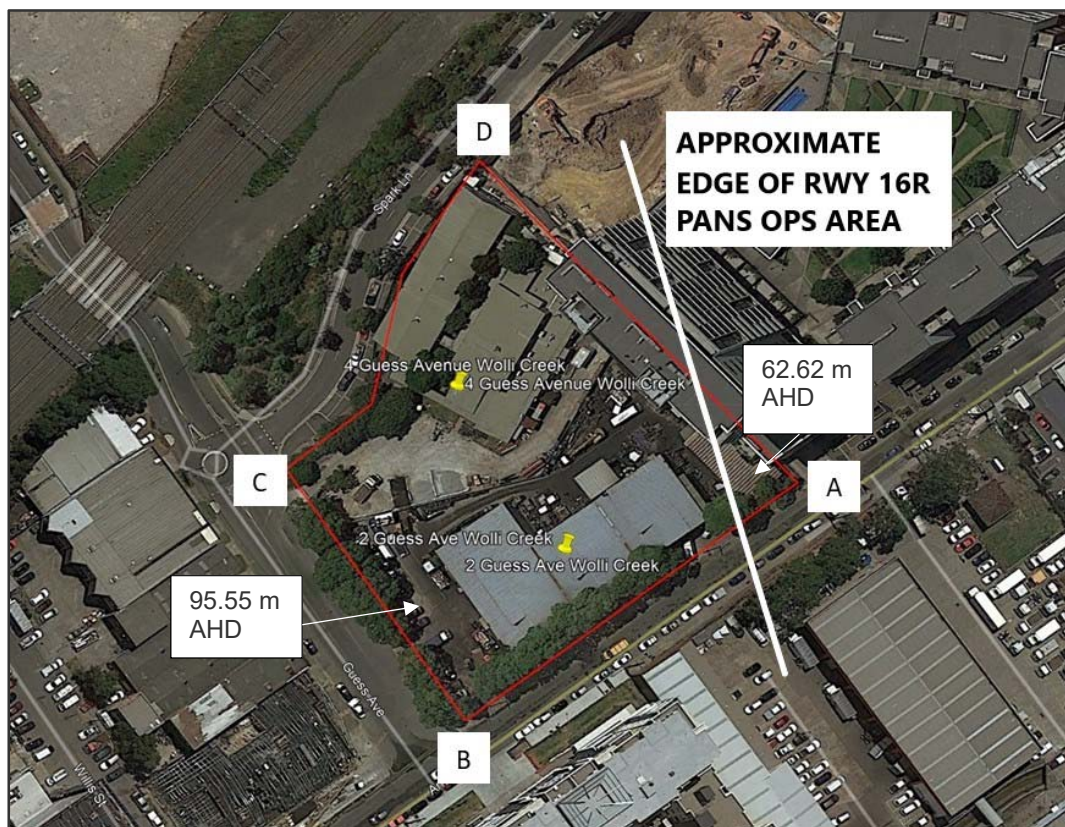


Figure 2: Site Boundary Points (Google Earth Image)

Figure 3 depicts the site with the PANS OPS surface boundary of the RNAV-Z (GNSS) RWY 16R coloured in green. The area between the green line and point A has a PANS OPS height limit of 62.62 m AHD and the rest of the site to the west of the green line has a PANS OPS height limit of 95.55 m AHD.



Figure 3: Site boundary with RNAV RWY 16R PANS OPS Area (Google Earth Image)

Figure 4 depicts the site with the PANS OPS boundaries of the RNAV-Z (GNSS) RWY 07 coloured in green.



Figure 4: Site boundary with RNAV RWY 07 PANS OPS Area (Google Earth Image)

The location of the edge of the RNAV 16R area allows a maximum building height of 95.55 m AHD over the majority of the site, except for the eastern corner which must be limited to 62.62 m AHD.

Approval for infringements of the PANS OPS surfaces are not likely to be approved by the aviation authorities. The RNAV-Z (GNSS) RWY 16R and RNAV-Z (GNSS) RWY 07 approaches are new approaches which contain a Vertical Navigation capability. This provides a significant safety and efficiency benefit to aircraft landing at Sydney Airport. They were first published in 2017.

2.3 RTCC

The RTCC is well above the limiting PANS OPS surfaces at 152 m AHD.

2.4 OLS

The site is located laterally within the Inner Horizontal Surface (IHS) of the Sydney Airport OLS which is at a height of 51m AHD.

Figures 5 and 6 depict the location of the site in relation to Sydney OLS.

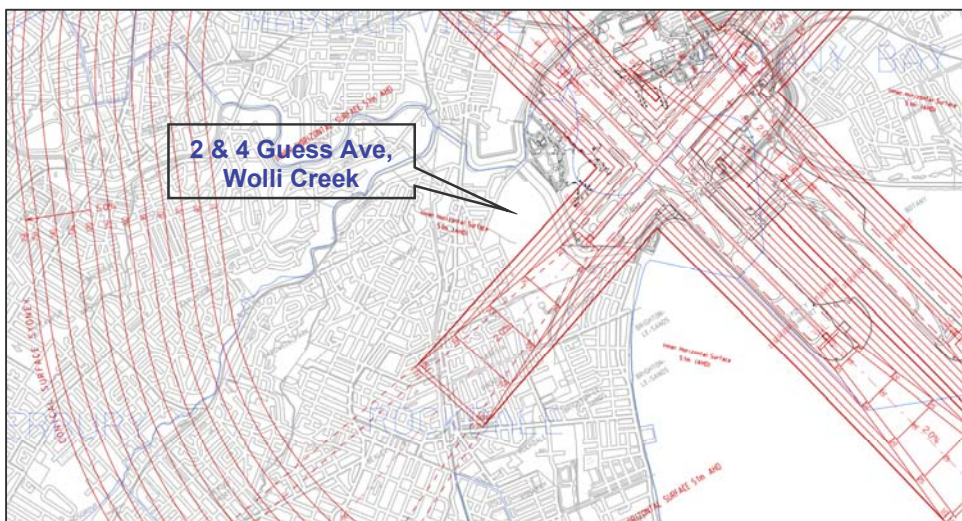


Figure 5: Site location within the Inner Horizontal Surface boundary (SACL Masterplan 2015)



Figure 6: Site Location in relation to OLS – Close Up (SACL Masterplan 2015)

Buildings on the site will not impact on the Sydney Airport OLS if the building is lower than 51 m AHD and would not require approval from the aviation authorities.

Past assessments and applications have resulted in the approval of some infringements of this OLS. These have included suburbs such as Rockdale, Mascot, Kingsford, Pagewood, Roseberry, and Zetland with IHS infringements between 0.2 m and 53.9 m into the IHS.

A higher building on this site, up to the lowest PANS OPS surface may be able to be approved after presentation of a detailed Aeronautical Impact Assessment and Aeronautical Study. This study would include an assessment of construction cranes.

Approval cannot be taken for granted. It can only be granted upon a detailed assessment of a comprehensive aeronautical study by the relevant aviation authorities.

3 ATC Surveillance System Performance

This assessment identified two radars in relative proximity to the site: the Sydney Airport Terminal Area Radar (TAR), and the Cecil Park TAR.

Table 1 shows the height of the ATC Surveillance System clearance plane above the nearest point of the site to the TAR site.

Surveillance System	Distance from Site (m)	Antenna Elevation (m AHD)	Clearance Plane Elevation at site (Distance x Tan 0.5° + Antenna elevation) (m AHD)
Sydney Airport TAR	3360	38.2	67.5
Cecil Park TAR	29600	200.5	458.8

Table 1: Heights of Clearance Planes above the site

The clearance planes are above the lowest PANS OPS surface. If the building height is below the PANS OPS surface then the ATC Surveillance System Clearance planes will not be infringed.

Buildings or terrain that infringe the clearance planes can cause surveillance system shadows in which ATC can provide a critical service. Infringements of the Sydney TAR clearance planes by buildings are common in the Sydney area. This is recognised by Airservices Australia and has been mitigated by the installation of the Cecil Park radar approximately 25 km from Sydney CBD, and more recently ADS-B receivers situated

strategically around Australia, to ensure that ATC receives adequate surveillance coverage for the airspace around the Sydney Basin airports.

Cranes are considered not to impact the performance of ATC surveillance equipment.

Airservices Australia will assess any likely impact that the any future development on the site may have on the Sydney Airport TAR, or other surveillance systems such as ADS-B.

4 Navigation Aid Performance

There are a number of navigation aids installed at Sydney Airport, including ILS, GBAS and DME.

The Building Restricted Areas (BRA) describes a sensitive zone that exists to a radius of 3000 m from the navigation aid antenna sites.

The building development limitations within the BRA is specified in the Airservices Australia document Navigation Aid Building Restricted Areas and Siting Guidance AEI-7.1613 Issue 2.

Table 2 lists the navigation aids and the assessment result in accordance with the BRA documents.

Navigation Aid	Distance from site (m)	Result
SY DME	3200	Beyond maximum BRA radius.
SY GBAS	4331	Beyond maximum BRA radius.
RWY 25 ILS LOC	1535	Pointing in the other direction. No infringement.
RWY 07 ILS LOC	3729	Beyond maximum BRA radius.

Table 2: Navigation Aid Clearance Plane Impacts

The site is located outside of all BRA for all navigation aids in the Sydney area.

5 Roof Top Exhaust Plumes

Exhaust plumes in excess of 4.3 m/s can create sufficient turbulence to upset the stability of aircraft during take-off and landing operations.

Roof top exhaust plumes with a vertical velocity in excess of 4.3 m/s that infringe Prescribed Airspace must be referred to CASA for their assessment of risk to aircraft operations.

6 Obstacle Lighting

CASA may require the installation of permanent obstacle lighting if a building or structure infringes Prescribed Airspace.

7 VFR and Helicopter Operations

Due to the proximity of the site to Sydney Airport, VFR flight paths and helicopter flights would be controlled by ATC and are unlikely to operate in the area surrounding the site. As VFR aircraft operate in a visual environment and can see and avoid obstacles and terrain, it is unlikely that such flights would be affected by the any future development of the site.

8 Cranes

Should any future development of the site be of a height that is close to any Prescribed Airspace, construction cranes, above this height will normally require a separate assessment and a separate approval from the aviation authorities, once height requirements and duration of operations are known.

Infringements by cranes, up to a maximum of 3 months duration can be approved by DIRDC but it is not guaranteed or routine. A carefully considered construction plan, including the use of cranes will provide a strong basis for any approval.

9 Conclusion

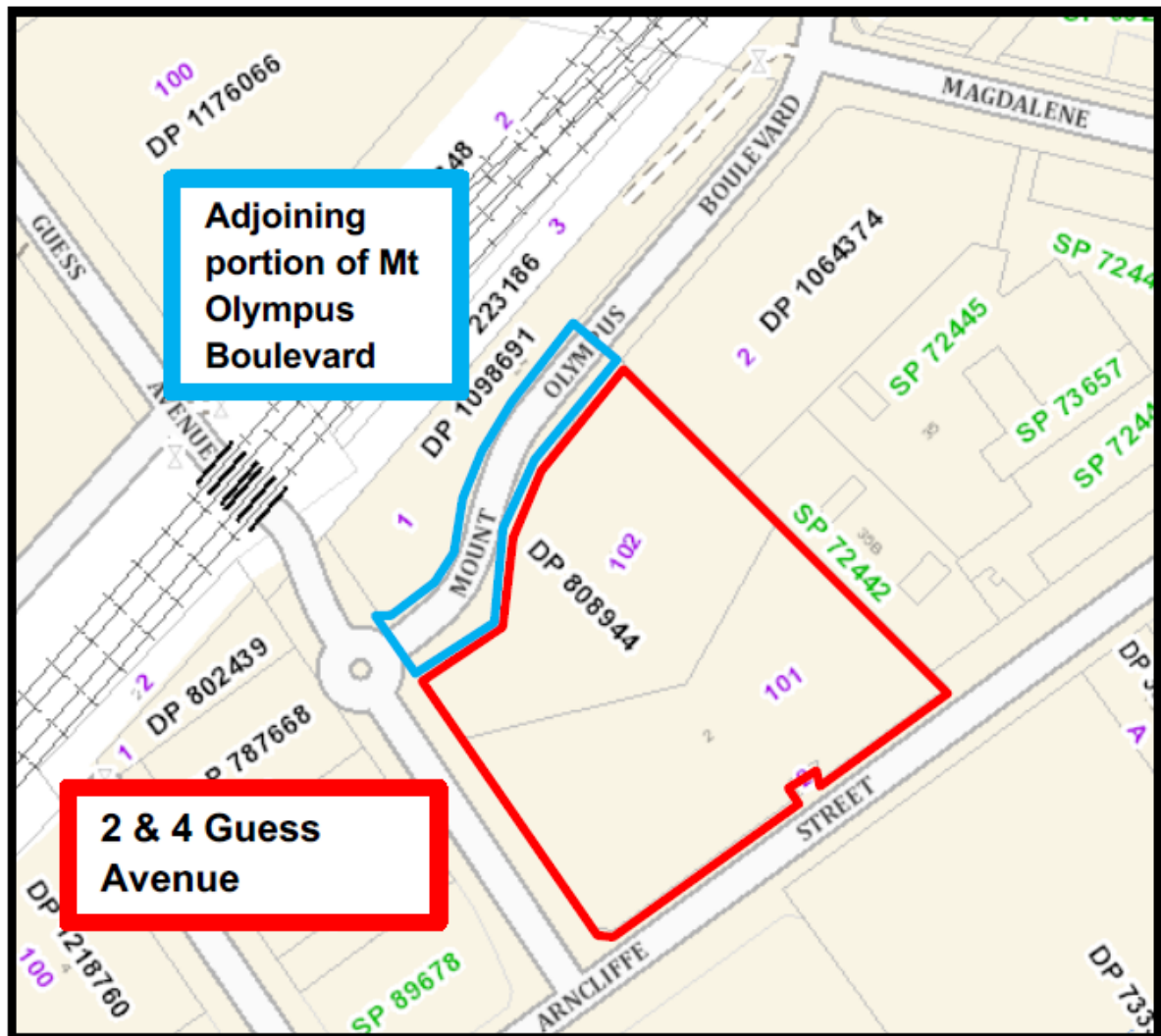
The proposed site at 2— 4 Guess Avenue, Wolli Creek has the following Prescribed Airspace limitations:

- The Inner Horizontal Surface of the OLS for Sydney Airport - **51m AHD**;
- The Sydney Airport PANS OPS surface related to the RNAV-Z(GNSS) RWY 16R – **66.62 m AHD**;
- The Sydney Airport PANS OPS surface related to the RNAV-Z (GNSS) RWY 07 – **95.55 m AHD**;
- Is beyond the lateral limits of all BRA for navigation aids at Sydney Airport;
- The Sydney TAR clearance planes of **67.5 m AHD** , but the effect of a higher building will be mitigated by the Cecil Park TAR and ADS-B receivers in the area; and
- The RTCC protection surface - **152 m AHD**.

It will be necessary to gain approval for any infringement of the Sydney OLS and/or PANS OPS surfaces via an application to Sydney Airport Corporation Limited supported by a comprehensive Aeronautical Impact Assessment.

Appendix A

Site Layout Diagram



Site Description

Source: Bayside Council

Appendix B

Assessment Methodology

In preparing aeronautical impact assessments associated with airport safeguarding and protection, it is necessary to observe the requirements of the relevant aviation authorities including:

- The Department of Infrastructure, Regional Development and Cities (DIRDC);
- The Civil Aviation Safety Authority of Australia (CASA);
- Airservices Australia (ASA);
- Airport Operators; and
- Department of Defence where appropriate.

The *Airports Act 1996* and *Airports (Protection of Airspace) Regulations 1996* prescribes the volumes of airspace surrounding Federally Leased Airports that protect aircraft operations into those airports, in order to ensure the safety and regularity of airline and other flight operations.

Sydney and Bankstown Airports' Prescribed Airspace comprises:

- Obstacle Limitation Surfaces (OLS) that restrict obstacle growth in the vicinity of takeoff and landing paths;
- PANS OPS surfaces that provide a buffer between flight paths and terrain or obstacles; and
- Radar Terrain Clearance Chart protection surfaces that provide ATC with a safe altitude to assign to aircraft during radar vectoring activities.

Relevant Acts and Regulations applicable to developments near airports and air traffic routes were referenced during this assessment.

The major relevant documents include:

- The Airports Act 1996, Airports (Protection of Airspace) Regulations 1996;
- Civil Aviation Safety Regulation (CASR) Part 139 Manual of Standards – Aerodromes;
- Aeronautical Information Publication (AIP);
- Airservices Australia's Airways Engineering Instruction – Navigation Aid Building Restricted Areas and Siting Guidance (BRA);
- International Civil Aviation Organisation (ICAO) DOC 8168 Procedures for Air Navigation – Aircraft Operations (PANS OPS).

A Glossary of Aeronautical Terms and Abbreviations is shown at Appendix C.

Appendix C

Glossary of Aeronautical Terms and Abbreviations

To facilitate the understanding of aviation terminology used in this report, the following is a glossary of terms and acronyms that are commonly used in aeronautical impact assessments and similar aeronautical studies.

AC (Advisory Circulars) are issued by CASA and are intended to provide recommendations and guidance to illustrate a means, but not necessarily the only means, of complying with the *Regulations*.

Aeronautical study is a tool used to review aerodrome and airspace processes and procedures to ensure that safety criteria are appropriate.

AIPs (Aeronautical Information Publications) are publications promulgated to provide operators with aeronautical information of a lasting character essential to air navigation. They contain details of regulations, procedures and other information pertinent to flying and operation of aircraft. In Australia, AIP is issued by Airservices Australia on behalf of CASA.

Air routes exist between navigation aid equipped aerodromes or waypoints to facilitate the regular and safe flow of aircraft operating under IFR.

Airservices Australia is the Australian government-owned corporation providing safe and environmentally sound air traffic management and related airside services to the aviation industry.

Altitude is the vertical distance of a level, a point or an object, considered as a point, measured from mean sea level.

ATC (Air Traffic Control) service is a service provided for the purpose of:

- a. preventing collisions:
 1. between aircraft; and
 2. on the manoeuvring area between aircraft and obstructions; and
- b. expediting and maintaining an orderly flow of air traffic.

CASA (Civil Aviation Safety Authority) is the Australian government authority responsible under the *Civil Aviation Act 1988* for developing and promulgating appropriate, clear and concise aviation safety standards. As Australia is a signatory to the ICAO *Chicago Convention*, CASA adopts the standards and recommended practices established by ICAO, except where a difference has been notified.

CASR (Civil Aviation Safety Regulations) are promulgated by CASA and establish the regulatory framework (*Regulations*) within which all service providers must operate.

Civil Aviation Act 1988 (the Act) establishes the CASA with functions relating to civil aviation, in particular the safety of civil aviation and for related purposes.

ICAO (International Civil Aviation Organization) is an agency of the United Nations which codifies the principles and techniques of international air navigation and fosters the planning and development of international air transport to ensure safe and orderly growth. The ICAO Council adopts standards and recommended practices concerning air navigation, its infrastructure, flight inspection, prevention of unlawful interference, and facilitation of border-crossing procedures for international civil aviation. In addition, the ICAO defines the protocols for air accident investigation followed by transport safety authorities in countries signatory to the Convention on International Civil Aviation, commonly known as the *Chicago Convention*. Australia is a signatory to the *Chicago Convention*.

IFR (Instrument Flight Rules) are rules applicable to the conduct of flight under IMC. IFR are established to govern flight under conditions in which flight by outside visual reference is not safe. IFR flight depends upon flying by reference to instruments in the flight deck, and navigation is accomplished by reference to electronic signals. It is also referred to as, "a term used by pilots and controllers to indicate the type of flight plan an aircraft is flying," such as an IFR or VFR flight plan. Pilots must hold IFR qualifications and aircraft must be suitably equipped with appropriate instruments and navigation aids to enable flight in IMC.

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

LSALT (Lowest Safe Altitudes) are published for each low level air route segment. Their purpose is to allow pilots of aircraft that suffer a system failure to descend to the LSALT to ensure terrain or obstacle clearance in

IMC where the pilot cannot see the terrain or obstacles due to cloud or poor visibility conditions. It is an altitude that is at least 1,000 feet above any obstacle or terrain within a defined safety buffer region around a particular route that a pilot might fly.

MOS (Manual of Standards) comprises specifications (Standards) prescribed by CASA, of uniform application, determined to be necessary for the safety of air navigation.

NOTAMs (Notices to Airmen) are notices issued by the NOTAM office containing information or instruction concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to persons concerned with flight operations.

Obstacles. All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that are located on an area intended for the surface movement of aircraft or that extend above a defined surface intended to protect aircraft in flight.

OLS (Obstacle Limitation Surfaces) are a series of planes associated with each runway at an aerodrome that defines the desirable limits to which objects may project into the airspace around the aerodrome so that aircraft operations may be conducted safely.

PANS OPS (Procedures for Air Navigation Services - Aircraft Operations) is an Air Traffic Control term denominating rules for designing instrument approach and departure procedures. Such procedures are used to allow aircraft to land and take off under Instrument Meteorological Conditions (IMC) or Instrument Flight Rules (IFR). ICAO document 8168-OPS/611 (volumes 1 and 2) outlines the principles for airspace protection and procedure design which all ICAO signatory states must adhere to. The regulatory material surrounding PANS OPS may vary from country to country.

PANS OPS Surfaces. Similar to an Obstacle Limitation Surface, the PANS OPS protection surfaces are imaginary surfaces in space which guarantee the aircraft a certain minimum obstacle clearance. These surfaces may be used as a tool for local governments in assessing building development. Where buildings may (under certain circumstances) be permitted to infringe the OLS, they cannot be permitted to infringe any PANS OPS surface, because the purpose of these surfaces is to guarantee pilots operating under IMC an obstacle free descent path for a given approach.

Prescribed airspace is an airspace specified in, or ascertained in accordance with, the Regulations, where it is in the interests of the safety, efficiency or regularity of existing or future air transport operations into or out of an airport for the airspace to be protected. The prescribed airspace for an airport is the airspace above any part of either an OLS or a PANS OPS surface for the airport and airspace declared in a declaration relating to the airport.

Radar Terrain Clearance Chart (RTCC) is a chart that provides air traffic controllers with the lowest usable altitude that they can vector an aircraft using prescribed surveillance procedures within controlled airspace. There is a protection surface below this usable altitude which is shown in airport master plans.

Regulations (Civil Aviation Safety Regulations)

VFR (Visual Flight Rules) are rules applicable to the conduct of flight under VMC. VFR allow a pilot to operate an aircraft in weather conditions generally clear enough to allow the pilot to maintain visual contact with the terrain and to see where the aircraft is going. Specifically, the weather must be better than basic VFR weather minima. If the weather is worse than VFR minima, pilots are required to use instrument flight rules. Pilots must be specifically qualified and aircraft specifically equipped to enable flight in IMC,

VMC (Visual Meteorological Conditions) are meteorological conditions expressed in terms of visibility, distance from cloud and ceiling, equal or better than specified minima.

Abbreviations

Abbreviations used in this report, and the meanings assigned to them for the purposes of this report are detailed in the following table.

Abbreviation	Meaning
AC	Advisory Circular (document support CAR 1998)
ACFT	Aircraft
AD	Aerodrome
ADS-B	Automatic Dependent Surveillance - Broadcast
AHD	Australian Height Datum
AIP	Aeronautical Information Publication
Airports Act	Airports Act 1996, as amended
AIS	Aeronautical Information Service
ALT	Altitude
AMSL	Above Mean Sea Level
APARs	Airports (Protection of Airspace) Regulations, 1996 as amended
ARP	Aerodrome Reference Point
AsA	Airservices Australia
ATC	Air Traffic Control(ler)
ATM	Air Traffic Management
BARO-VNAV	Barometric Vertical Navigation
BRA	Building Restricted Area
CAO	Civil Aviation Order
CAR	Civil Aviation Regulation
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation
Cat	Category
DAP	Departure and Approach Procedures (charts published by AsA)
DER	Departure End of (the) Runway
DME	Distance Measuring Equipment
Doc nn	ICAO Document Number nn
DIT	Department of Infrastructure and Transport. (Formerly Dept. of Infrastructure, Transport, Regional Development and Local Government and Department of Transport and Regional Services (DoTARS))
DOTARS	See DIT above
ELEV	Elevation (above mean sea level)
ENE	East North East
ERSA	Enroute Supplement Australia
FAF	Final Approach Fix

Abbreviation	Meaning
FAP	Final Approach Point
FAS	Final Approach Surface of a BARO-VNAV approach
ft	feet
GBAS	Ground Based Augmentation System (satellite precision landing system)
GNSS	Global Navigation Satellite System
GP	Glide Path
IAS	Indicated Airspeed
ICAO	International Civil Aviation Organisation
IHS	Inner Horizontal Surface, an Obstacle Limitation Surface
ILS	Instrument Landing System
ISA	International Standard Atmosphere
km	kilometres
kt	Knot (one nautical mile per hour)
LAT	Latitude
LLZ	Localizer
LONG	Longitude
LNAV	Lateral Navigation criteria
m	metres
MAPt	Missed Approach Point
MDA	Minimum Descent Altitude
MGA94	Map Grid Australia 1994
MOC	Minimum Obstacle Clearance
MOS	Manual of Standards, published by CASA
MSA	Minimum Sector Altitude
MVA	Minimum Vector Altitude
NASAG	National Airports Safeguarding Advisory Group
NDB	Non Directional Beacon
NE	North East
NM	Nautical Mile (= 1.852 km)
nnDME	Distance from the DME (in nautical miles)
NNE	North North East
NOTAM	NOtice to AirMen
OAS	Obstacle Assessment Surface
OCA	Obstacle Clearance Altitude
OCH	Obstacle Clearance Height
OHS	Outer Horizontal Surface
OFZ	Obstacle Free Zone

Abbreviation	Meaning
OIS	Obstacle Identification Surface
OLS	Obstacle Limitation Surface
PANS OPS	Procedures for Air Navigation Services – Aircraft Operations, ICAO Doc 8168
PBN	Performance Based Navigation
PRM	Precision Runway Monitor
QNH	An altimeter setting relative to height above mean sea level
REF	Reference
RL	Relative Level
RNAV	aRea NAVigation
RNP	Required Navigation Performance
RPA	Rules and Practices for Aerodromes. Replaced by the MOS Part 139 — Aerodromes
RPT	Regular Public Transport
RTCC	Radar Terrain Clearance Chart
RWY	Runway
SFC	Surface
SID	Standard Instrument Departure
SOC	Start Of Climb
STAR	STandard ARrival
SGHAT	Solar Glare Hazard Analysis Tool
TAR	Terminal Approach Radar
TAS	True Air Speed
THR	Threshold (Runway)
TNA	Turn Altitude
TODA	Take-Off Distance Available
VNAV	Vertical Navigation criteria
V _n	aircraft critical Velocity reference
VOR	Very high frequency Omni directional Range
WAC	World Aeronautical Chart