

Attachment 5: Aeronautical Impact Assessment prepared by
Landrum & Brown



Aeronautical Impact Assessment

Building Development
112 Talavera Road,
Macquarie Park, NSW

Meriton Group

LB00206

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Landrum & Brown Worldwide (Aust) Pty Ltd, 2018

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1 Introduction

1.1 The Development

Meriton Group Pty Ltd has tasked Landrum & Brown Worldwide (Australia) Pty Ltd to prepare an Aeronautical Impact Assessment (AIA) for a proposed building development at 112 Talavera Road, Macquarie Park, NSW.

The development comprises a mixed-use building with a maximum height of 243 m AHD and will be constructed using a Tower Crane (TC).

Table 1 shows the distances of the various airports and heliports in the vicinity of the development.

Airport	Direction and distance from 112 Talavera Rd
Sydney Airport	19.7 km south
Bankstown Airport	20.68 km south west
RAAF Richmond	35.5 km north west
Western Sydney Airport (Proposed)	37.6 km south west

Table 1: Airports in the vicinity



Figure 1: Location in relation to Sydney Airport

2 Prescribed Airspace

2.1 Overview

Prescribed Airspace for an airport is the airspace above any part of either an Obstacle Limitation Surface (OLS), a PANS OPS (Procedures for Air Navigation Services – Aircraft Operations) surface for the airport and 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;
- balked landing surface; and
- take-off climb surface.

The PANS OPS surfaces are designed to guarantee an obstacle free path to and from a runway, with a prescribed minimum obstacle clearance above the obstacles or terrain, for the safety of aircraft operations in Instrument Meteorological Conditions (IMC).

The RTCC provides ATC with minimum heights that they can provide surveillance services to aircraft in the area around major airports.

Infringement by a building or crane through the OLS requires the approval of 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.

2.2 OLS

The Outer Horizontal Surface of the OLS extends to 15 km from the applicable airport. There are no other OLS extending beyond 15 km from the applicable airport.

The development site is located more than 15 km from any of the airports in the Sydney area and is therefore located laterally outside of all applicable OLS.

Table 2 identifies the various Airports' OLS and Infringement.

Airport	Prescribed Airspace Surface	Height of surface (m AHD)	Infringement (m)
Sydney	All OLS	Laterally Outside	Nil
Bankstown	All OLS	Laterally Outside	Nil
RAAF Richmond	All OLS	Laterally Outside	Nil
Western Sydney	All OLS	Laterally Outside	Nil

Table 2: Development site relationship to various Airports' OLS

2.3 PANS OPS

Sydney Airport's PANS OPS surfaces are the most relevant for this proposed development. PANS OPS surfaces related to other airports are well above the maximum proposed height of this development.

The development site is situated at the edge of an area where the PANS OPS surface height is 246.8 m AHD, but the majority of the development is situated beneath a PANS OPS surface height of 335.2 m AHD.

Figure 2 depicts Sydney Airport's Master Plan 2015 diagram of the PANS OPS surfaces with the location of the development marked upon it.



Figure 2: PANS OPS Surface Diagram and Development Site (SACL Masterplan 2015)

Table 3 shows the lowest PANS OPS surface height above the development site for each airport and the clearance (in green) or infringement (in red) of the building on each surface.

Airport/Approach or Departure Procedure	Surface Height (m AHD)	Building 243 m AHD
Sydney (Extracted from Sydney Airport Master plan 2015)	246.8	3.8
Bankstown (Extracted from Bankstown Airport Masterplan 2014)	820	577
Camden (25nm MSA)	1341	1098
RAAF Richmond	396	153
Radar Terrain Clearance Chart (RTCC)	244	1

Table 3: PANS OPS Surface Heights and result

A Radar Terrain Clearance Chart (RTCC) protection surface exists above the site. This surface relates to the lowest level that aircraft are able to descend to whilst under the direction of ATC.

Figure 3 depicts the development site and the RTCC protection surface chart (SACL Masterplan 2015).

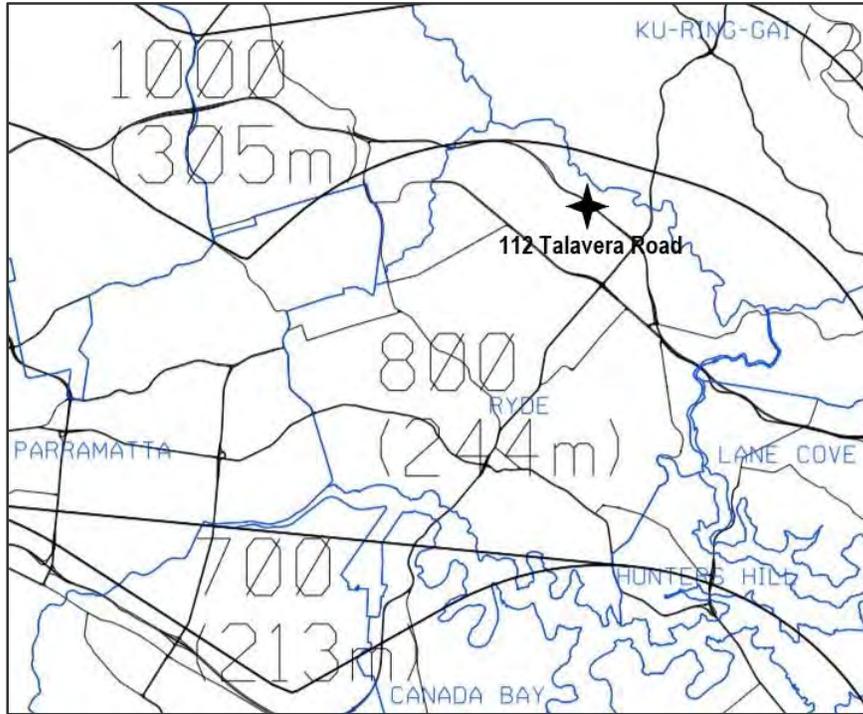


Figure 3: Development Site in Relation to RTCC

2.3.1 Result of Assessment

The proposed development at a maximum height of 243 m AHD:

- will not infringe the PANS OPS surface of Sydney Airport;
- will not infringe any PANS OPS surfaces at any other airport;
- will not infringe the RTCC protection surface.

3 ATC Surveillance System Performance

This assessment identified two radars in relative proximity to the development at 112 Talavera Road, Macquarie Park: the Sydney Airport Terminal Area Radar (TAR), and the Cecil Park TAR.

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

Table 4 depicts the impact of the development on the performance of the ATC Surveillance System Performance.

Surveillance System	Distance from development	Distance in metres	Antenna Elevation (m AHD)	Plane Elevation at Church St (m AHD) Distance x Tan 0.5° + TAR elevation	Infringement result for building height of 243 m AHD
Sydney Airport TAR	19.7 km south	19700	38.2	210.1	32.9 m Infringement
Cecil Park TAR	28.6 km SW	28600	200.51	450.1	No infringement
RTCC				244	No infringement

Table 4 Impact of development on ATC Surveillance System Performance

3.1 Result of Assessment

The proposed development:

- will infringe the clearance plane for the Sydney Airport TAR;
- will not infringe the clearance plane for the Cecil Park TAR.

It is common that building developments infringe terminal area radar clearance planes. The infringement of the Sydney Airport TAR clearance plane should be mitigated by the additional coverage from the Cecil Park TAR and the multitude of ADS-B receiver sites in the area.

Airservices Australia will conduct an assessment of the effect that the proposed development will have on the Sydney TAR, and the mitigating effect of the other installations.

4 Navigation Aid Performance

There are a number of navigation aids installed at Sydney Airport, including ILS, GBAS and DME. An NDB is installed at Bankstown Airport and an ILS with a DME is planned for future installation.

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

4.1 Result of Assessment

The development 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 plume rises in excess of 4.3 m/s must be referred to CASA for their assessment of risk to aircraft operations.

There are no airfields within the immediate vicinity of the development site. Aircraft operating overhead or nearby to the building will not be in the take-off or landing phase of flight and therefore should not be affected by any exhaust plume above the building.

6 Obstacle Lighting

CASA will classify the building a 'Tall Structure' as per the CASA AC139-08v2.0 *Reporting of tall structures and hazardous plume sources*, and may require the installation of permanent obstruction lighting.

Shielding of the lights to avoid distraction to residents may be installed, however the lights must remain visible above a horizontal plane.

Obstacle lighting for the building, if required by CASA, will be in accordance with the Manual of Standards Part 139 – Aerodromes, Chapter 9.4 *Obstacle Lighting*.

Police and Ambulance helicopter operations occur in and around the Sydney metropolitan area, but the dominant structure by day, and obstacle lighting at night will provide sufficient visibility of the building for pilots to be able to identify it and adjust their flight path if required.

7 Cranes

Meriton understands that the RTCC and PANS OPS surfaces above the site restrict the use of construction cranes, and will develop a construction methodology plan that allows for the majority of the construction to be completed by tower cranes operating beneath the aeronautical surfaces.

An application will be made at a later date for cranes to infringe the surfaces for the minimum duration.

8 Conclusion

Recognition of the significance of the aeronautical protection surfaces has enabled Meriton to design a building development that will not adversely impact the aviation sector.

The proposed building at 112 Talavera Road, Macquarie Park, to a maximum height of 243 m AHD:

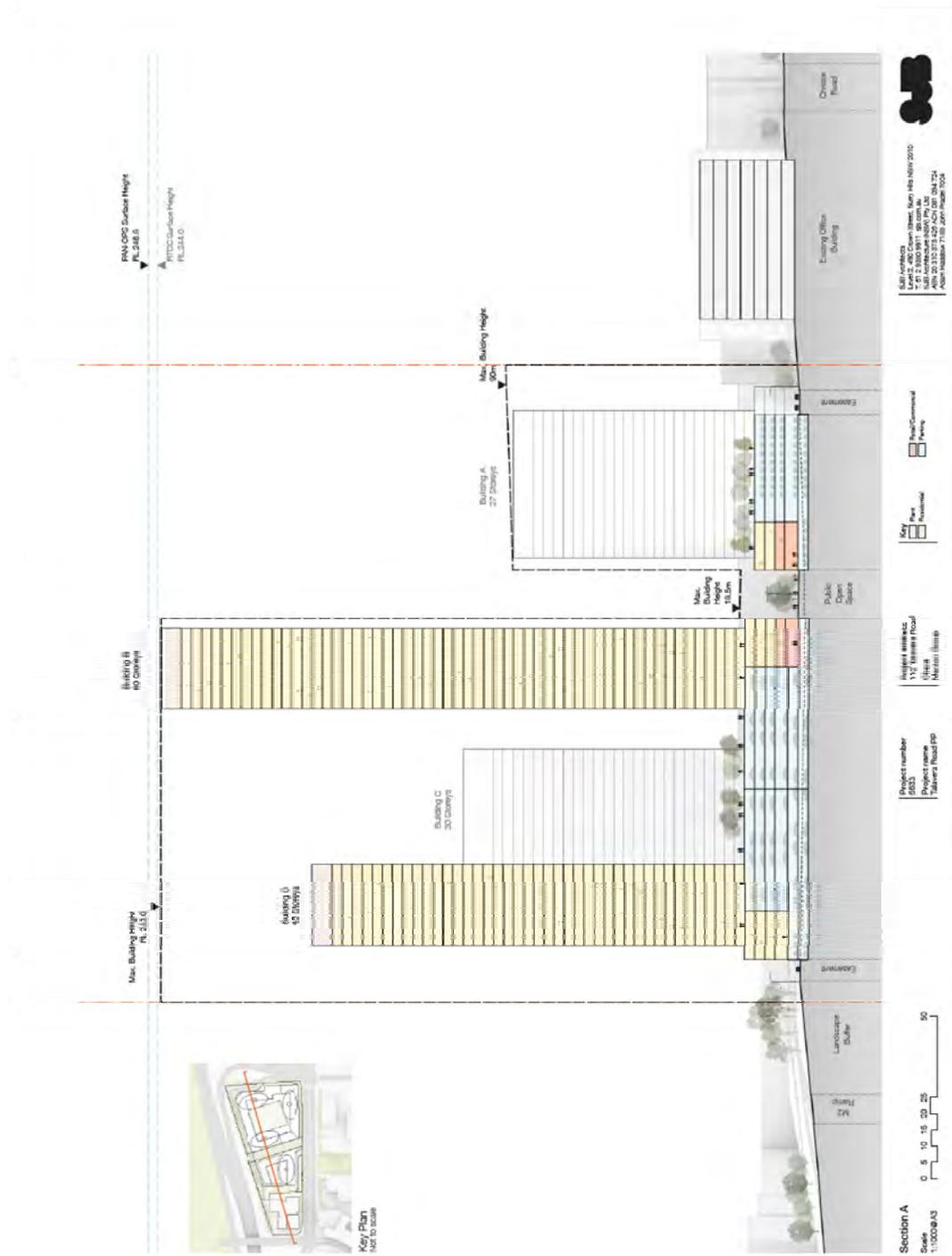
- will not infringe the OLS for Sydney Airport or any other airport in the vicinity;
- will not infringe the Sydney Airport PANS OPS surfaces, or the PANS OPS surfaces for any other airport in the vicinity; and
- will not infringe the RTCC protection surface above the site.

It will be necessary to gain approval from Airservices Australia for the infringement of the Sydney TAR. This approval process will be managed by SACL during the assessment of the application for aviation approval.

Subsequent to the grant of any approval for this development, a detailed application to CASA, Airservices Australia, Bankstown and Sydney airports will need to be made for the cranes (temporary obstacles) required during the building process.

Appendix A

Building Height Diagram



Maximum building heights
 Source: SJB Architects

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 and Regional Development (DIRD);
- 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 Airport's Prescribed Airspace comprises:

- Obstacle Limitation Surfaces (OLS) that restrict obstacle growth in the vicinity of takeoff and landing paths; and
- PANS OPS surfaces that provide a buffer between flight paths and terrain or obstacles.

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
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
FAP	Final Approach Point

Abbreviation	Meaning
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
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
OIS	Obstacle Identification Surface
OLS	Obstacle Limitation Surface
PANS OPS	Procedures for Air Navigation Services – Aircraft Operations, ICAO Doc 8168
PBN	Performance Based Navigation

Abbreviation	Meaning
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
V _n	aircraft critical Velocity reference
VOR	Very high frequency Omni directional Range
WAC	World Aeronautical Chart