FINAL REPORT V1.0

AERONAUTICAL IMPACT ASSESSMENT

PROPOSED DEVELOPMENT

AT

137-151 ANZAC PARADE, KENSINGTON, NSW

J0465

Report to:

Toga Addison Pty Ltd

17 December 2015

AMBIDJI

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1. INTRODUCTION

The Ambidji Group Pty Ltd (Ambidji) has been tasked by Toga Addison Pty Ltd (Toga) to prepare an Aeronautical Impact Assessment (AIA) for the proposed development at 137-151 Anzac Parade, Kensington, NSW.

There are two buildings proposed for the development, and the highest building is 83 m AGL. As the ground height is 26 m AHD, the building height is 109 m AHD. Construction cranes are proposed to a height of approximately 162 m AHD. However, as this height will penetrate the PANS-OPS surface (see section 4), this AIA has been prepared using a crane height of 126 m AHD or 17 m above the building height to avoid penetration of the PANS OPS surface during construction.

The site location in relation to the local area is shown in Appendix A, and a Glossary of Aeronautical Terms and Abbreviations is shown in Appendix B.

2. THE PROPOSED DEVELOPMENT LOCATION

The site is located 5.7 km from the Aerodrome Reference Point (ARP) at Sydney Airport. Figure 2.1 shows the location of the development site in relation to Sydney Airport.

Figure 2.1 - The Development Site and Sydney Airport.

3. OLS EXAMINATION

The proposed building is located under the OLS Conical Surface (CS) for Sydney Airport. It is estimated that the height of this surface at the site rises from 56 m AHD to 61 m AHD.

The base drawing for Figure 3.1 has been taken from the Sydney Airport OLS Chart, and the Figure shows the CS heights and development site.

The building height of 109 m AHD and the crane height of 126 m AHD will penetrate the CS by 53 m and 70 m respectively.

There are conditions for allowing the penetration of the CS; however any application for approval would have to be supported by an aeronautical study and safety case. The conditions for OLS CS penetration are discussed in Section 5.

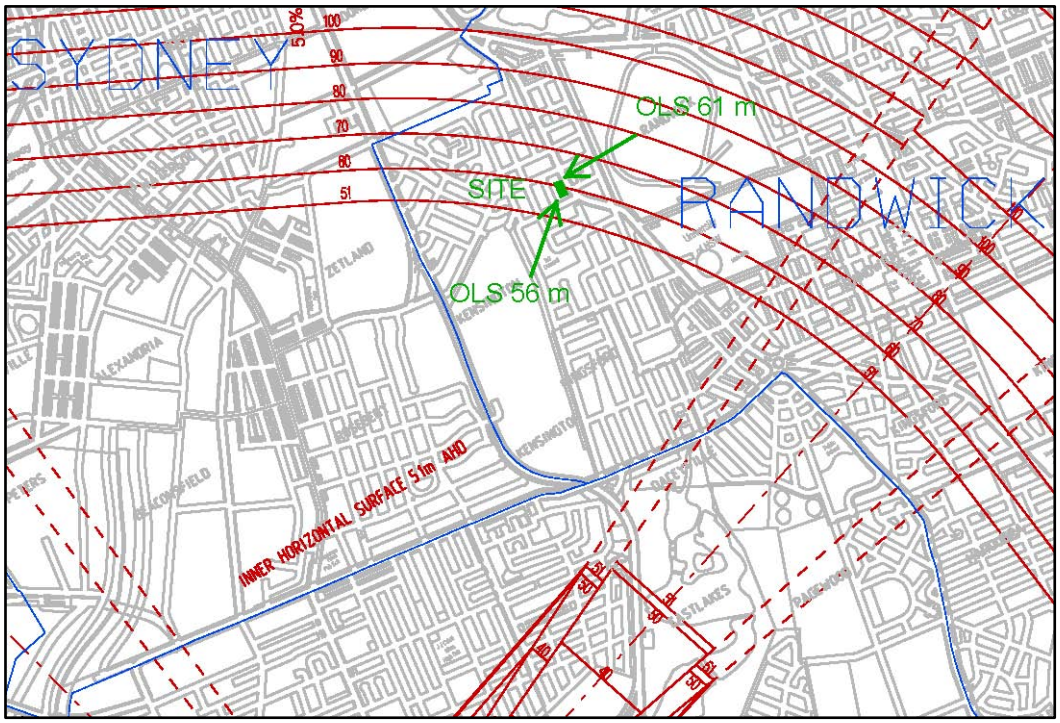

Figure 3.1 - Development Site in relation to the OLS surfaces (from Sydney Airport OLS Chart)

4. PANS-OPS EXAMINATION

The development site is located under the circling PANS-OPS surface for Sydney as shown in an extract from the SACL PANS OPS chart in Figure 4.1 below. The surface height is 126.4 m AHD.

PANS-OPS surfaces for departures are not shown on this chart. The lowest surface height for departures (RWY 07 SIDs) has been estimated to be 448 ft (136 m) AHD by Ambidji in accordance with CASA MOS Part 173 Standards Applicable to Instrument Flight Procedure Design, and the ICAO Document 8168 PANS-OPS Volume II Construction of Visual and Instrument Flight Procedures. However this height will require confirmation or review by Airservices Australia.

As the lowest PANS-OPS surface at the building site is 126.4 m AHD, this will limit crane heights to 126 m AHD. An application to penetrate the PANS-OPS surface will not be approved. The building and crane heights AHD of 109 m and 126 m will not penetrate the PANS-OPS surface.

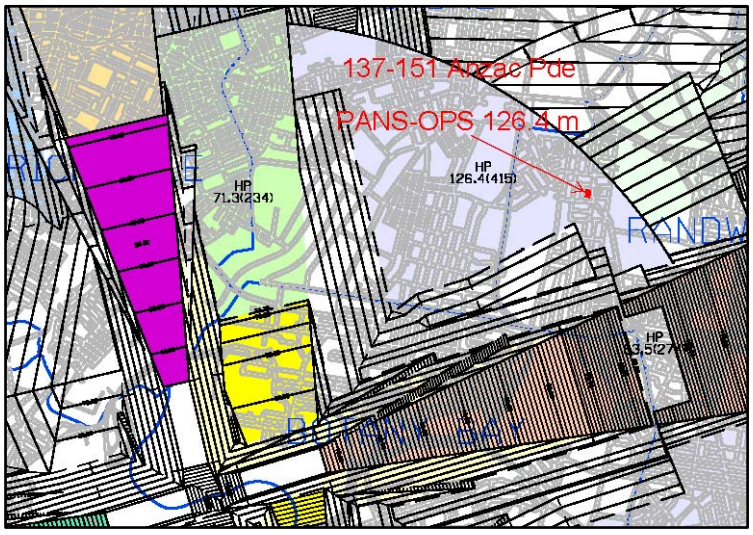

Figure 4.1 PANS-OPS Approach Surfaces

5. PENETRATION OF THE OLS CONICAL SURFACE

As discussed in Section 3, the building height of 109 m AHD and the crane height of 126 m AHD will penetrate the CS by 53 m and 70 m respectively.

The conditions for OLS CS penetration are discussed in the following sections which also include an aeronautical study and safety case.

5.1 PENETRATION OF THE INNER HORIZONTAL SURFACE – ICAO DOCUMENT REFERENCES

ICAO Airport Services Manual Part 6 Control of Obstacles states in Para 1.2.2.4:

In assessing the operational effect of proposed new construction, tall structures would not be of immediate significance if they are proposed to be located in:

a) *An area already substantially obstructed by terrain or existing structures of equivalent height*
b) *An area which would be safely avoided by prescribed procedures associated with navigational guidance where appropriate*

The Inner Horizontal Surface and Conical Surface can be penetrated in accordance with the recommendations of ICAO Doc ANNEX 14 Volume 1 Aerodrome Design and Operations, Para 4.2.20, which states:

> *New objects or extensions of existing objects should not be permitted above the Conical Surface and the Inner Horizontal Surface except when, in the opinion of the appropriate authority, an object would be shielded by an existing immovable object, or after an aeronautical study it is determined that the object would not adversely affect safety or significantly affect the regularity of operations of aeroplanes.*

As part of this assessment, a basic aeronautical study and safety case has been conducted by the consultants to show that the proposed building to a height of 109 m AHD *"would not adversely affect safety or significantly affect the regularity of operations of aeroplanes."*

5.2 AERONAUTICAL STUDY PRECEDENTS

It is common for both the Inner Horizontal and Conical Surfaces to be penetrated at many airports in the world, especially those located close to metropolitan areas.

The control towers at most of the new airport developments in Asia (Bangkok, Kuala Lumpur, Jakarta, Singapore, Incheon, Beijing etc.), and Brisbane in Australia all penetrate the Inner Horizontal Surface.

Numerous penetrations of both the Inner Horizontal and Conical Surfaces occur in the vicinity of Sydney Airport.

5.3 IMPACT ON INSTRUMENT APPROACH PROCEDURES

The Inner Horizontal and Conical Surfaces were originally established by ICAO to protect the obstacle clearance of aircraft circling the airport in visual flight conditions prior to landing. When these surfaces were first established in the 1950s and 1960s, the majority of airports and aircraft were not equipped for straight in approaches, and circling approaches were necessary.

With the implementation and extensive use of procedures for approaches aligned with the runway (ILS, GLS, RNP, RNAV (GNSS), VOR and Locator) the use of circling approaches has decreased considerably. At many airports the restrictions imposed by noise avoidance procedures prevent the use of circling approaches.

All of the Sydney Airport Runways are served by published straight in approaches including ILS, GLS, and RNAV (GNSS).

Circling approaches (if permitted) would only be required for aircraft initially making straight in approaches in the unlikely event of a change of runway due to significant weather (mainly wind velocity) changes or changes in serviceability of ground or airborne navigation equipment.

Although circling approaches are not used significantly at Sydney, the site development to the elevation proposed was examined in the study to confirm that there would be no changes required to the circling minimum altitudes.

5.4 EXAMINATION OF CIRCLING APPROACHES

Note 1: In the Aeronautical Information Publication (AIP) all distances are shown in Nautical Miles (nm) and Altitudes in feet (ft) for instrument flight procedures. Displays to pilots are in the same format.

Note 2: The aircraft category (CAT) depends on a number of aircraft performance parameters, and is published in the ICAO PANS-OPS document.

The minimum altitudes published for circling approaches at Sydney are:

- CAT A and B aircraft: 710 ft AMSL, and
- CAT C and D aircraft: 1000 ft AMSL.

Circling is not permitted beyond 3 nm from the SY DME (the site is 2.78 nm from the DME) to the North East of the airport due to obstacles in this area, and also is not permitted following many of the straight in approach procedures.

All jet aircraft and all aircraft above 5,700 kg maximum take-off weight (MTOW) are subject to noise abatement procedures, which limit flight paths at Sydney. This means that these aircraft cannot do circling approaches.

5.5 PANS-OPS CIRCLING AREA CRITERIA

The circling area radiuses from the runway thresholds and Minimum Obstacle Clearance (MOC) for circling approaches are published in the PANS-OPS document, as follows:

- CAT A and B: Area radius 2.66 nm, MOC 295 ft, and
- CAT C and D: Area radius 5.28 nm, MOC 394 ft.

As the site is located 2.3 nm from the threshold of RWY 25 (the nearest threshold), it is therefore located in the circling area for all aircraft categories.

5.6 APPLICATION OF MOC

Table 5.1 shows the application of the MOC to the maximum building heights AHD of 358 ft and 414 ft during construction.

	m	ft
Ground AHD	26	86
Building Height AGL	83	273
Building Height AHD	109	358
Crane height above roof	17	56
Crane AHD	126	414
Conical Surface AHD	56	184
Building Height Penetration	**53**	**174**
Crane height Penetration	**70**	**230**
Circling ALT CAT A&B		710
MOC CAT A&B		295
Bldg Ht + MOC CAT A&B		**653**
Crane Ht + MOC CAT A&B		**709**
Circling ALT CAT C&D		1000
MOC CAT C&D		394
Bldg Ht + MOC CAT C&D		**752**
Crane Ht + MOC CAT C&D		**808**

Table 5.1 Application of MOC to Building and Crane Heights

5.7 IMPACT ON CIRCLING MINIMUM ALTITUDES

CAT A and B:

Published minimum circling altitude is 710 ft. Building height + MOC is 653 ft and 709 ft during construction (assuming 17 m cranes).

There is no impact on the CAT A and B circling altitude.

CAT C and D:

Published minimum circling altitude is 1000 ft. Building elevation + MOC is 752 ft and 808 ft during construction (assuming 17 m cranes).

There is no impact on the CAT C and D circling altitude.

5.8 CONCLUSION OF AERONAUTICAL STUDY AND SAFETY CASE

The penetration of the OLS Conical Surface by the building and construction cranes will not impact on the circling altitudes at Sydney and will *"not adversely affect safety or significantly affect the regularity of operations of aeroplanes."*

6. RADAR PERFORMANCE IMPACT

The Sydney Airport Terminal Area Radar (TAR), comprising of Primary Surveillance Radar (PSR) and Secondary Surveillance Radar (SSR) is located on the airport 5729 m south west of the building site, at an antenna elevation of 34.5 m AHD

There is another TAR located at Cecil Park, 36 km to the west of the building site, at an antenna elevation of 161.27 m AHD.

6.1 CLEARANCE REQUIREMENTS FOR RADARS

CASA Manual of Standards (MOS) Part 139 Aerodromes publishes the clearance requirements for radars. The section of the MOS that applies to the Anzac Parade site is:

> *11.1.14.4*
>
> *The following clearance requirements are to be maintained:*
>
> *(a) No intrusion within 1 km of the radar into a height surface 5 m below the bottom of the antenna. No intrusion between the radar and the possible location of any desired targets, i.e. roughly speaking above 0.5 degrees elevation at any distance.*
>
> *(b) No metallic or other electrical reflective surfaces anywhere which subtend an angle of more than 0.5 degrees when viewed from the radar, e.g. fences, power lines, tanks as well as many buildings. All overhead power lines within 1 km must be aligned radially from the radar or be located at least 10 degrees below horizontal from the antenna.*

6.2 CLEARANCE REQUIREMENTS FOR THE SYDNEY AIRPORT TAR

The elevation of the Sydney airport TAR antenna is 34.5 m AHD, and the distance to the building site is 5729 m. The elevation of a 0.5° plane from the antenna at the site is:

> 5729 x Tan 0.5° = 50 m + TAR elevation of 34.5 m = 84.5 m.

As the building height is 109 m AHD, the building will penetrate the Sydney TAR clearance plane by 24.5 m.

Airservices Australia may require an engineering analysis to be undertaken to determine what impact this penetration would have on the performance of the Sydney TAR. If this is done by Airservices the developer would be charged. Ambidji can also provide a qualified radar engineer to undertake this task under commercial arrangements with the developer.

However, there are alternative airspace surveillance sensors that could be utilised to minimise any impact on the performance of the Sydney TAR. These are:

- The Cecil Park TAR provides similar radar coverage in the airspace to that of the Sydney TAR, and in fact is coverage backup for the latter radar;
- In addition to the radars, a Wide Area Multilateration (WAM) surveillance system is installed in the Sydney region, and this provides airspace surveillance for Mode S transponder equipped aircraft. WAM is a distributed sensor system and is not subject to the same clearance requirements and building impact on performance as radars. As most aircraft operating in the Sydney controlled airspace are required to be equipped with Mode S transponders, the WAM system is another suitable coverage alternative to the Sydney TAR;
- Automatic Dependant Surveillance – Broadcast (ADS-B) surveillance is also provided for ADS-B equipped aircraft in the Sydney terminal airspace and this system is also another surveillance alternative to the Sydney TAR, but only for ADS-B equipped aircraft.

6.3 CLEARANCE REQUIREMENTS FOR THE CECIL PARK TAR

This radar is located 36 km from the building site, at an elevation of 161.27 m AHD, which is above the building height, and the building will not penetrate the clearance requirements for this radar.

6.4 CONCLUSIONS OF RADAR CLEARANCE REQUIREMENTS

The building height of 109 m AHD will penetrate the clearance requirement of the Sydney TAR by 24.5 m.

Airservices Australia may require an engineering analysis to be conducted to confirm if the penetration of the clearance requirement impacts on the performance of the Sydney TAR.

Even if there is an impact on the performance of the Sydney TAR, there are other sensors (the Cecil Park TAR, WAM and ADS-B) which can provide alternative primary and secondary surveillance coverage in the airspace in the vicinity of the designated site.

7. NAVIGATION AID PERFORMANCE IMPACT

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

The Building Restricted Areas (BRA) specified in the Air Services Australia document Navigation Aid Building Restricted Areas and Siting Guidance AEI-7.1613 Issue 2 contain building development limitations.

The BRA for the GBAS installation is within 3000 m of this installation, all other BRAs are less than 3000 m.

As the site is 3810 m from the nearest airport boundary, the BRAs for all of the airport navigation aids will not be impacted.

8. HELICOPTER OPERATIONS – CODED CLEARANCES

Numerous coded clearances for helicopter operations are published in the AIP ERSA document. The significant segments of the route for the clearance passing in the vicinity of the development site are:

BARRACKS 4 INBOUND:

> .....ALT 1000ft ....thence E of South Dowling Street and Southern Cross Drive via the Gardeners Road thence Wentworth Avenue Overpass on descent to 500 ft.

BARRACKS 4 OUTBOUND:

> Reverse routeing to the inbound route at ALT 1000FT

This route passes approximately 590 m west of the development site.

Figure 8.1 below shows the above route in relation to the development site.

Helicopters on the above route are required to operate under the Visual Flight Rules (VFR) in Visual Meteorological Conditions (VMC), with a minimum flight visibility of 5000m, or subject to ATC approval on a Special VFR clearance with a minimum flight visibility of 800 m, and thus will be able to see and if necessary to avoid the proposed building and cranes during construction. There may be a requirement for the cranes to have obstruction and other conspicuous lighting.

The building will not impact on the BARRACKS 4 clearance route.

Figure 8.1 – Helicopter routes in relation to the development site

9. CONCLUSION

This AIA and Safety Study concludes that:

- The proposed development to a building height of 109 m AHD will infringe Prescribed Airspace at Sydney Airport, specifically the Conical Surface by 53 m when completed, and by 70 m during construction;
- An aeronautical safety study demonstrates that this infringement should not impact on the safety, efficiency or regularity of airport operations and is therefore considered likely to be approvable under the Airports (Protection of Airspace) Regulations (APARs);
- The building at 109 m AHD m when completed and 126 m AHD during construction (assuming 17 m cranes) should not penetrate the PANS-OPS lowest surface over the building site, estimated as 126.4 m; however the PANS-OPS surface height requires confirmation by Airservices Australia;
- The proposed development will not impact the Sydney circling approach minimum altitudes;
- The building height of 109 m AHD will penetrate the clearance requirement of the Sydney TAR by 24.5 m.
    - Airservices Australia may require an engineering analysis to be conducted to confirm if the penetration of the clearance requirement impacts on the performance of the Sydney TAR.
    - Even if there is an impact on the performance of the Sydney TAR, there are other sensors (the Cecil Park TAR, WAM and ADS-B) which can provide alternative primary and secondary surveillance coverage in the airspace in the vicinity of the designated site.
- The building will not penetrate the clearance requirements of the Cecil Park TAR;
- The performance of the navigation aids and communication facilities in the Sydney region will not be impacted;
- The standard helicopter route in the vicinity of the building site will not be impacted; and
- Cranes (temporary obstacles), to a maximum height of 17 m above the proposed maximum height of the building will not impact on the circling approach minimum altitudes during the construction period. However the cranes will penetrate the Sydney OLS and would need to be separately approved and the developer must provide timely advice to Sydney Airport prior to construction so that appropriate NOTAMs may be issued.

Therefore, based on the provisions of the Airports (Protection of Airspace) Regulations 19109, there appears to be a good case for the Department of Infrastructure and Regional Development approving the development of the site to a height of 109 m AHD,

However this would be subject to examination of the application by Sydney Airport Corporation Ltd, the Civil Aviation Safety Authority, Airservices Australia and other relevant aviation agencies.

APPENDIX A

SITE LOCATION IN RELATION TO THE LOCAL AREA

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APPENDIX B

GLOSSARY OF AERONAUTICAL TERMS AND ABBREVIATIONS

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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, AIPs may be issued by CASA or Airservices Australia.

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 Chica*go 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.

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 penetrate the OLS, they cannot be permitted to penetrate 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.

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.

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
AHD	Australian Height Datum
AHT	Aircraft height
AIP	Aeronautical Information Publication
Airports Act	Airports Act 19109, as amended
AIS	Aeronautical Information Service
Alt	Altitude
AMSL	Above Mean Sea Level
APARs	Airports (Protection of Airspace) Regulations, 19109 as amended
ARP	Aerodrome Reference Point
AsA	Airservices Australia
ATC	Air Traffic Control(ler)
ATM	Air Traffic Management
BRA	Building Restricted Area (for GP)
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
DEVELMT	Development
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
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

Abbreviation	Meaning
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 – 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

Abbreviation	Meaning
TAR	Terminal Approach Radar
TAS	True AirSpeed
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