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6.0 AIRFIELD DEVELOPMENT PLAN

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Key points

- The airfield development plan in this Master Plan is capable of meeting forecast demand to 2033 and beyond. The development plan:
  - Increases the safety and the efficiency of the airfield for the airlines, improves the passenger experience and maximises the capacity of the airfield
  - Enables flexibility and adaptability of the airfield and allows its development and operation to respond to the changing demand and the constantly evolving aviation industry
  - Incorporates taxiway developments to improve disruption management and support noise sharing modes
  - Will be sequenced to meet apron, taxiway and customer demand
- The creation of integrated international, domestic and regional passenger precincts improves the safety, efficiency and capacity of the airfield through:
  - Improved balancing of airside aircraft movement activities across the precincts. Today during some peak hour periods it is common to have 80% of aircraft movements in the Terminal 2/Terminal3 (T2/T3) precinct with only 20% occurring in the Terminal (T1) precinct. This development plan rebalances this activity to an improved 66:34 split. The more balanced activity will benefit all passengers by reducing congestion on the roads, taxiways and runways, and in the terminals
  - Improved utilisation of aprons/gates throughout the day, with the use of international-domestic/regional capable swing gates
  - Reduced towed aircraft runway crossings, which are generally conducted at slow speed and have the potential to cause taxiway congestion. In contrast the modelling indicates that the incidence of powered runway crossings has no impact on airport capacity and does not generate taxiway congestion
  - Improved capacity across the airfield to operate and park larger Code E and F aircraft such as the A380. New terminal infrastructure is capable of delivering 16 additional A380 contact gates, almost twice the capability of the 2009 Master Plan, by developing new infrastructure north of T3 and east of T2
  - Improved future expansion capability to accommodate the up-gauging of aircraft
- An independent airfield model using the Comprehensive Airport Simulation Technology (CAST) fast time simulation demonstrated that the airfield development plan:
  - Improves the capability to store aircraft accessing the runways
  - Reduces taxiing delays for arriving aircraft
  - Reduces aircraft taxiing conflicts
  - Provides a capability to assist with disruption management
  - Provides a capability to accommodate all aircraft types, in particular Code F aircraft, at both terminal precincts
  - Eliminates the need for jet aircraft operating from T2/T3 to cross Runway 16R/34L for departures to the north
  - Can accommodate forecast demand for airfield capacity and aircraft stands under a wide variety of air traffic scenarios
- These improved airfield efficiencies will provide the opportunity for flow-on benefits such as improved airline on-time performance at Sydney Airport and across the broader network
- New navigation and surveillance technologies are anticipated to provide continued benefits to passenger and aircraft safety and reduced airline operating costs
  - Sydney Airport continues to collaborate with Airservices Australia to deliver one of the most technologically advanced airports in the world
  - Sydney Airport will continue to support the introduction of new technologies to further improve safety and efficiency

The airfield development plan improves safety, efficiency and capacity of the airfield and incorporates taxiway developments to improve disruption management and support noise sharing modes.

The development plan in this Master Plan provides the opportunity for Sydney Airport to optimise the efficiency of the airfield for the airlines. It facilitates flexibility and adaptability of the airfield to respond to the changing priorities and the constantly evolving aviation industry. It also allows for the development of taxiways and aprons to be sequenced to meet demand.

A number of airfield developments are proposed to support the forecast growth in passenger and aircraft movements, including the development of additional contact gate capacity and further apron developments.

The proposed development plan was developed following extensive consultation with the airlines to understand limitations experienced on the airfield today and potential design solutions.

The broad outcome of the development plan is that it provides a more evenly balanced airfield operation across the two precincts, particularly in peak periods. Today during some peak hour periods it is common to have 80% of aircraft movements in the Terminal 2/Terminal 3 (T2/T3) precinct with only 20% occurring in the Terminal 1 (T1) precinct. This development plan rebalances this activity to an improved 66:34 split. This will support airlines in achieving improvements to their on-time performance through reduced congestion on apron areas and improved runway access. Terminal aprons and gates can also be better utilised throughout the day through the use of swing gates and additional contact gates.

The ability to use swing gates between international and domestic/regional aircraft operations provides significant advantages for the airport to respond to fluctuations in actual demand between international, domestic and regional operations. Through this fundamental step change, the development plan is to a large degree future proofed against variances in the forecast market share between international, domestic or regional services over the planning period.

As well as providing an outcome that meets the projected traffic demand, this Master Plan also incorporates initiatives to improve Sydney Airport's ability to manage aircraft during periods of disruption, whether caused by off-schedule aircraft movements or consequential disruption as a result of capacity constraints at other airports.[1] The planned enhancements better equip the airport through the use of taxiways and remote aprons that can provide storage to facilitate off-gate holding capability.

1 All airlines report the reasons for every off-schedule flight to the Slot Compliance Committee. Off-schedule movements occur for a wide variety of reasons, with the most common including aircraft engineering, weather, faster/slower flight times (generally due to winds), safety (generally aircraft related) and delays for passenger convenience. Airport facilities (whether Sydney Airport or the departing airport) are cited for fewer than 3% of off-schedule movements.

6.1 Airfield modelling confirms the capability to meet 2033 planning horizon

Independent modelling by Airbiz using the 2033 representative busy day forecast schedule confirmed that the Master Plan development plan for the airfield layout is capable of efficiently handling the predicted traffic volumes. The modelling was reviewed by Airservices Australia as part of their endorsement of the ANEF noise contours, and has been peer reviewed by Landrum & Brown.

The airfield modelling study was carried out using the Comprehensive Airport Simulation Technology (CAST) fast time simulation model. The model is a gate to gate real time simulator of aircraft movements. Real time simulators produce stochastic models and results that include an element of randomisation.

The CAST simulation model was structured around:

- The 2033 Master Plan development plan for the airfield movement area layout
- The 2033 representative busy day forecast schedule
- Weather assumptions facilitating maximum runway capacity in all runway modes of operation (RMO).

The model was tested against a 2012 traffic and movement area configuration for calibration. Both peak period and noise sharing runway operating scenarios were modelled based on typical weather patterns.

When developing the taxiway enhancement plan, consideration was given to the areas where congestion is currently observed, namely:

- Congestion on Taxiways B and C in the vicinity of the existing T3
- Congestion on taxiways to the east of Taxiways B10 and L and the intersection of Runway 16R/34L
- Congestion at the eastern end of Taxiway G between the Runway 25 threshold and T2.

Anticipated congestion in the T3 and new international terminal area is proposed to be alleviated by the development of a taxiway racetrack system that ensures access to the terminal for inbound aircraft under the most demanding conditions. The apron has been designed to facilitate a dual Code F taxilane system.

The Taxiway B extension and the development of a number of entrance taxiways to the south of existing taxiways is expected to alleviate congestion in the Taxiway B10 and Taxiway L areas.

The development of Taxiway J East and a Code C taxiway to the north of Taxiway G at the eastern end of the airport are planned to alleviate congestion in the T2 area and to better facilitate Long Term Operating Plan (LTOP) runway modes.

The realignment of Taxiways B and C and the development of a number of rapid exit taxiways on the eastern side of Runway 16R/34L will be required to facilitate the relocation of Code F (A380) operations to the T2/T3 area and to ensure ongoing MOS – Part 139 compliance.

Overall the modelling demonstrated:

- Improved capability to store aircraft accessing the runways
- Reduced taxiing delays for arriving aircraft
- Reduction in aircraft taxiing conflicts
- A capability to assist with disruption management
- A capability to accommodate all aircraft types, in particular Code F aircraft, at both terminal precincts
- Elimination of the need for jet aircraft operating from T2/T3 to cross Runway 16R/34L for departures to the north

6.2 Airfield development plan – planned upgrades

The development plan will see the proposed expansion and reconfiguration of the airfield precincts to accommodate increased numbers of larger aircraft types such as the Code F and Code E aircraft for international and domestic operations.

The proposed development of the two integrated international, domestic and regional terminal precincts and associated supporting airfield infrastructure developments is designed to provide a number of benefits for the airlines and airport. These include:

- Improved balancing of aircraft movements
- Improved utilisation of aprons/gates throughout the day, with the use of swing gates
- Reduced towed aircraft runway crossings
- Improved capability to handle Code F and Code E aircraft
- Improved capability to respond to changes in aircraft up-gauging
- Consolidation of airline equipment and resources
- Dual apron taxiways to improve capacity and enhance safety
- Improved responsiveness to disruption
- An opportunity for airlines to improve their aircraft utilisation, with aircraft able to operate as an international or a domestic service without the need for towing between precincts across the main runway
- Removal of the current need for all jet aircraft operating from the integrated T2/T3 precinct, including Code F, to undertake a powered Runway 16R/34L crossing for departures to the north

Aircraft runway allocations in the airfield model are in accordance with parameters provided by Airservices Australia. To comply with the agreed runway allocations a number of powered runway crossings are required. The modelling indicates that the incidence of powered runway crossings has no impact on the airport capacity and does not generate taxiway congestion.

In contrast towed runway crossings are particularly disruptive to airport operations as they are generally conducted at slow speed, and consequently have the potential to cause significant taxiway congestion. The reduction of towed runway crossings envisaged under this development plan provides a significant benefit to airfield operations.

These improved terminal and airfield efficiencies will provide the opportunity for flow-on benefits such as improved airline on-time performance at Sydney Airport and across the broader network.

The existing runway system is adequate to cater for future projected traffic and is proposed to be retained in its existing configuration. The development plan proposes a number of new taxiway elements and apron developments to support the forecast increase in traffic. In addition, low visibility enhancements will improve the reliability of the airfield during poor weather conditions. The main Master Plan airfield developments are:

6.2.1 T2/T3 precinct airfield development

- Additional Code E and F gates on the new T2/T3 integrated terminal precinct
- Development of dual Code F taxiways to serve the proposed Code F aircraft gates
- Additional Code E/F aircraft gates on T2, in particular at the proposed swing gates
- Realignment of Taxiway G east of T2 and development of a proposed new parallel Code C taxiway to improve aircraft circulation to and from T2 as well as improving taxiway capacity when operating under noise sharing runways modes.

6.2.2 T1 precinct airfield development

- Development of dual Code C taxiways to serve the proposed Code C domestic aircraft operations on the western apron of T1, served through Pier C and a new proposed Pier D.

6.2.3 General airfield development

- Realignment of Taxiways B and C between the Runway 16R threshold and Taxiway L to accommodate independent Code F operation on both taxiways
- Extension of Taxiways J and D to provide improved access to the two integrated terminal precincts
- Extension of Taxiway K between Taxiway C and Taxiway D to provide access to the proposed South East Sector apron
- Development of a maintenance and engineering precinct in the North East and South East sectors of the airport, reducing the number of aircraft towed across Runway 16R/34L
- Implementation of Cat 2 approach lighting systems for runway approaches on Runways 16R and 34L to enhance runway capacity during low visibility conditions
- Provision of a link taxiway segment between Taxiway U and Taxiway B10
- Provision of additional entry/exit taxiways on Runway 16R/34L
- Extension of Taxiway B for the full length of Runway 16R/34L to accommodate Code F operations, eliminating the need for all jet aircraft operating from T2/T3 to cross Runway 16R/34L for departures to the north
- Development of a new entry taxiway on Runway 16L/34R to provide improved operations for regional aircraft
- Development of two additional rapid exit taxiways on the eastern and western side of Runway 16R/34L

Figure 6.1 illustrates the anticipated developments in the airfield.

6.2.4 Aprons and stands development

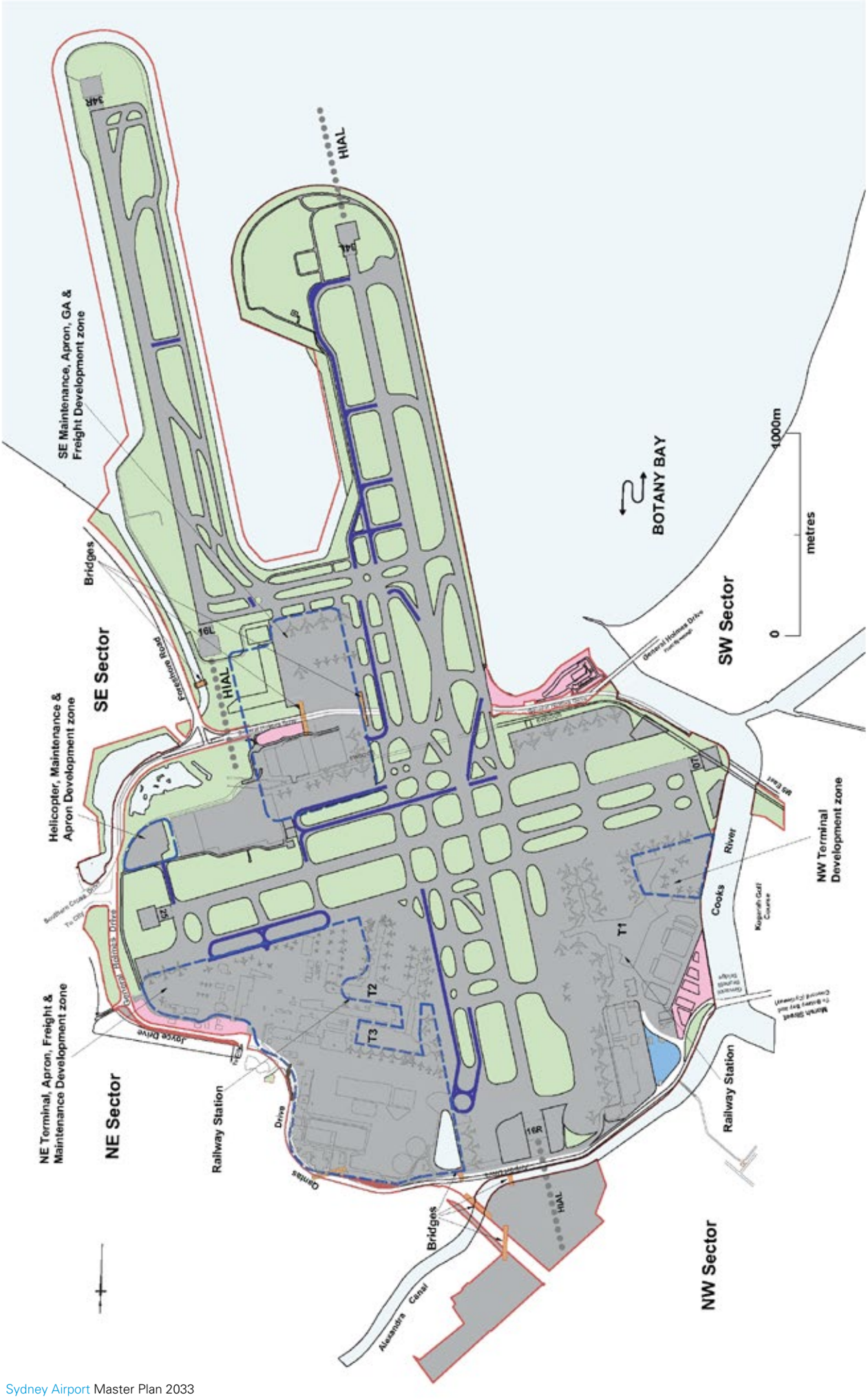
Sydney Airport works closely with the airlines to ensure that aprons are developed to meet demand, and adapts the development program as airline demand changes. Sydney Airport has sufficient capacity to meet current demand, with additional aprons in development to meet the expected increases in demand over the planning period.

As a result of the proposed two integrated terminal precincts and additional apron developments, Sydney Airport will have apron and stand capacity to meet the forecast growth in airport activity up to and beyond the 2033 horizon of the Master Plan. Airbiz demonstrated that the forecast stand demand would be met by the development plan. Their analysis has been peer reviewed by Landrum & Brown. Airbiz has separately demonstrated that the development plan would be able to meet stand demand under a wide variety of future air traffic scenarios.

The ability to handle Code F (such as the A380) international aircraft in the North East Sector, as well as the current North West Sector, enables Sydney Airport to substantially increase its capacity to accommodate Code F aircraft well beyond the Master Plan planning period.

Figure 6.1
Indicative Taxiway Developments

This drawing has been prepared to illustrate the Sydney Airport Master Plan and is not intended to serve any other purpose. The drawing must be read in conjunction with the Master Plan.



Further, swing gates at both of the proposed integrated terminal precincts provide additional opportunities to efficiently increase Sydney Airport's capacity and flexibility to handle the growing demand of Code E (such as A330 and B787) domestic aircraft as well as an improved ability to respond to fluctuations in actual demand between international, domestic and regional operations.

The 2033 representative busy day forecast schedule was used to determine aircraft parking requirements and airfield demand to inform development options.

The number and size of the aircraft parking stands was determined through modelling the bay allocation rules/ principles. The traffic forecasts presented in Chapter 3 include a 101% increase in passengers between 2012 and 2033, made up of:

- A 27% increase in aircraft movements, including a replacement of existing aircraft with quieter, new generation aircraft. This increase includes a significant growth in the off-peak (which typically does not significantly increase apron demand) and a 5-10% increase in peak period movements
- A 58% increase in average passengers per aircraft, reflecting a growth in passenger aircraft size, increased seat density, higher load factors and a reduction in non-passenger aircraft movements

The development plan meets the apron demand by:

- Substantially increasing the average size of the aprons
- Developing swing gates which can be used in both the international and domestic peaks
- Increasing the total number of aprons

The aircraft parking stand demand for each category was determined on the basis of the largest aircraft type using a particular stand over the entire busy day. Larger stands can be configured to accommodate smaller aircraft (potentially multiple smaller aircraft) and will be the subject of detailed project planning.

Under the Master Plan Sydney Airport will meet the forecast 2033 stand/apron demand outlined in **Table 6.1**.

Sydney Airport has also undertaken a sensitivity analysis to understand how the development plan responds to a differing level of demand, particularly in relation to aircraft gauge. This analysis demonstrates that the development plan is able to respond to and accommodate a wide range of demand forecasts. The development plan is also capable, and over the planning period, flexible in accommodating a range of different airline grouping scenarios between the two integrated terminal precincts.

Additional apron areas are proposed to provide for the projected aircraft stand requirements. The proposed additional passenger aircraft aprons include the completion of the South West Sector and new apron

Table 6.1 Stand demand forecasts, 2033

Category	T1	T2/T3	Freight (Note 3)
Active (Note 1)			
Code F	5	8	0
Code E	16	20	2
Code C	8	25	0
Subtotal	29	53	2
Layover (Note 2)			
Code F	3	8	0
Code E	6	7	0
Code C	0	11	0
Subtotal	9	26	0
Total	38	79	2

Note 1: Active stands are those used for actual passenger processing. They can be contact stands (i.e. those served by an aerobridge or walk-up) or passengers can be bussed to and from other locations.

Note 2: Layover stands are those stands where aircraft not carrying out an immediate turnaround are towed and parked prior to being towed back to the terminal for departure.

Note 3: This is the demand for freight stands occurring concurrently with passenger peak stand demand. Dedicated freight aircraft will operate from common use passenger stands.

Note 4: The stand demand for each category was determined on the basis of the largest aircraft type using a stand. Larger stands should be able to accommodate smaller aircraft codes subject to detailed project planning.

Note 5: For the purposes of land use planning and to maintain future flexibility, domestic Code C regional stands were sized to accommodate the largest code aircraft type.

developments in the North East and South East sectors of the airport. The proposed future apron areas were reviewed as part of the airfield modelling exercise.

6.2.5 Airfield supporting infrastructure development

The Master Plan envisages the upgrade of the airfield to facilitate improved low visibility capability for conditions such as fog. During the master planning period it is expected that Runway 16R/34L approaches will be upgraded to facilitate landings in visibility conditions down to 350 metres (Category 2).

Runway 16R will require the current Category 1 ILS and approach lighting system to be upgraded to Category 2. Runway 34L ILS already has Category 2 capability but it will need an upgraded approach lighting system to be installed.

ICAO has recommended that all member states implement satellite-assisted navigation technologies at major airports by 2016. Australia's independent aviation safety regulator, CASA, supports this proposal.[2] On-board aircraft technologies will be progressively introduced to facilitate standard instrument departures (SIDS) and standard arrival routes (STARS) (see Section 6.6).

It is envisaged in the longer term that the GPS landing system (GLS) currently on trial at Sydney Airport will replace or augment the current ILS equipment. Operation of the GLS is discussed in Section 6.6.

The GLS delivers a range of benefits including:

- One GLS unit replaces six ILS units on a single site
- Less exposure to interference from ground based activities (such as aircraft, buildings etc)

A doppler very high frequency omni range and co-located distance measuring equipment (DVOR/DME) is currently located in the South East Sector of the airport. Using technology first deployed around the world in the 1940s, it provides the ability to conduct non-precision approaches in poor weather and also serves as an inbound and outbound tracking and en-route navigation aid.

Today, nearly all modern aircraft have the capability to fix their position using a range of air navigation systems, including satellite-assisted navigation technology, and are therefore not reliant on the DVOR/DME. Aircraft can (and do) rely on a number of other inputs such as global navigation satellite systems (GNSS), other DME units and precision approach aids provided at Sydney Airport.

Airservices Australia is, over time, upgrading the air navigation systems, including the replacement of the DVOR/DME.

During the Master Plan period it is envisaged that the DVOR/DME will be relocated to allow the proposed development of expanded apron areas for additional aircraft parking, associated new taxiway works and new engineering facilities. The Master Plan makes provision for the DVOR to be located at the southern end of Runway 16R/34L, should it be required. A DME may also be co-located with this facility. Provision has also been made in the Master Plan to facilitate a DME at the site of the decommissioned PRM facility. Discussions with Airservices Australia indicate that flight procedures based on the use of GNSS technology could be developed to replicate Sydney Airport's existing flight tracks which use the existing DVOR/DME location as a reference/datum point. Sydney Airport supports the development of such procedures.

6.3 Airservices Australia facilities

Sydney Airport and Airservices Australia, together with the aviation industry, are working co-operatively on the implementation of new technologies which are delivering improvements to air navigation and surveillance. The development plan takes advantage of these technologies as they become available.

Consistent with the previous 2009 Master Plan:

- The proposed airfield development will require the relocation of existing Airservices Australia facilities
- The proposed development of expanded apron areas for additional aircraft parking, new engineering facilities and associated new taxiway works in the South East Sector may impact on the existing control tower sightlines as well as navigational and radar aids. As a result, if necessary the impacted aids and the existing facilities will need to be relocated to ensure that airfield surveillance is maintained
- If relocations are required, development sites are available in the Southern Sectors of the airport, noting that some of the new aid/radar facilities may not require replacement or may be accommodated off airport

Given the critical importance of air traffic control services to all airport users, Sydney Airport will maintain an ongoing close dialogue with Airservices Australia on a range of Issues, including:

- On the impact and timing of any Manoeuvring Area developments
- Any potential new air traffic control tower, fire station(s) and A-SMGCS Remote Units. Appropriate sites will be protected and made available when required

6.4 Business and general aviation

The business and general aviation industry using Sydney Airport is almost exclusively limited to the premium corporate market, such as business jets.

Some of these aircraft types are currently unable to be accommodated at other airports in the Sydney Basin on a regular basis. It is recommended that over time these airports be upgraded to also accommodate such aircraft.

2 Information sourced from Airservices Australia website: http://www.airservicesaustralia.com/environment/smart-tracking/ (accessed March 2013)

RAAF VIP flights operate through one of the fixed base operators and are irregular and low-frequency users of Sydney Airport.

As demand increases for passenger aircraft parking in the North East Sector the business and general aviation facilities will be progressively relocated to the South East Sector. The South East Sector is proposed to include facilities such as aircraft maintenance hangars, aircraft parking, freight and aviation support.

6.5 Helicopters

The Master Plan forecasts that demand for helicopter air traffic will not exceed current levels over the planning period and, consequently, the existing facilities are expected to be adequate for the planning period.

6.6 Emerging technologies

Several of the emerging technologies described below have been implemented for the benefit of airline and airport operations. These technologies will continue to be implemented as they are complemented by aircraft equipage and regulatory rule changes.

6.6.1 GPS landing system (GLS)

The global positioning system (GPS) is currently used for en-route and non-precision terminal and instrument approach navigation. As other space based navigation systems become available the term GNSS will come into use. In the more critical phases of flight (approach, departure and landing), GNSS requires augmentation to realise the accuracy needed for guidance. These systems are referred to as GBAS (ground based augmentation) or GLS.

As indicated in Section 6.1.5, a GBAS unit is currently operational at Sydney Airport and Category 1 certification is expected by early 2014.

6.6.2 Multilateration systems (multistatic dependant surveillance or MDS)

Multilateration (MLAT) is a surveillance system that receives and locates transponder and other transmissions radiating from aircraft on various frequencies, typically 1090MHz - the frequency used by SSR, Mode S and automatic dependant surveillance broadcast (ADSB) transponders. All aircraft operating into Sydney Airport are equipped with transponders and nearly all are equipped with transponders capable of interrogation.

A wide area multilateration system has now been commissioned to replace the precision runway monitor and to supplement the terminal area radar (TAR).

The system can be augmented to facilitate increased coverage or to facilitate developments in the vicinity of the airport that may otherwise be impossible due to sterilisation of land by on-airport radars or unacceptable reflections from radar transmissions. MLAT receivers are also capable of receiving ADSB transmissions.

The transition to this technology will enable development of land on- and off-airport including the Sydney Port Development and the proposed hangar developments in the South East Sector of the airfield.

6.6.3 Automatic dependant surveillance broadcast

Automatic dependant surveillance broadcast (ADSB) is a system that gives aircraft the capacity to automatically broadcast aircraft position, altitude, velocity and other data continuously.

Other aircraft and ATC can access the data on display screens without the need for radar. ADSB systems are being defined and standardised by ICAO and other standards organisations worldwide.

Aircraft position is derived from the GNSS or internal navigation systems on board the aircraft.

The ground unit is simply a receiver for the data, which is then integrated into the ATC system. ADSB units are currently being deployed to provide surveillance of airspace above 30,000 feet over the entire continent, including areas not currently provided with radar coverage.

6.6.4 Required navigation performance

Required navigation performance (RNP) is a statement of the navigation performance necessary for the operation of aircraft within a defined airspace. Procedures based on RNP provide for approaches to a lower minima than non-precision but typically higher than instrument landing systems. Such approaches can be conducted independently of any ground based aids.

Most modern aircraft are capable of performing RNP approaches subject to procedure development and crew training. RNP approaches will provide safety and operating benefits by providing pilots with a predictability of operations and further reducing reliance on ground based aids.

Such predictability will provide environmental benefits by reducing aircraft fuel burn and providing for more flexible tracking in airspace around the airport, thus improving noise outcomes for some communities in the vicinity of the airport.

6.6.5 Advanced surface movement control and guidance systems (ASMGCS)

ASMGCS have been introduced at Sydney Airport. The system comprises surface movement radar (SMR), multilateration (MLAT) and automatic dependant surveillance broadcast (ADSB) system. This system, in conjunction with stop bars, will maximise capacity in low visibility conditions and increase airport safety.