Australian Government
Civil Aviation Safety Authority
www.casa.gov.au

Broome and Karratha Airspace Review

September 2020

File Reference: OP19/158-5

Document Reference: D19/279261

Document control:

Version	Issue/Nature of Revision	Date
0.1	Initial draft	July 2019
0.2	Peer review	August 2019
0.3	Management review	October 2019
0.4	Post review draft	December 2019
0.5	Incorporates Airservices feedback	July 2020
0.6	Incorporates Comparison of Collision Risk	September 2020

1 Executive Summary

Note – this Airspace Review was conducted before the impact of COVID-19 on the aviation industry. The downturn in all aviation activity across Australia and internationally may have a significant impact on the analysis, outcomes and projections used in this report. It is noted that the downturn in aviation into Broome and Karratha has not been as significant as at aerodromes in the Eastern States due to the fly-in fly-out (FIFO) resource sector.

The *Airspace Act 2007* (Act)[1] provides the Civil Aviation Safety Authority (CASA) with the authority to administer and regulate Australian-administered airspace and authorises CASA to undertake regular reviews of existing airspace arrangements.

The purpose of this airspace review was to evaluate the airspace arrangements within 75 nautical miles (NM) and below Flight Level (FL) 180 of Broome International Airport (Broome) and Karratha Airport (Karratha) to determine if the airspace remains fit for purpose[2]. The review period was from the 1 April 2014 to 31 December 2019. Infrastructure issues are outside the scope of this review.

The methodology used in conducting this review included quantitative and qualitative analysis consisting of:

- Aerodrome traffic data;
- Airspace design;
- Australian Transport Safety Bureau (ATSB) incident data;
- Airservices Australia's (Airservices) Corporate Integrated Reporting and Risk Information System (CIRRIS) data; and
- Stakeholder consultation.

Passenger numbers and air transport movements at Broome have increased by 11.3% and 4.0% respectively during the review period. Passenger numbers and air transport movements at Karratha have decreased by 33.1% and 23.4% respectively during the review period.

Broome experienced a sharp increase in movements from February 2018 to June 2018. The increase was due to new oil field establishment activity. Passenger figures are currently declining as the resource activity transitions from the establishment phase to production.

New mining projects in the Pilbara region, combined with oil and gas exploration and projects off the north west coast may result in an increase of air transport and passenger numbers[3].

CASA will provide stakeholder feedback related to improving efficiency, to relevant agencies and CASA staff.

1.1 Summary of Conclusions

- Stakeholders indicated that the current airspace architecture with Class E airspace[4] surrounding Class D airspace in a non-radar environment presents an elevated risk when compared to airspace where full electronic surveillance (Radar or Multilateration (MLAT)) is available. Controllers with full electronic surveillance have greater situational awareness of all traffic in controlled airspace. In non-radar or non-MLAT surveillance areas, such as Broome and Karratha where Automatic Dependent Surveillance-Broadcast (ADS-B) is the only electronic surveillance available, air traffic controllers may not have full awareness of all aircraft operating in Class E airspace because visual flight rules (VFR) aircraft are not required to carry ADS-B avionics; are not required to broadcast position or intentions; and are not required to have a clearance to enter Class E airspace.

1 A full list of acronyms and abbreviations used in this report can be found in Annex A.

2 For this review, fit for purpose means that the airspace architecture is suitable for its intended purpose.

3 This forecast was made before COVID-19. However, there is still investment occurring and the establishment of new sites has continued.

4 Annex B contains the Australian Airspace Structure.

- During Broome Tower hours, there is a 1,200 feet (ft) above ground level (AGL) Class E airspace step out to 31 NM. Stakeholders indicated that this step provides no benefit to operators. Protection of instrument flight rules (IFR) procedures could be contained by a keyhole arrangement. VFR aircraft do not benefit from this Class E airspace and IFR operators do not use this volume of airspace.
- Stakeholder feedback suggested the West Kimberley broadcast area could be improved to reduce frequency confusion and improve situational awareness of traffic operating in the area by adjusting the boundaries to better suit operations. ***Note:*** *CASA undertook industry consultation with an improved design of the broadcast area to better suit the needs of operators. The design was agreed upon and implemented in May 2020.*
- There is a 100 ft discrepancy between the Broome control zone (CTR) and Control Area (CTA) step. The Broome CTR is from the surface to 2,600 ft above mean sea level (AMSL). The overlying Class D airspace step has a LL of 2,500 ft AMSL which creates a discrepancy.
- Coordination between the Karratha tower and the Onslow flight information area (FIA) can be difficult for tower controllers, due to area frequency congestion. This can result in a delay to traffic departing from Karratha during peak periods.
- Stakeholder feedback suggests that the introduction of standard instrument departures (SIDs) and standard terminal arrival routes (STARs) would be beneficial for aircraft operating into Broome and Karratha. The procedures would make aircraft operations more predictable and the flight paths more efficient.

1.2 Recommendations

The Review makes the following recommendations:

Recommendation 1:
Airservices should submit an ACP changing the Class E airspace at Broome and Karratha to Class D airspace from 5,500 ft AMSL to FL125.

Recommendation 2:
Airservices should submit an Airspace Change Proposal (ACP) to remove the Broome Class E airspace step at 1200 ft AGL extending to 31 NM during tower hours. The ACP should include consideration of a keyhole design of the CTR to protect instrument flight procedures.

Recommendation 3:
Airservices should investigate the discrepancy between the Broome CTR upper limit and CTA step and submit an ACP to address the issue.

Recommendation 4:
Airservices should develop SIDs and STARs for both Broome and Karratha for segregated arrivals and departures for IFR aircraft.

Table of Contents

2 Introduction

The Office of Airspace Regulation (OAR) within the Civil Aviation Safety Authority (CASA) has carriage of the regulation to administer and regulate Australian-administered airspace, in accordance with section 11 of the *Airspace Act 2007* (Act). Section 12 of the Act requires CASA to foster both the efficient use of Australian-administered airspace and equitable access to that airspace for all users. CASA must also consider the capacity of Australian-administered airspace to accommodate changes to its use and national security. In exercising its powers and performing its functions, CASA must regard the safety of air navigation as the most important consideration.[5]

Section 3 of the Act states that 'the object of this Act is to ensure that Australian-administered airspace is administered and used safely, considering the following matters:

a. protection of the environment;
b. efficient use of that airspace;
c. equitable access to that airspace for all users of that airspace;
d. national security.

2.1 Overview of Australian Airspace

Australian airspace classifications accord with Annex 11 of the International Civil Aviation Organization (ICAO) and are described in the Australian Airspace Policy Statement (AAPS). Australian airspace is classified as Class A, C, D, E and G depending on the level of Air Traffic Service (ATS) required to best manage the traffic safety and efficiency. Government policy also allows the use of Class B and Class F airspace. However, these are not currently used in Australia. The airspace classification determines the category of flights permitted, aircraft equipment requirements and the level of ATS provided. Annex B provides details of the classes of airspace used in Australia. Within this classification system, aerodromes are either controlled (i.e. Class C or Class D) or non-controlled (Class G).

2.2 Purpose and Scope

The purpose of the review was to assess the airspace architecture and aircraft activity within a 75 nautical mile (NM) radius of Broome International Airport (Broome) and Karratha International Airport (Karratha) from the surface up to Flight Level (FL) 180. The objective of the review was to determine if the airspace still complies with the requirements of the Act for safe operations, efficiency and delivers equitable access to all airspace users where possible.

The review period was from the 1 April 2014 to 31 December 2019.

The scope of the review did not include aerodrome or aviation infrastructure issues that may have been raised by stakeholders.

The review process included:

- An analysis of current passenger and aircraft movement numbers;
- A review of forecast air travel demand;
- An analysis of risks based on safety incident reporting from the air navigation service provider (ANSP) and the Australian Transport Safety Bureau (ATSB);
- An analysis of aircraft operations and traffic mix operating within 75 NM of Broome and Karratha;
- The suitability of the existing Air Traffic Control Services at Broome and Karratha; and
- An evaluation of the ICAO airspace classifications surrounding Broome and Karratha based on aircraft and passenger movement numbers.

[5] Civil Aviation Act 1988, section 9A – Performance of Functions

2.3 Objective

The objective of this review was to examine the airspace arrangements and classifications within 75 NM of Broome and Karratha from the surface to FL180 to determine if the airspace remains fit for purpose and compliant with the Airspace Regulations.

3 Aerodromes

3.1 Broome Study Area

Broome is a certified aerodrome owned and operated by Broome International Airport Group and is located 0.46 NM west of the Broome township. Domestic passenger transport (PT) services operate to Broome from Perth, Brisbane, Port Hedland, Kununurra and Darwin. Sydney and Melbourne are serviced seasonally by direct routes. PT and charter operator include Qantas, QantasLink, Cobham, Virgin Australia, Virgin Australia Regional Airways, Skippers Aviation and Air North. The Royal Flying Doctor Service has a base at Broome. Broome is ranked as the 7th busiest Class D aerodrome for passengers in Australia[6] with 16 PT flights operating per day. Several general aviation charter companies also operate at the aerodrome. Broome facilitates a heavy lift heliport servicing the Browse Basin oil and gas shelf, which covers an area of approximately 140,000 km^2.

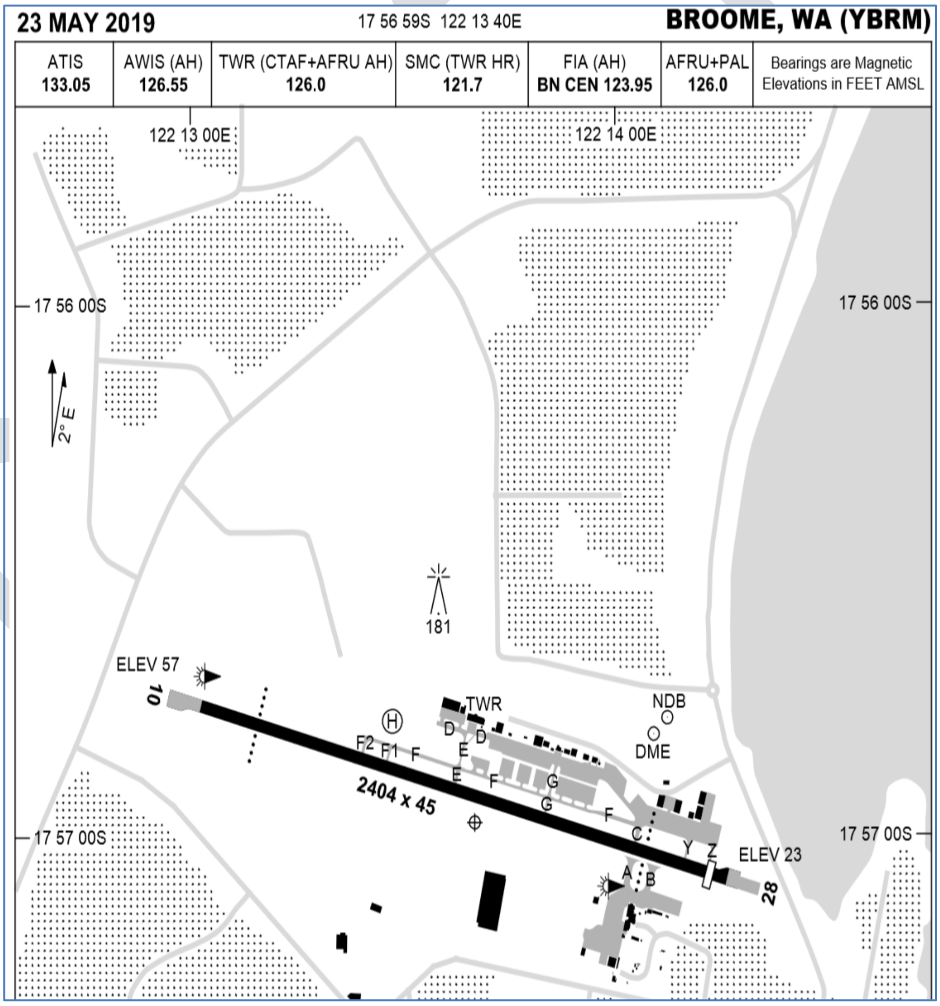

Figure 1: Broome layout (Airservices Australia (Airservices): (Aeronautical Information Package) *AIP 24 MAY 2019*).

6 Passenger figures obtained from BITRE data

There are three Aircraft Landing Areas (ALAs) within 75 NM of Broome.

Beagle Bay (YBGB) is a privately-owned ALA, 60.5 NM north east of Broome. Beagle Bay is located within Class G airspace. Broome's Class E airspace step with a lower level (LL) of FL115 sits above the ALA. Beagle Bay has one unmarked, unsealed, dirt runway (RWY), designated as RWY08/26 which is approximately 1,000 metres (m) long. Beagle Bay is used by light aircraft and helicopters.

Eco Beach (YECB) is a privately-owned ALA situated at Eco Beach Resort servicing guests and tourist flights. Eco Beach is 23.2 NM south west of Broome. Eco Beach is located within Class G airspace, Broome's Class D step with a lower level of 3,500 ft AMSL sits above the ALA. Eco Beach has one unmarked, unsealed, dirt runway designated as RWY10/25, which is approximately 1,400 m long. Eco Beach is used by light aircraft and helicopters.

La Grange Bay (YLGB) is a privately-owned ALA, 51.0 NM south west of Broome and is located within Class G airspace. Broome's Class E airspace step with a lower level of FL115 sits above the ALA. La Grange Bay has one unmarked, unsealed, dirt runway, designated as RWY09/27 which is approximately 1,110 m long. La Grange Bay is used by light aircraft and helicopters.

3.2 Karratha

Karratha is a certified aerodrome operated by the City of Karratha and is located 8.7 NM west of the Karratha township. Domestic PT services operate to Perth and on occasion to the east coast. Qantas, QantasLink, Cobham, Virgin Australia and Virgin Australia Regional Airways operate into Karratha with regular PT and charter operations. Karratha is ranked as the 9th busiest Class D aerodrome in Australia[7] with 20 PT flights operating per day. Several general aviation charter companies also operate at the aerodrome. Heavy lift helicopter operations at Karratha service the Dampier oil and gas shelf.

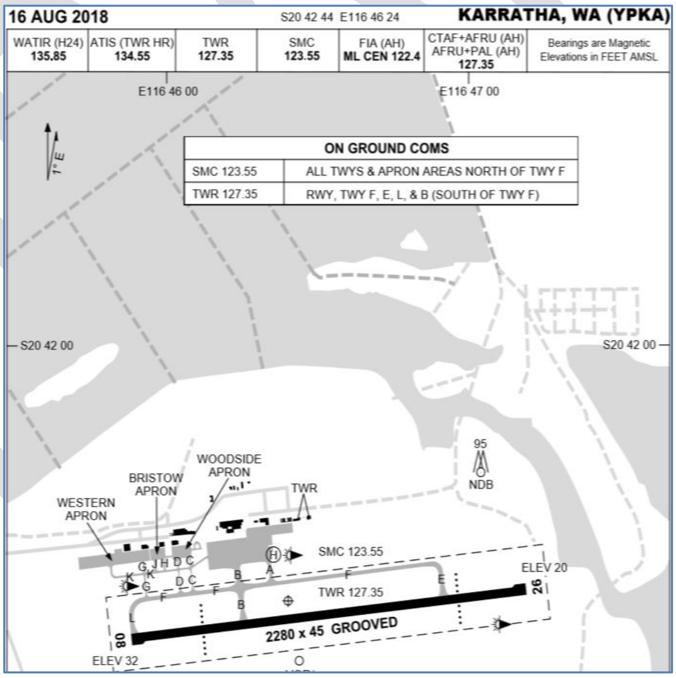

Figure 2: Karratha layout (Airservices: *AIP 24 MAY 2019*).

There is one registered aerodrome, two offshore platforms and eleven ALAs within 75 NM of Karratha.

Cape Preston (YCPR) is a certified aerodrome and is located underneath Karratha's Class D airspace step with a LL of 2,500 ft AMSL. Cape Preston has area navigation (RNAV) approaches for both runway ends. The airline operating into Cape Preston has specific operating instructions at Cape Preston regarding engine out procedures resulting in

[7] Passenger figures obtained from BITRE data

entering Karratha Class D airspace. Karratha tower is aware of these procedures and the schedule for aircraft operating into Cape Preston. Cape Preston has no negative impact on Karratha's airspace architecture.

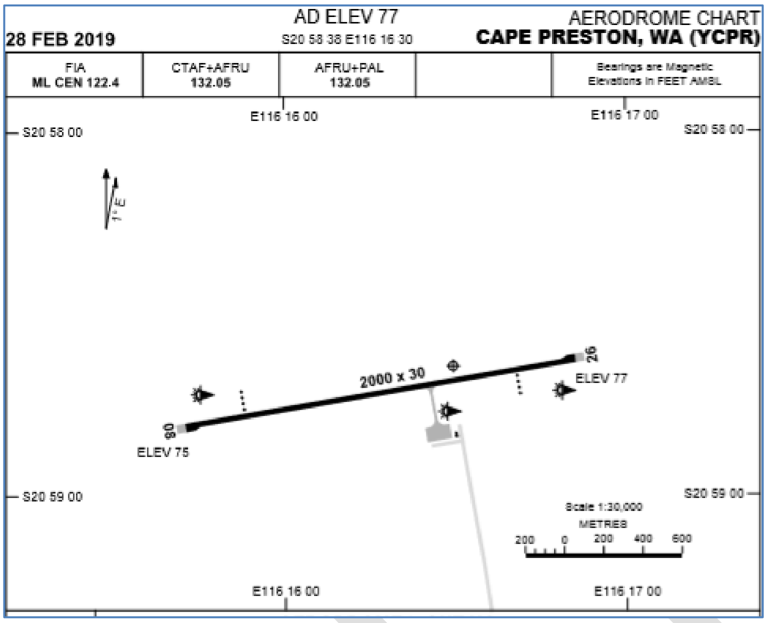

Figure 3: Cape Preston aerodrome layout (Airservices: *AIP 24 MAY 2019*).

Seabuoy (YSBY) is a helicopter marine platform with an RNAV approach underneath the Class D airspace step 18 NM to the North of Karratha. Seabuoy has no negative impact on Karratha's airspace.

Charlie 1 (YCLN) is a helicopter marine platform with an RNAV approach underneath the Class E airspace step 36 NM to the north east of Karratha. Charlie 1 has no negative impact on Karratha's airspace.

Malina (YMLA) is a privately-owned ALA. Malina is 72.4 NM south east of Karratha and is located within Class G airspace. Karratha's Class E airspace step with a LL of FL145 sits above the ALA. Malina has two unmarked, unsealed, dirt runways RWY10/28 and RWY06/24 both approximately 1,000m long.

Montebello Island (YMBS) is a privately-owned Helicopter Landing Site (HLS). Montebello Island is 72.3 NM north west of Karratha and is located within Class G airspace. Karratha's Class E airspace step with a LL of FL145 sits above the HLS. Montebello Island has one Helicopter landing site.

Lowendal Island (YLOW) is a privately-owned HLS. Lowendal Island is 68.8 NM west of Karratha and is located within Class G airspace. Karratha's Class E airspace step with a LL of FL145 sits above the HLS. Lowendal Island has one Helicopter landing site.

Fortescue River (YFCU) is a medivac ALA. Fortescue River is 50.8 NM south west of Karratha and is located within Class G airspace. Karratha's Class E airspace step with a LL of FL115 sits above the ALA. Fortescue River utilises the highway as a facility for the Royal Flying Doctor Service to service the remote community.

Compressor Station 1 (YSCD) is a privately-owned ALA. Compressor Station 1 is 63.6 NM south east of Karratha and is located within Class G airspace. Karratha's Class E airspace step with a LL of FL145 sits above the ALA. Compressor Station 1 has one unmarked, unsealed, dirt runway RWY15/33 approximately 1,010m long.

Pannawonica (YPNW) is a council owned and operated ALA. Pannawonica is 60.6 NM south west of Karratha and is located within Class G airspace. Karratha's Class E airspace step with a LL of FL145 sits above the ALA. Pannawonica has one unmarked, unsealed, dirt runway RWY12/30 approximately 1,410m long.

Millstream (YMST) is a privately-owned ALA. Millstream is 58.0 NM south east of Karratha and is located within Class G airspace. Karratha's Class E airspace step with a LL of FL145 sits above the ALA. Millstream has two unmarked, unsealed, dirt runways RWY12/30 and RWY06/24 approximately 1,010m long.

Sherlock Bay (YSRK) is a privately-owned ALA. Sherlock Bay is 58.0 NM south east of Karratha and is located within Class G airspace. Karratha's Class E airspace step with a LL of FL145 sits above the ALA. Sherlock Bay has one unmarked, unsealed, dirt runways RWY12/30 approximately 1,410m long.

Malina (YMLA) is a privately-owned ALA. Malina is 71.6 NM south east of Karratha and is located within Class G airspace. Karratha's Class E airspace step with a LL of FL145 sits above the ALA. Sherlock Bay has one unmarked, unsealed, dirt runways RWY10/28 approximately 1,410m long.

Roebourne (YROE) is a privately-owned ALA. Roebourne is 23.9 NM south east of Karratha and is located within Class G airspace. Karratha's Class D airspace step with a LL of 2,500 ft sits above the ALA. Roebourne has one unmarked, unsealed, dirt runway RWY 01/18 approximately 1,120m long

Mundabullangana (YMDB) is a privately-owned ALA. Mundabullangana is 74.0 NM north east of Karratha and is located within Class G airspace. Karratha's Class E airspace step with a LL of FL145 sits above the ALA. Mundabullangana has one unmarked, unsealed, dirt runways RWY 02/20 approximately 1,410m long.

The ALAs do not impact Karratha's controlled airspace and do not present an unacceptable risk to aviation safety.

3.3 Terminal Instrument Flight Procedures

Broome has global navigation satellite system (GNSS) arrivals including required navigation performance (RNP) approaches to all runway ends for fixed wing and helicopter operations. Broome also has non-directional beacon (NDB) and distance measuring equipment (DME) approaches for all runway ends.

Karratha has GNSS, RNP - Authorisation Required (RNP-AR), Very High Frequency (VHF) Omni-Directional Range (VOR) and NDB/DME approaches for all runway ends.

3.4 Aeronautical Information

The En Route Supplement Australia (ERSA) entries for Broome and Karratha were determined to be accurate. There were no errors on the aeronautical charts or ERSA entries.

3.5 Aerodrome Facilities

Broome's air traffic control (ATC) service operates seven days a week during peak PT traffic. Pilots are advised of the ATC operating hours via automatic terminal information service (ATIS). Tower hours are published in the ERSA.

Broome's Aerodrome Rescue and Fire Fighting (ARFF) service (provided by Airservices), operates in accordance with the hours published by Notice to Airmen (NOTAM).

Karratha's ATC service operates 7 days a week during peak PT traffic. Pilots are advised of the ATC operating hours via ATIS. Tower hours are published in the ERSA.

Karratha's ARFF service (provided by Airservices) operates in accordance with hours published by NOTAM.

4 Airspace

4.1 Airspace Structure

During tower operating hours the Broome tower provides a procedural tower and procedural approach service in Class D and Class E airspace below 5,500 ft AMSL within 31NM of Broome. Class D airspace (control zone and control area steps – surface to 5,500 ft AMSL) extends to 25 DME Broome. Class E airspace is established underneath the Class D airspace, 1,200 ft above ground level (AGL) and above to 31 DME Broome.

Above the airspace managed by Broome tower is Class E airspace from 5,500 ft AMSL to FL245 in steps extending out to 75 DME Broome and managed by Brisbane Centre.

Outside the tower hours of operations, the Class D and Class E airspace which the Broome tower manages (5,500 ft AMSL and below to 31 DME Broome) is deactivated and reclassified as Class G airspace. The Class G airspace and the Class E airspace (5,500 ft AMSL and above) are managed by Brisbane Centre. Refer to Figure 4.

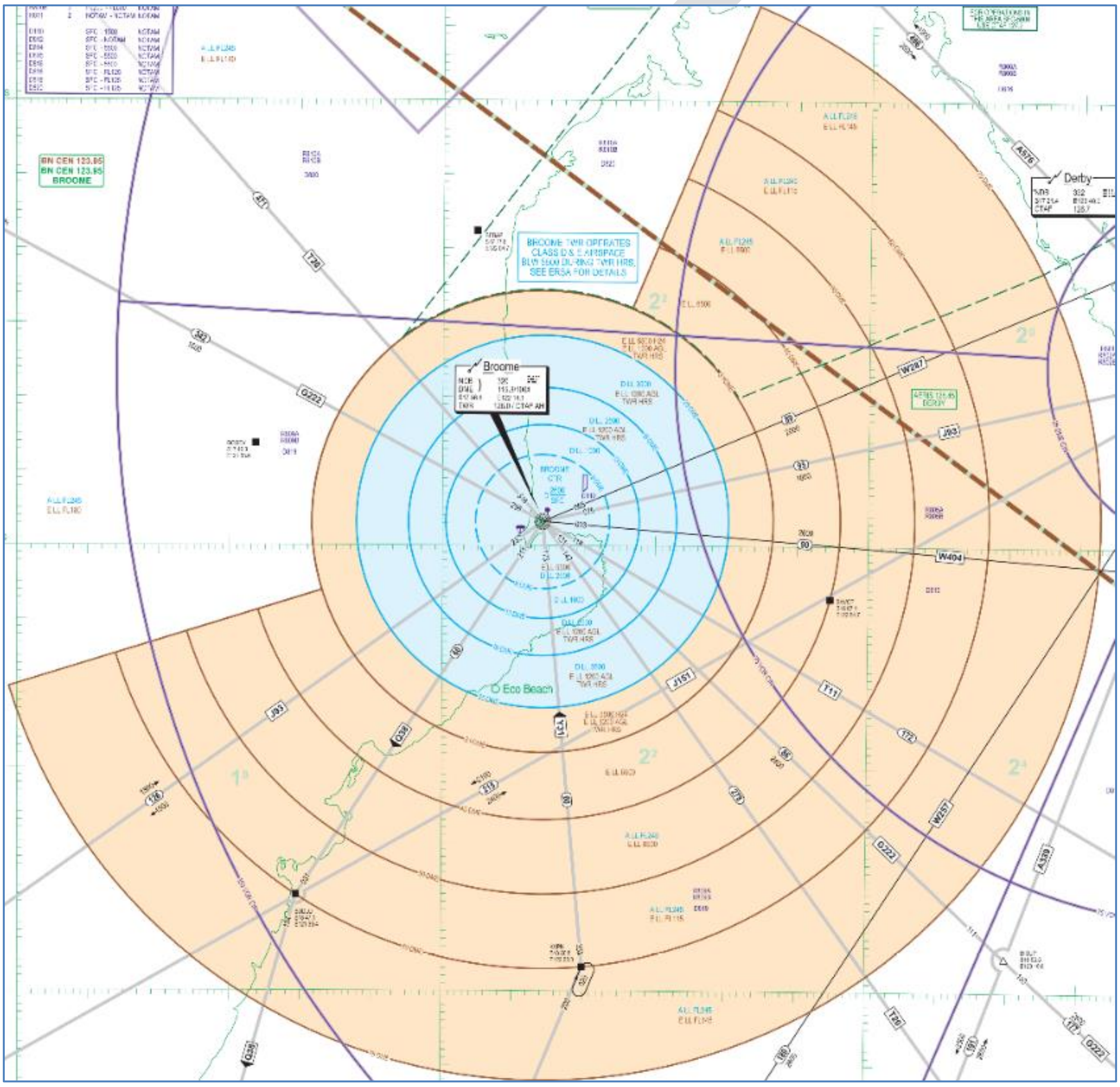

Figure 4: Broome airspace (Broome Terminal Area Chart, *AIP 24 MAY 2019*).

During tower hours of operations, the Karratha tower provides a procedural tower and procedural approach service in Class D airspace (control zone and control area steps) below 5,500 ft AMSL within 31NM of the Karratha DME.

Above the airspace managed by Karratha tower is Class E airspace from 5,500 ft to FL245 in steps extending out to 75 DME Karratha; managed by Brisbane Centre.

Outside the tower hours of operations, the Class D airspace which the Karratha tower manages (5,500 ft AMSL and below to 31 DME Karratha) is deactivated and reclassified Class G airspace. The Class G airspace and the Class E airspace (5,500 ft AMSL and above) are managed by Melbourne Centre. Refer to Figure 5.

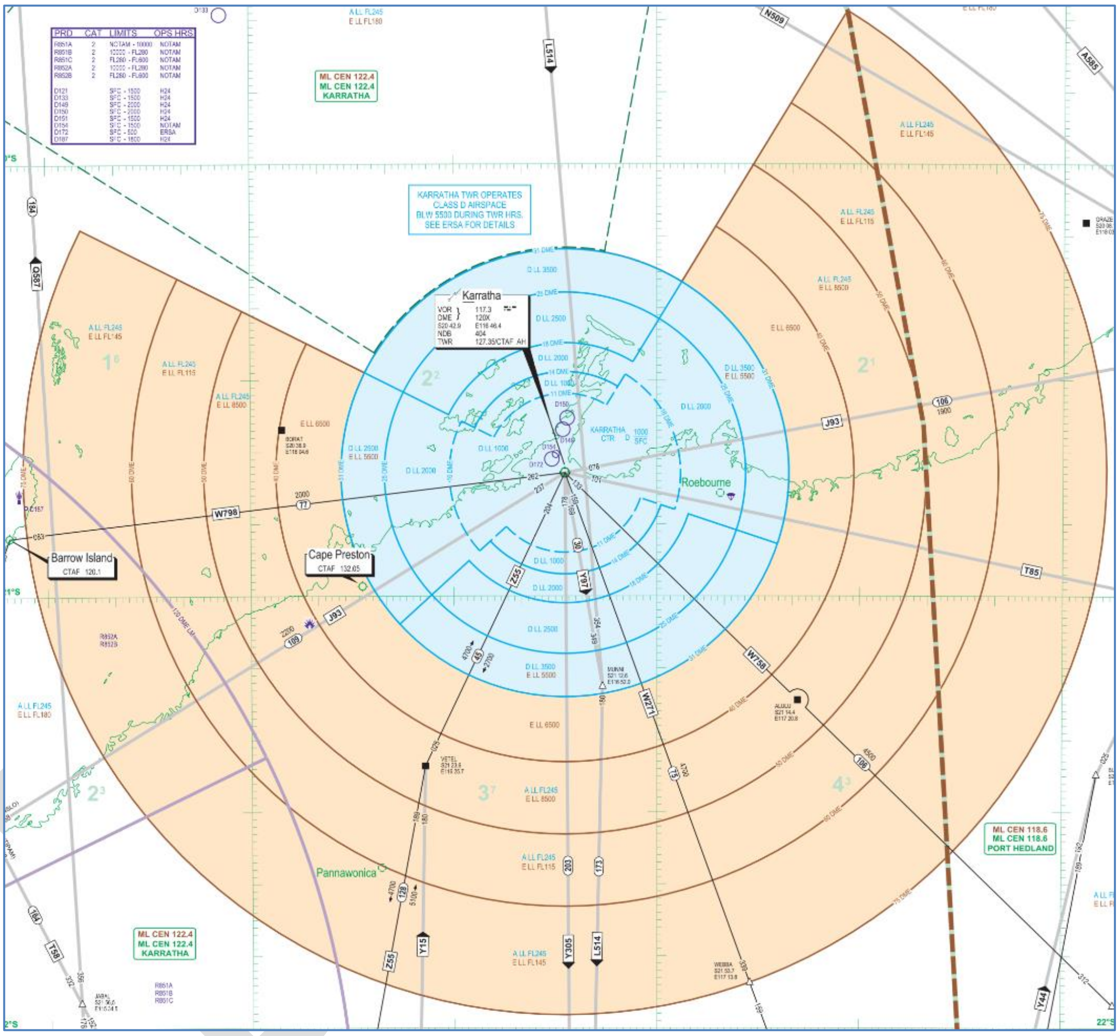

Figure 5: Karratha airspace (Karratha Terminal Area Chart, *AIP 24 MAY 2019*).

4.2 Restricted and Danger Areas

Broome's airspace includes three Danger Areas; D110, D815 and D819 and three Restricted Areas; R805A, R806A and R809A. The controlling authority for these areas is the Department of Defence.

Karratha's airspace includes five Danger Areas; D121, D149, D150, D154 and D172. and five Restricted Areas; R851A, R851B, R851C, R852A and R852B. There are various controlling authorities for these Restricted Areas.

The proximity of these Restricted Areas have no negative impact on Karratha's or Broome's airspace.

4.3 Air Routes

Eight air routes service Broome. Two are international routes with the remainder utilised for domestic travel. The busiest domestic air routes are the airways that are inbound from and outbound to Perth.

Seven air routes service Karratha. One is an international route and the remainder are utilised for domestic travel. The busiest domestic air routes in this region are the airways that are inbound from and outbound to Perth.

4.4 Surveillance

Radar or Multilateration (MLAT) electronic surveillance is not available at Broome or Karratha. Automatic Dependent Surveillance-Broadcast (ADS-B) ground stations are located at Broome and Karratha which detect appropriately equipped aircraft. Surveillance is down to the ground at Broome and Karratha. ADS-B coverage at 5,000 ft AMSL is shown in Figure 6. Flight following services are not available for all aircraft operating under visual flight rules (VFR) at Broome and Karratha due to a lack of appropriate surveillance or avionic equipage.

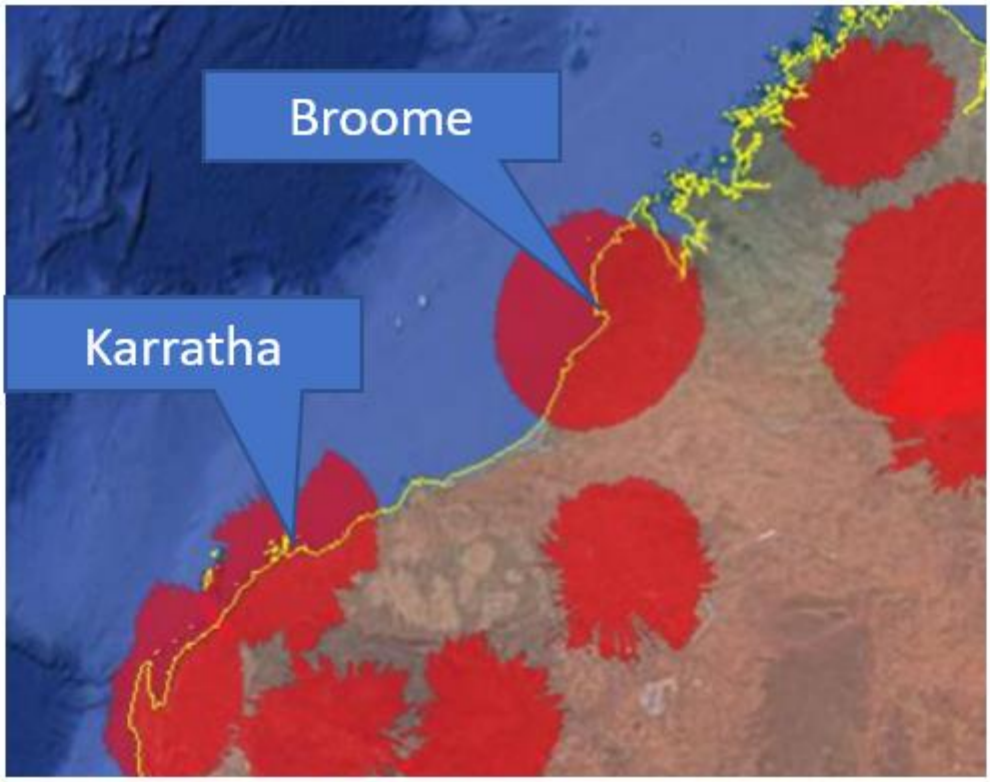

Figure 6: ADS-B coverage at 5,000 ft AMSL (Source: Airservices' website).

4.5 Environment

The airspace within 75 NM of Broome was reviewed to examine current aircraft environmental issues associated with:

- Noise;
- Gaseous emissions;
- Interactions with birds and wildlife; and
- Environment Protections and Biodiversity Conservation Act 1999 (EPBC Act) items.

The 2008 Broome Airport Masterplan Australian noise exposure forecast (ANEF) indicates some Broome communities are subject to aircraft noise. Type of aircraft and frequency varied between fixed wing and helicopter operations, thereby changing the noise impact to communities throughout the day. Broome mitigates this with several fly neighbourly advices and the establishment of an IFR helicopter standard instrument departure (SID). No efficiencies or environmental improvements were identified. No other environmental issues were identified.

The airspace within 75 NM of Karratha was reviewed to examine if there are current aircraft environmental issues associated with:

- Noise;
- Gaseous emissions;
- Interactions with birds and wildlife; and
- Environment Protections and Biodiversity Conservation Act 1999 (EPBC Act) items.

The 2013-2033 Karratha Airport Masterplan states that there are no environmentally sensitive issues on the airport site, therefore, no baseline environmental assessments were considered necessary to be undertaken at the master planning stage. No new impacts on community due to aircraft noise are known. No other environmental issues were identified.

5 Traffic

Broome and Karratha traffic consists of PT and charter services. Passenger movements to Broome consists of tourist and fly-in fly-out (FIFO). Karratha supports FIFO and business-related travel.

5.1 Analysis of aircraft movements

Total aircraft movements for the review period at Broome were 32,336, Refer to Figure 7.

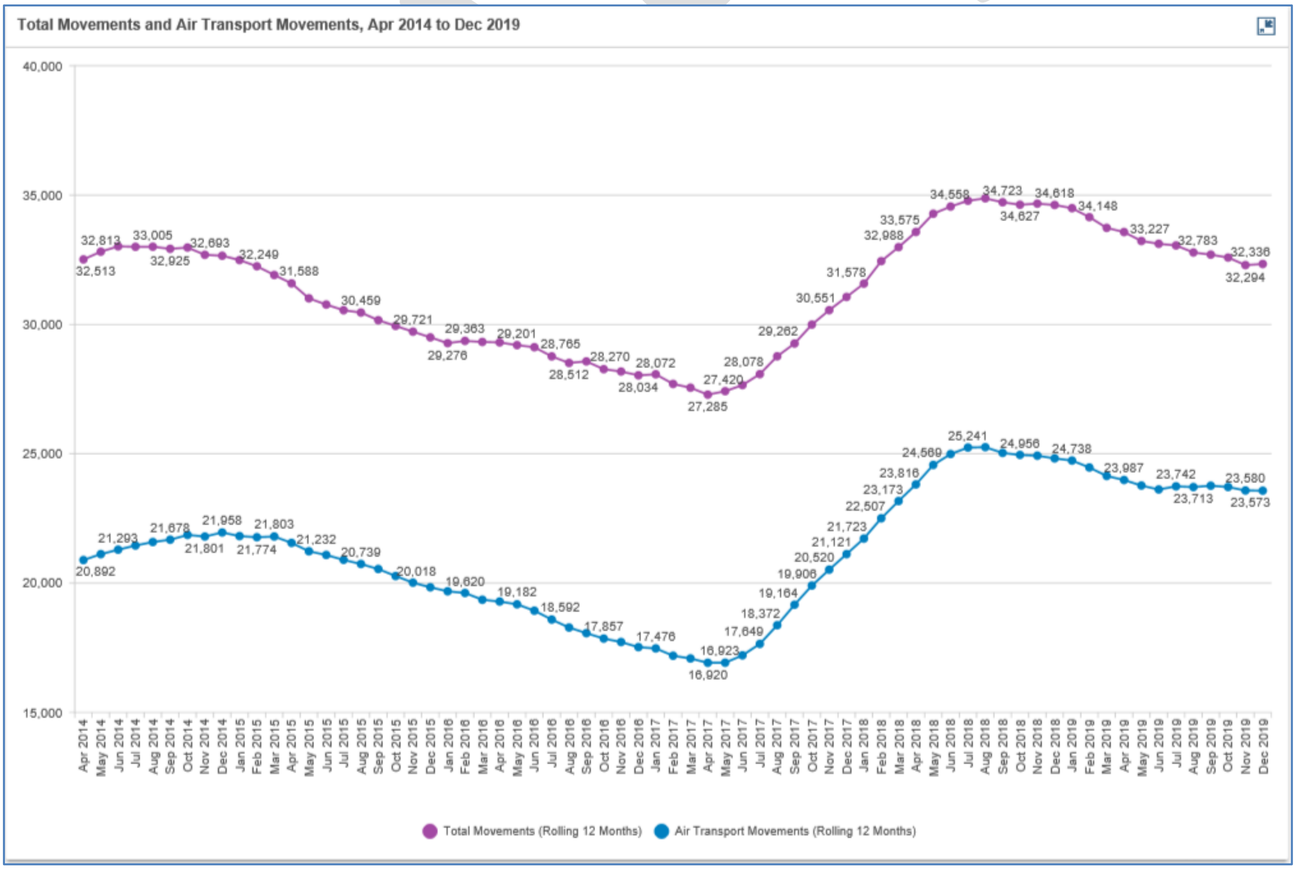

Figure 7: Air Transport Movements Broome

Total aircraft movements for the review period at Karratha was 22,055, refer to Figure 8.

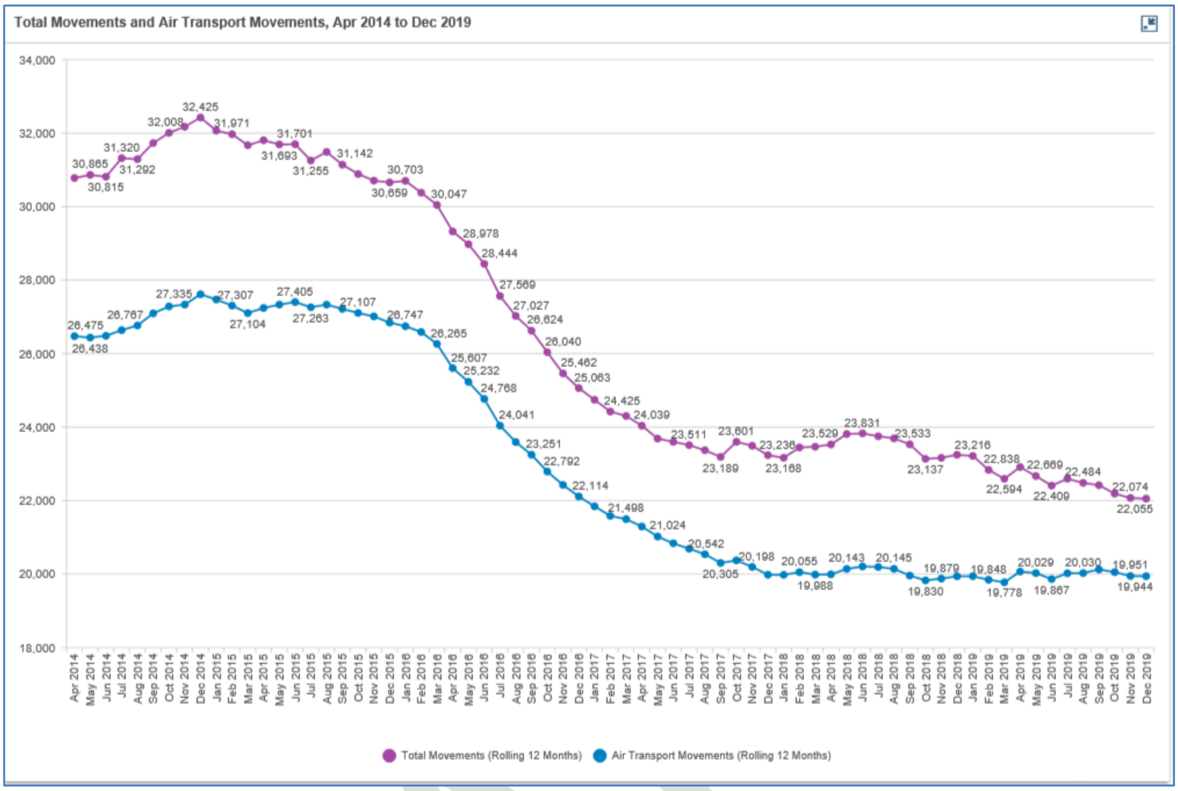

Figure 8: Air Transport Movements Karratha

5.2 Analysis of passenger numbers

Total passenger movements for the review period at Broome was 626,664 on a rolling 12-month basis. Refer Figure 9

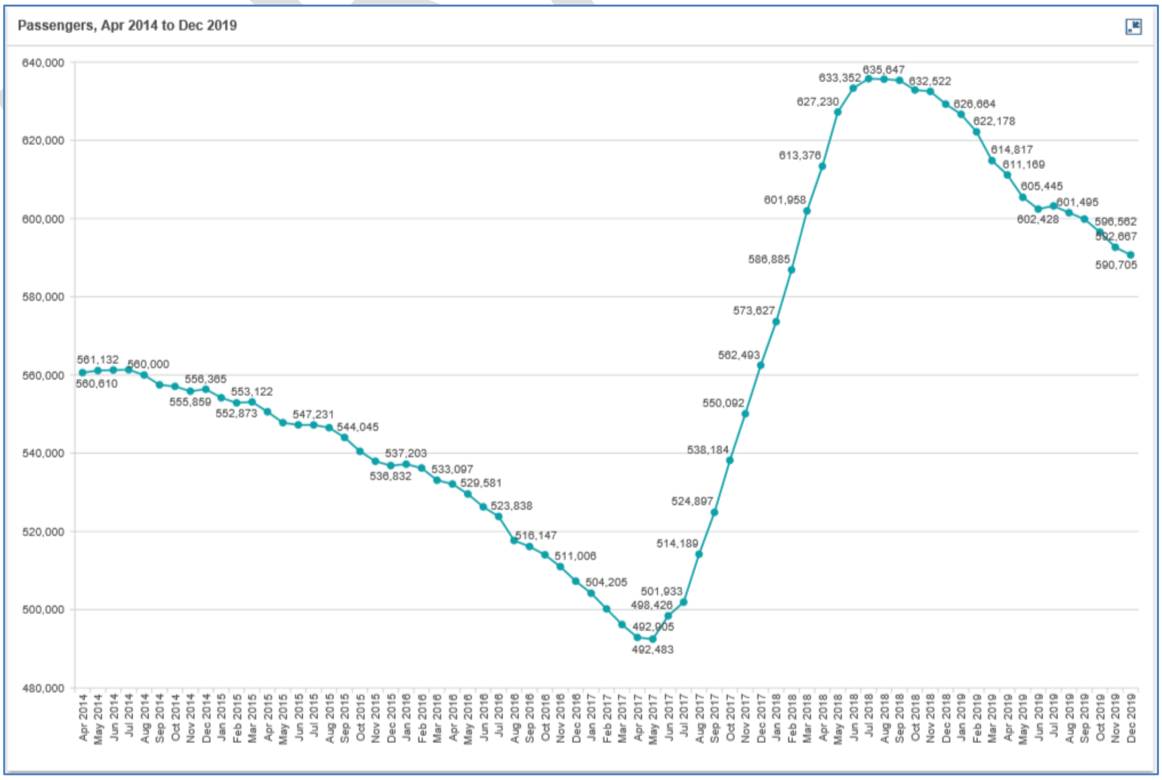

Figure 9: Passenger movements Broome

Total passenger movements for the review period at Karratha was 572,486 on a rolling 12-month basis. Refer to Figure 10.

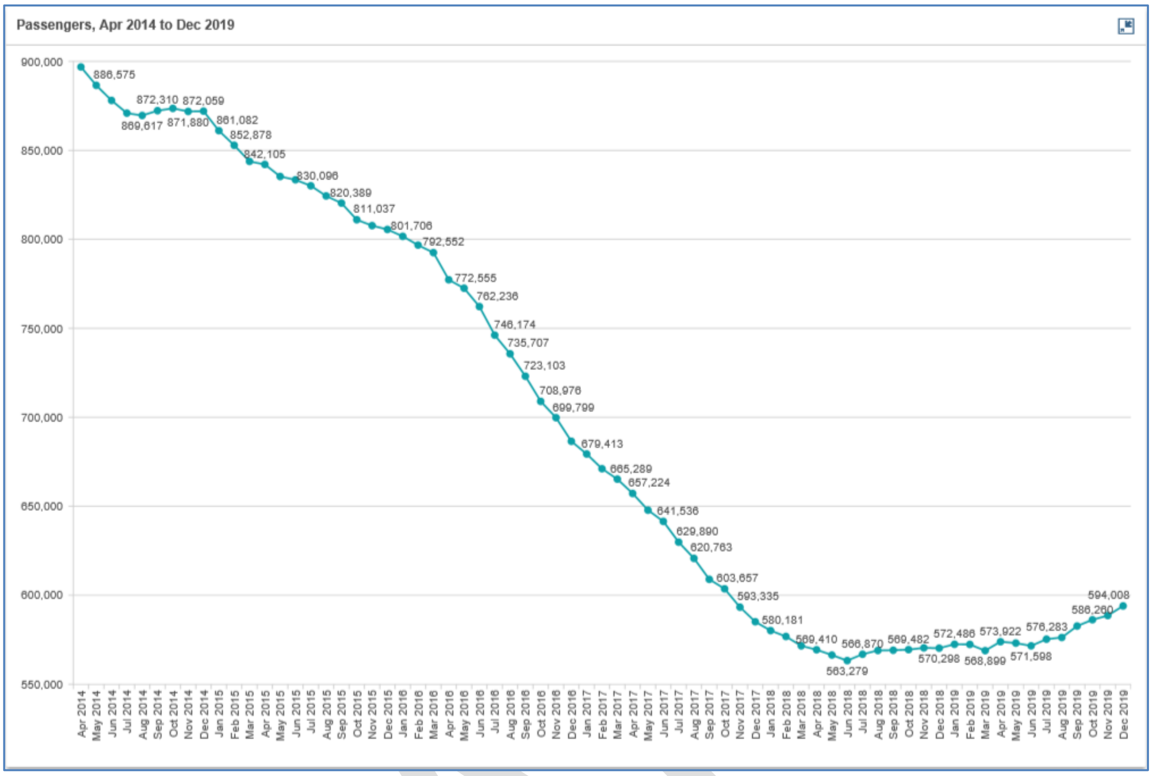

Figure 10: Passenger movements Karratha

Information gathered though stakeholder engagement, Airport Master Plans and the Mining Industry anticipates a 3-5% growth in the region over the next 3 years.

6 Aviation Incident Reports

All occurrences involving Australian civil registered aircraft, or foreign civil aircraft in Australian airspace must be reported to the ATSB. These may be events, incidents, serious incidents or accidents. The ATSB receives incident information via pilot reports, Airservices' Corporate Integrated Reporting and Risk Information System (CIRRIS) reports and the Australian Defence Forces' Aviation Safety Occurrence Reports.

The ATSB also maintains a database, the Safety Investigation Information Management System (SIIMS), in which all reported occurrences are logged, assessed, classified and recorded. The information contained within SIIMS is dynamic and subject to change based on additional and/or updated data. Each individual report is known as an Aviation Safety Incident Report (ASIR) and for identification purposes is allocated its own serial number.

CASA receives de-identified ASIR data for the purpose of improving safety. The airspace related incidents within 75 NM of Broome and Karratha from 1 April 2014 to 31 December 2019 were reviewed to determine any risks to aviation safety.

6.1 ATSB Aviation Safety Incident Reports

Broome: A total of 27 incidents were classified as airspace related from 2014 to 2019. A breakdown of the incidents is listed in Table 1.

Type of incident	Number of airspace attributed incidents					
	2014	**2015**	**2016**	**2017**	**2018**	**2019**
Aircraft Separation	5	3	1	1	1	2
ANSP Operational Error	1	1	1	1	1	0
Encounter with RPA	0	0	1	0	0	0
Operational Non-Compliance	3	0	1	2	1	1
Total airspace Incidents	**9**	**4**	**4**	**4**	**3**	**3**
Total aircraft movements	32,656	29,500	28,034	31,063	34,618	32,336

Table 1: Airspace attributed incidents for Broome 1 April 2014 to 31 January 2019 (ATSB ASIR data).

Karratha: A total of 14 incidents were classified as airspace related from 2014 to 2019. A breakdown of the incidents is listed in Table 2.

Type of incident	Number of airspace attributed incidents					
	2014	**2015**	**2016**	**2017**	**2018**	**2019**
Aircraft Separation	0	3	0	1	0	1
ANSP Operational Error	1	2	1	1	2	1
Encounter with RPA	0	0	0	0	0	0
Operational Non-Compliance	0	2	0	0	0	0
Total airspace Incidents	**1**	**7**	**1**	**1**	**2**	**2**
Total aircraft movements	32,425	30,659	25,063	23,236	23,249	22,055

Table 2: Airspace attributed incidents for Karratha 1 April 2014 to 31 January 2019 (ATSB ASIR data).

6.2 Airservices CIRRIS data

Broome: The CIRRIS data safety occurrences listed between 2014-2019 are summarised below in Table 3.

Type of incident	Airspace attributed incidents					
	2014	2015	2016	2017	2018	2019
Aircraft Accident	1	1	1	0	0	0
Aircraft Confliction	0	1	0	0	1	1
Other – Safety Related	2	1	2	3	4	1
Airspace Infringements	3	1	3	5	1	2
Laser	0	4	1	1	0	0
Total airspace Incidents	**9**	**8**	**7**	**9**	**6**	**0**

Table 3: Airspace attributed incidents for Broome 1st April 2014 to 31 January 2019 (CIRRIS data).

Karratha: The CIRRIS data safety occurrences are summarised below in Table 4.

Type of incident	Airspace attributed incidents					
	2014	2015	2016	2017	2018	2019
Aircraft Accident	0	0	0	0	0	0
Aircraft Confliction	0	1	0	0	0	2
Other – Safety Related	5	1	1	0	0	1
Airspace Infringements	0	0	1	1	1	0
Laser	0	1	1	0	0	0
Total airspace related Incidents	**5**	**3**	**3**	**1**	**1**	**3**

Table 4: Airspace attributed incidents for Karratha 1st April 2014 to 31 January 2019 (CIRRIS data).

The review determined that most incidents were reported during Tower operating hours. This indicates that airspace related occurrences were identified and reported when the Tower was active and when the greatest frequency of arrivals and departures were occurring (0800 hours to 2145 hours local time). The spread of incidents between Class E and Class D airspace were similar for Broome and Karratha. The majority of separation issues were related to procedural tower operations with known traffic.

Stakeholders were invited to provide comment on issues relating to Broome and Karratha airspace. A list of contributing stakeholders to this review can be found in Annex C.

6.3 Summary of feedback from consultation

Stakeholder consultation included information relating to the airspace review via industry forums, CASA’s Consultation Hub and face to face interviews. Information received from this process included:

- Introduction of SIDs and standard terminal arrival routes (STARs) at Broome and Karratha may assist in aircraft management and efficiency from an aircraft operations perspective. Some stakeholders stated that SIDs and STARs were not currently needed but may be required in the future. Further consultation should be undertaken.
- The 1,200 ft AGL Class E airspace step to 31 NM during tower hours of operation at Broome provides no benefit to IFR operators. Disestablishing the Class E airspace step and replacing it with Class G airspace would be more appropriate.
- There is a 100 ft discrepancy between the upper limit of the Broome control zone (CTR) and the LL of the overlaying Control Area (CTA) step. The Broome CTR is from the surface to 2,600 ft AMSL. The overlying Class D airspace step has a LL of 2,500 ft AMSL which creates a discrepancy. This should be addressed.
- Low level IFR routes to the Browse Basin oil fields north of Broome would be beneficial to IFR helicopters.
- Although outside the scope of the study, improved VHF communications and ADS-B surveillance coverage to the Browse Basin would be beneficial for IFR helicopters.
- Stakeholder feedback suggests that the Tranche 3 proposal from Airservices could negatively affect jet operations out of Broome and Karratha outside of tower hours. During tower hours of operation, the reduction of Class D airspace from 5,500 ft AMSL to 4,500 ft AMSL would be problematic for IFR helicopters and tower controllers. Outbound flights to the oil rigs are usually conducted at 4,000 ft AMSL and inbound at 5,000 ft AMSL. Opposite direction traffic would be operating on different frequencies reducing situational awareness. This would increase coordination with the tower and Centre (reported to be an already congested coordination channel) with increased aircraft coordination. Jet aircraft operating from Karratha are currently released to 5,000 ft AMSL. If the Tranche 3 proposal was implemented, aircraft would be delayed on the ground, as tower controllers could not release the aircraft to 4,000 ft AMSL as the lowest safe altitude is 4,300 ft AMSL.
- Class E airspace above Class D airspace is a safety concern for high capacity jet traffic. Not all traffic is known, due to the type of surveillance employed at Broome and Karratha and fitment rates of specific transponders in VFR aircraft. There is too much reliance on traffic alert and collision avoidance system (TCAS) for situational awareness introducing human factors. Better knowledge of traffic operating in volumes of airspace by ATC would increase the “traffic picture” and enable more accurate traffic advisories for inbound IFR aircraft. Most IFR stakeholders would prefer that Class D airspace be extended, replacing the current Class E airspace.
- The different rules which apply to IFR and VFR aircraft in Class E airspace are a safety issue which needs to be addressed. Replacing Class E airspace with Class D airspace would improve situational awareness of controllers and pilots. The lack of appropriate electronic surveillance (either radar or MLAT) prevents ATC from being able to detect all aircraft in the vicinity of Broome and Karratha. Stakeholders explained that incidents reports are not submitted by ATC or industry, as rules are not broken. Two types of incidents were provided by stakeholders:
    - <u>VFR denied entry into Class D airspace:</u>
      A VFR Cessna was arriving into Broome in the evening VFR arrival peak and was told that a clearance was not available. The Cessna pilot climbed above 5,500 ft AMSL (into Class E airspace) and proceeded inbound to Broome. The pilot did not make broadcasts (nor were they required to) or have ADS-B avionics (nor were they required to), therefore situational awareness for controllers on the tower

situational awareness display (TSAD) was not available. The pilot was orbiting above the CTR in Class E airspace waiting for an opportunity for them to land. IFR jets and helicopters were operating at the airfield at the time and the controllers were unaware that the aircraft was there and were only alerted to the fact that when the pilot asked for clearance again to enter the CTA.

- <u>Cessna Caravan change of tracking route</u>:
  A VFR Cessna Caravan was departing Broome RWY 10 and "was going to track south via the coast". The Caravan was equipped with ADS-B avionics.

  The controller cleared the Cessna for take-off and observed the aircraft following the departure instruction which had been issued. As the Caravan was departing, a Boeing 717 jet (717) aircraft was lined up and then cleared for take-off.

  During the clearance for take-off departure instruction "Cleared for take-off make right turn", there was traffic information given on a "VFR Caravan departing tracking via the coast". As the 717 was in the right hand turn the air traffic controller noticed on TSAD that the Caravan had made an early right turn and was no longer tracking "via the coast". The Caravan was nine miles closer to the aerodrome than ATC expected.

  The Caravan was above 5,500 ft AMSL, in Class E airspace and operating under the VFR. There was no requirement for the aircraft to call the controllers and advise them of the change of plan.

  If the Caravan was not equipped with ADS-B then the controllers wouldn't have had situational awareness on the aircraft. Then next possible alert of the traffic for the 717 pilots might have been a TCAS Resolution Advisory climbing through the level of the Caravan.

- The frequency boundary for the Onslow Sector between Learmonth Airport and Onslow Airport should be adjusted for better frequency coverage. By moving the North South section of the boundary east of Lowendal Island, there would be a reduction of aircraft at low level having to communicate via relayed messages due to poor VHF coverage to other aircraft reducing controller workload and frequency congestion.
- Receiving clearances outside tower hours on the ground for Broome and Karratha are different. Some Centre controllers are willing to give an airways clearance at Karratha outside tower hours. Centre controllers will only issue an airways clearance to aircraft departing Broome, once established on climb, increasing the workload for crews after becoming airborne.
- The West Kimberley broadcast area should be extended to reduce frequency confusion and increase situational awareness of traffic. *[CASA comment: This has been approved and has been implemented in May 2020, at the next chart cycle.]*

7 Key Issues, Recommendations and Observations

7.1 Issues

Stakeholders have expressed a view that Class E airspace over Class D airspace utilising only ADS-B surveillance is not as safe as is should be. VFR aircraft are not required to contact ATC to obtain a clearance to operate or communicate in Class E airspace. ATC do not have a comprehensive traffic picture to provide information to IFR aircraft. TCAS only provides a limited traffic picture. VFR aircraft that are not carrying appropriate avionics for ADS-B do not appear on the TSAD.

Stakeholder feedback suggests that the Tranche 3 proposal from Airservices would impact operations at Broome and Karratha outside of tower hours. Stakeholders have commented that the proposal to reduce tower-controlled Class D airspace from 5,500 ft AMSL to 4,500 ft AMSL needs further safety analysis and operator consultation. Opposite direction IFR helicopters would be operating on different frequencies reducing situational awareness. This increases coordination with Karratha and Broome Towers and Melbourne and Brisbane Centre. Jet aircraft departing from Karratha are currently released to 5,000 ft AMSL. Aircraft operating under the Tranche 3 model would be delayed on the ground, as tower controllers could not release the aircraft to 4,000 ft AMSL. The lowest safe altitude for Karratha is 4,300 ft AMSL requiring further coordination with Melbourne Centre.

7.2 Findings

The 1,200 ft AGL to 31NM Class E airspace step during Broome tower hours provides no benefit to IFR operators.

The 100 ft discrepancy between the Broome CTR and CTA should be addressed.

A keyhole CTR to 16 NM may protect IFPs for Broome and enable the 1,200 ft AGL Class E airspace step to be removed.

The West Kimberley broadcast area could be amended to reduce frequency confusion and improve situational awareness of VFR tourist flights by adjusting the boundaries of the broadcast area to better suit operations. *[CASA Comment: Following stakeholder consultation, the West Kimberley broadcast area has been amended. Changes have been implemented in May 2020.]*

Coordination from Karratha tower to Onslow Sector can be difficult for tower controllers due to frequency congestion resulting in delays to departing traffic.

SIDs and STARs would be beneficial for aircraft operating into and out of Broome and Karratha. The benefits are the introduction of more predictable flight paths and improved aircraft operational efficiency.

7.3 Recommendations

The recommendations are:

Recommendation 1:
Airservices should submit an ACP changing the Class E airspace at Broome and Karratha to Class D airspace from 5,500 ft AMSL to FL125.

Recommendation 2:
Airservices should submit an Airspace Change Proposal (ACP) to remove the Broome Class E airspace step at 1200 ft AGL extending to 31 NM during tower hours. The ACP should include consideration of a keyhole design of the CTR to protect instrument flight procedures.

Recommendation 3:
Airservices should investigate the discrepancy between the Broome CTR and CTA step and submit an ACP to address the issue.

Recommendation 4:
Airservices should develop SIDs and STARs for both Broome and Karratha for segregated arrivals and departures for IFR aircraft.

8 Conclusion

The OAR has conducted a review of the airspace within 75 NM radius of Broome and Karratha.

The review determined that there are opportunities to improve airspace efficiency and reduce risk.

An assessment of airspace incidents and feedback from stakeholders concluded that replacing Class E airspace with Class D airspace may enhance safety by providing ATC with greater situational awareness. There would be less unknown traffic operating in the area because all aircraft must obtain a clearance to operate within the Class D airspace. This will reduce the chance of unknown aircraft overflying Class D towers in Class E airspace possibly on a different frequency. There are no extra cost implications for airspace users as the minimum equipment fitment for Class D is already a requirement at Broome and Karratha.

Stakeholder feedback also indicates the current airspace architecture is not fit for purpose. Feedback suggests that there is a too greater reliance on traffic detection and avoidance technology. TCAS technology was designed as last line of defence for aircrews, not as a separation or awareness tool. Not all aircraft operating in the volumes of Class D and Class E airspace are fitted with traffic detection technology. Changing the airspace architecture from Class E airspace to Class D airspace below 10,000 ft AMSL would enhance situational awareness for all airspace users as aircraft must obtain a clearance to enter the airspace. Controllers would know who is operating where, VFR and IFR, to create a complete traffic picture.

Oil and gas activity and resource flights continue to fluctuate in Western Australia. The establishment of the IMPEX and Prelude projects off the north west of Broome have increased both jet and helicopter traffic. Heavy investment in the resource industry and new exploration in oil and gas at Karratha is expected to increase traffic at Karratha in the coming years.

Appendix A Comparison of collision risk in Class E, class D and Class C airspace in Broome and Karratha airspace

Introduction
This report quantifies the benefit of changing Class E airspace at Broome and Karratha to Class D airspace from 5,500 ft above mean sea level (AMSL) to 10,000 ft AMSL. Changing the airspace to Class C is also considered. The airspace review of Broome and Karratha identifies that the area in question lacks any electronic surveillance apart from ADS-B which may present an elevated risk to Instrument Flight Rules (IFR) flights in this area. While IFR aircraft are Automatic Dependent Surveillance – Broadcast (ADS-B) equipped and provided a separation service, Visual Flight Rules (VFR) are not required to be ADS-B equipped, are not provided with a separation service and do require a clearance to enter Class E airspace. In Class D airspace VFR and IFR aircraft require a clearance to enter and IFR aircraft are provided with traffic information on VFR aircraft. IFR aircraft are separated from other IFR aircraft. In Class C airspace IFR aircraft are separated from VFR aircraft. This report demonstrates the change in airspace to be an additional mitigator to reduce the likelihood of confliction between IFR and VFR aircraft.

This report quantifies the reduction in collision risk when an IFR aircraft is aware of a VFR aircraft's position verses when they are not aware of the aircrafts position.

Assumptions and Limitations
Rather than try to account for all difference between airspace classes, we specifically try to address the potential improvement that may come from the fact that IFR aircraft would gain awareness of VFR aircraft in the area. Because of this we do not attempt to calculate an overall collision risk between aircraft in either situation. We only attempt to compare the cases. We purposely left out of the current level of risk in the document because the methodology used is only suitable to compare risk between the different classes of airspace and not suitable to measure an absolute level of risk. To try and measure risk in the current configuration is too open to interpretation. There would be too much opportunity to skew the information by suggesting other parameters for consideration.

We assume that several factors do not change between airspace classes and in an effort to simplify the approach to do attempt to account for them:

- The effects of pilot actions and ability to sight other aircraft
- Effects of Traffic Alert and Collision Avoidance System (TCAS)
- Density of airspace
- Traffic mix
- Surveillance available
- Route structure

In an effort to simplify the approach the following factors are not included in this analysis. Each factor is considered to be overly complex to model and would only marginally contribute to the results.

- A pilot manoeuvring to avoid a collision is not accounted for
- Human errors, by pilots and air traffic controllers are not accounted for
- Technical faults are not accounted for
- Aircraft are assumed to be straight and level with constant speed while in the airspace. This means that aircraft climbing or descending; and aircraft turning horizontally are not accounted for.
- All aircraft are assumed to follow rules specific to the class of airspace, and all aircraft are assumed to follow instructions from air traffic control.
- Each aircraft operates independently of each other.

Method

This approach uses an overly simplified model which can be used as an indicator of the potential improvements. We start by identifying a generic method for determining collision risk in any given airspace and try to adapt this to the case of IFR colliding with VFR aircraft[8].

$$P(C) = P(L) * P(V|L) * M$$

Where:

P(C): A collision between IFR-VFR aircraft

P(L): Probability of horizontal overlap per unit of time

P(V|L): Probability that two aircraft overlap vertically given they overlap horizontally

M: Impact of mitigators

In all airspace classes, we assume P(L) can be modelled using the same types of distributions as P(V|L) to represent IFR and VFR aircraft. This enables us to be as conservative as possible. Previous literature does not provide robust guidance on what type of distributions should be used for the horizontal direction, but suggests P(V|L) would be calculated using a method similar to that used to estimate the probability of a collision between manned and unmanned aircraft[9]:

$$P(V|L) = \int_{G}^{G+H} f_V(Z) \left(F_I \left(U + \frac{h_I + h_V}{2} \right) - F_I \left(U - \frac{h_I + h_V}{2} \right) \right) dz$$

Where:

f_V: Distribution of vertical position of VFR aircraft

f_I: Distribution of vertical position of IFR aircraft

h_V: height of the VFR aircraft

h_I: height of the IFR aircraft

G: Lower height of airspace

H: Maximum height of airspace above G

We lack sufficient evidence to be able to calculate these probabilities from scratch. However, we can estimate a ratio to show the improvement of each type of airspace instead. We start with Class D airspace verses Class E airspace:

$$R = \frac{P_E(C)}{P_D(C)}$$

Where:

R = Ratio of collision risk between IFR and VFR aircraft in Class E airspace verses Class D airspace.

Since we are treating both directions (vertical and horizontal) as the same type of distribution it will be reasonable to compare the risk in just one direction and assume it's adequate for both directions. So, we reduce the ratio to:

$$R` = \frac{1 - P_D(IFR\ aircraft = m\ \cap VFR\ aircraft\ \in \{m - h_I, m + h_I\})}{1 - P_E(IFR\ aircraft = m\ \cap VFR\ aircraft\ \in \{m - h_I, m + h_I\})}$$

[8] Endoh, S 1982, *Aircraft collision Models*, Massachusetts Institute of Technology

[9] Cour-Harbo, A & Schiøler H 2019, *Probability of Low-Altitude Midair Collision Between General Aviation and Unmanned Aircraft,* Risk Analysis

Where:

R`: Improvement of collision risk between IFR and VFR aircraft in Class D airspace verses Class C airspace

m: Vertical position of IFR aircraft. In most cases we will use $m = \frac{2*G+H}{2}$

h_I: height of IFR aircraft here we assume the height is 50 feet for a collision and for a near miss we use 150 feet.

In words, R` is the ratio of a VFR aircraft not being in the same position as an IFR aircraft in Class D airspace verses Class E airspace. The same logic can be applied to compare Class C and Class E airsapce.

For Class E airspace we assume the VFR aircraft could be anywhere within the airspace relative to the IFR aircraft with equal probability. So, a uniform distribution is ideal for both aircraft in this situation:

$$f_{V,E} \sim Uniform(G, G+H)$$

$$f_{I,E} \sim Uniform(G, G+H)$$

For Class D airspace we no longer assume the IFR aircraft are in a completely randomly place with respect to the VFR aircraft. The IFR aircraft can be modelled in a variety of ways. Typically, a normal or Laplace distribution is used. For this analysis the difference would be minimal, and it seems logical to use an exponential type distribution, so a Laplace[10] is used. It also accounts for the fact that we don't have a reliable estimate in the variance of altitude, so heavier tails are desirable:

$$f_{I,D} \sim Laplace(m, s)$$

Where:

s: dispersion factor

In this case, the IFR aircraft still does not have good information on where the VFR aircraft is so we still use a Uniform distribution:

$$f_{V,D} \sim Uniform(G, G+H)$$

For Class C airspace we no longer assume the VFR aircraft are in a completely randomly place. We can replace the uniform distribution with a Laplace distribution, similar to the IFR aircraft.

$$f_{V,C} \sim Laplace(m, s)$$

$$f_{I,C} \sim Laplace(m, s)$$

Dispersion, s, is difficult to estimate. As it is related to variance, we can look to the height keeping ability of an IFR aircraft. ICAO states that for use of ADS-B in RVSM airspace no single aircraft should have an altimetry system error of more than 245 feet in the very worst case (additional requirements are based on fleet type and are more restrictive)[11], which most aircraft in Australia are able to comply with. This is used as a base line and round up to 250 ft. It is reasonable to assume the dispersion would be larger for the VFR aircraft. But since we are already using a large dispersion, we will use the same value. So:

s = 250

[10] $Laplace(m,s)\text{: } f(x|m,s) = \frac{1}{2s}\exp\left(-\frac{|x-m|}{s}\right)$ $Uniform(G, G+H)\text{: } f(x|G, G+H) = \frac{1}{H}$

[11] ICAO 2019, *Doc 9937*, Montreal Canada

The estimated distributions are shown graphically in the figures below:

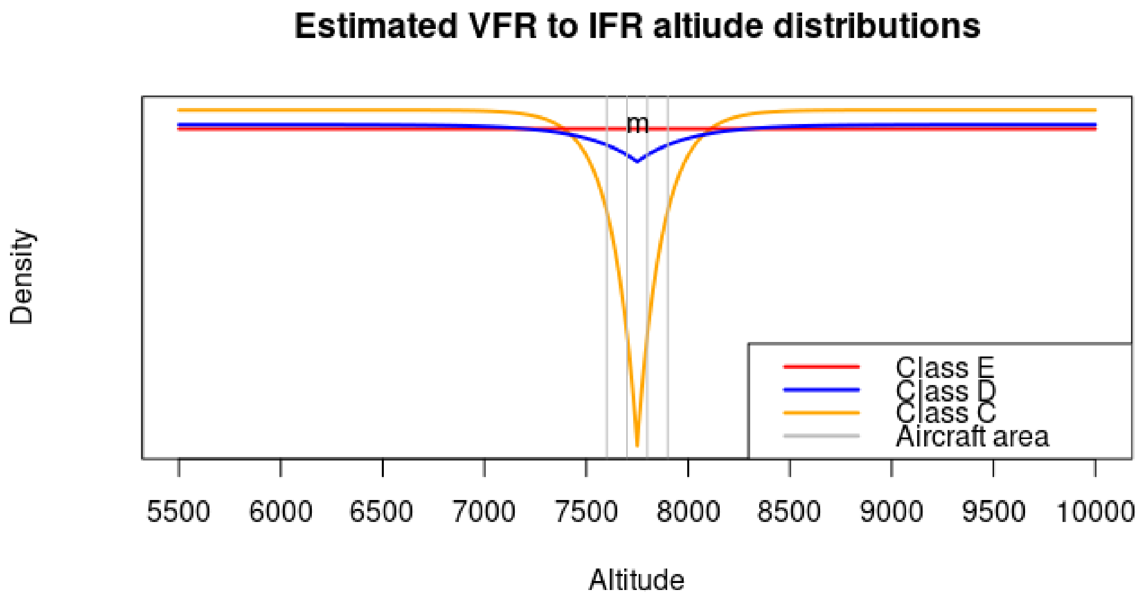

Figure 1: Estimate vertical distributions for VFR and IFR aircraft being in the same position at the same time

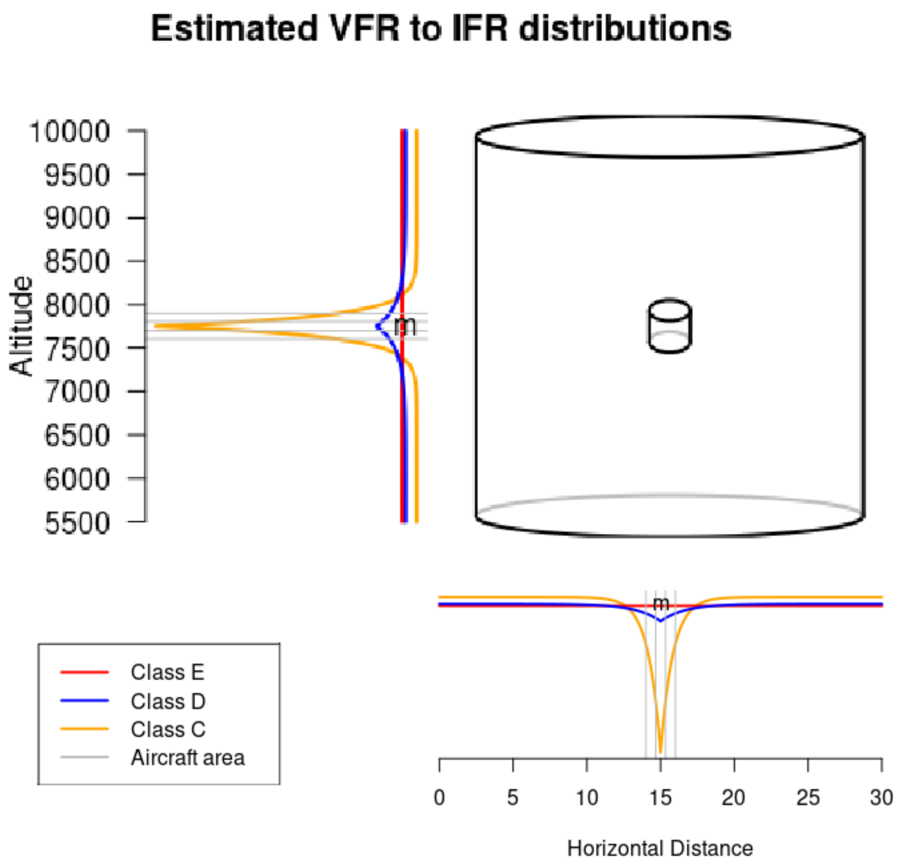

Figure 2: Estimate distributions for a VFR and IFR aircraft being in the same position at the same time. The outer cylinder represents the whole airspace and the inner cylinder represents the potential conflict area

Now we have enough information to complete the ratio estimate. Rather than calculate this analytically, we can use Monte Carlo simulations. To do this we:

1. Randomly simulate 10,000 positions between 5,500 feet and 10,000 feet AMSL
2. Determine the probability of conflict for each, assuming the IFR aircraft aims to be centred at m. We will say that a collision occurs if the aircraft are within 50 feet of each other and a collision occurs if the aircraft are within 150 feet of each other.
3. Use the results to determine the ratio.
4. Repeat 1,000 times and take the average as the final ratio.

Results

This results in an estimated reduction of collision risk by around **8** times by using Class D airspace instead of Class E airspace, and a reduction of likelihood of a near miss by around **7** times. That difference increases in Class C airspace as shown in Table 1.

	Class D vs Class E	Class C vs Class E
Collision	8 times less likely	15 times less likely
Near miss	7 times less likely	11 times less likely

Table 1: Estimated Ratio values

Notice that as we improve the height keeping ability and awareness of traffic (which deduces s) the improvement continues to increase. Due to the limitations of this report (such as not considering the pilots ability to manoeuvre or detect conflicts) in reality the difference may not actually reflect this. However, the numerical values are not the key take away in this analysis. This conclusion highlights that using Class D airspace in this region could be a significant risk mitigator. Using Class C would mitigate risk even further.

Annex A - Acronyms and Abbreviations

Acronym/abbreviation	Explanation
AAPS	Australian Airspace Policy Statement 2018
ACP	Airspace Change Proposal
Act	*Airspace Act 2007*
ADS-B	Automatic Dependent Surveillance - Broadcast
Airservices	Airservices Australia
ALA	Aircraft landing area
ALARP	As Low as Reasonably Practicable
AMSL	Above Mean Sea Level
ANSP	Air Navigation Service Provider
ASA	Aviation Safety Advisor
ASIR	Aviation Safety Incident Report
ATC	Air Traffic Control
ATS	Air Traffic Services
ATIS	Automatic Terminal Information Service
ATSB	Australian Transport Safety Bureau
CASA	Civil Aviation Safety Authority
CIRRIS	Corporate Integrated Reporting & Risk Information System
CTA	Control Area
CTAF	Common Traffic Advisory Frequency
CTR	Control Zone
DME	Distance Measuring Equipment
ERSA	En Route Supplement Australia
ft	Feet
FL	Flight Level
GA	General Aviation
GPO	General Post Office
ICAO	International Civil Aviation Organization
IFP	Instrument Flight Procedure
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
kt	Knot
m	Meters
NOTAM	Notice to air men
NM	nautical miles
OAR	Office of Airspace Regulation
PT	Passenger transport
RAPAC	Regional Airspace and Procedures Advisory Committee
RNAV	Area Navigation
TAC	Terminal Area Chart
TCAS	Traffic Alert and Collision Avoidance System
TSAD	Tower situational awareness display
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
VTC	Visual Terminal Chart

Annex B - Australian Airspace Structure

Class	Description	Summary of Services/Procedures/Rules
A	All airspace above Flight Level (FL) 180 (east coast) or FL 245 elsewhere	Instrument Flight Rules (IFR) only. All aircraft require a clearance from Air Traffic Control (ATC) and are separated by ATC. Continuous two-way radio and transponder required. No speed limitation.
B	IFR and Visual Flight Rules (VFR) flights are permitted. All flights are provided with ATS and are separated from each other. Not currently used in Australia.	
C	In control zones (CTRs) of defined dimensions and control area steps generally associated with controlled aerodromes	• All aircraft require a clearance from ATC to enter airspace. All aircraft require continuous two-way radio and transponder. • IFR separated from IFR, VFR and Special VFR (SVFR) by ATC with no speed limitation for IFR operations. • VFR receives traffic information on other VFR but are not separated from each other by ATC. SVFR are separated from SVFR when visibility (VIS) is less than Visual Meteorological Conditions (VMC). • VFR and SVFR speed limited to 250 knots (kt) Indicated Air Speed (IAS) below 10,000 feet (FT) Above Mean Sea Level (AMSL)*.
D	Towered locations such as Bankstown, Jandakot, Archerfield, Parafield and Alice Springs.	• All aircraft require a clearance from ATC to enter airspace. For VFR flights this may be in an abbreviated form. • As in Class C airspace all aircraft are separated on take-off and landing. All aircraft require continuous two-way radio and are speed limited to 200 kt IAS at or below 2,500 FT AMSL within 4 NM of the primary Class D aerodrome and 250 kt IAS in the remaining Class D airspace**. • IFR are separated from IFR, SVFR, and provided with traffic information on all VFR. • VFR receives traffic on all other aircraft but is not separated by ATC. • SVFR are separated from SVFR when VIS is less than VMC.
E	Controlled airspace not covered in classifications above	• All aircraft require continuous two-way radio and transponder. All aircraft are speed limited to 250 kt IAS below 10,000 FT AMSL*, • IFR require a clearance from ATC to enter airspace and are separated from IFR by ATC and provided with traffic information as far as practicable on VFR. • VFR do not require a clearance from ATC to enter airspace and are provided with a Flight Information Service (FIS). On request and ATC workload permitting, a Surveillance Information Service (SIS) is available • within surveillance coverage.
F	IFR and VFR flights are permitted. All IFR flights receive an air traffic advisory service and all flights receive a flight information service if requested. Not currently used in Australia.	
G	Non-controlled	• Clearance from ATC to enter airspace not required. All aircraft are speed limited to 250 kt IAS below 10,000 FT AMSL*. • IFR require continuous two-way radio and receive a FIS, including traffic information on other IFR. • VFR receive a FIS. On request and ATC workload permitting, a SIS is available within surveillance coverage. VHF radio required above 5,000 FT AMSL and at aerodromes where carriage and use of radio is required.

Annex C - Stakeholders

The following stakeholders were contacted to contribute to this review.

Organisation	Position
CASA	Aerodrome Inspector
CASA	Aviation Safety Advisor
Airservices Australia	Manager Towers North
Department of Transport WA	Principal Policy Officer - Aviation Infrastructure
Broome International Airport	General Manager
Karratha Airport	General Manager
Virgin Australia	Head of Operations - WA
Virgin Australia Regional Airlines	Chief pilot
Qantas Airways	Base Manager - WA
Skippers Aviation	Chief Pilot
Network Aviation	Head of Operations - WA
Royal Flying Doctor Service	Deputy Head of Operations
Cobham Aviation 717	Chief Pilot
King Leopold Air	Chief Pilot
Horizontal Falls	Chief Pilot
Aviair	Chief Pilot
CHC Helicopters	Operations Manager
HNZ Helicopters	Base Manager
Regional Airspace and Procedures Advisory Committees (RAPAC)	Members
Chamber of Minerals and Energy	Manager Economic Competitiveness
Department of Mines and Petroleum	Planning Manager Land Use Planning

Annex D - References

Airservices Australia; Karratha TAC, Effective 31 May 2018 Airservices Australia;

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Google Earth V 7.3.1.4507. 2018. Broome and Karratha http://www.earth.google.com;