Annex B

Civil Aviation Advisory Publications:

CAAP 166-1(0) – Operations in the vicinity of non-towered (non-controlled) aerodromes

And

CAAP 166-2(0) – Pilots' responsibility in collision avoidance in the vicinity of non-towered (non-controlled) aerodromes by 'see and avoid'

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Australian Government
Civil Aviation Safety Authority

Civil Aviation Advisory Publication

Effective 3 June 2010

Operations in the vicinity of non-towered (non-controlled) aerodromes

This publication is advisory and provides guidance on how to comply with the *Civil Aviation Regulations 1988 (CAR).*

Pilots are strongly advised that it is in their best interest to read this advisory publication that support the regulations.

Contents

The relevant regulations and other references

- Civil Aviation Regulation 1988 (CAR) 92 *Use of aerodromes*
- CAR 99A *Broadcasts to be made at certain aerodromes*
- CAR 120 *Weather reports not to be used if not made with authority*
- CAR 138 *Pilots to comply with requirements etc of aircraft's flight manual etc*
- CAR 161 *Right of way*
- CAR 162 *Rules for prevention of collision*
- CAR 163 *Operating near other aircraft*
- CAR 166 *Definitions for Subdivision 2*
- CAR 166A *General requirements for aircraft on the manoeuvring area or in the vicinity of a non-controlled aerodrome*
- CAR 166B *Carrying out a straight-in approach*
- CAR 166C *Responsibility for broadcasting on VHF radio*
- CAR 166D *Designation of non-controlled aerodromes*
- CAR 166E *Requirements for operating on or in the vicinity of certified, military, registered or designated non-controlled aerodromes*
- CAR 167 *General requirements for aerodrome traffic at controlled aerodromes*
- CAR 243 *Listening watch*
- Civil Aviation Order (CAO) 29.2 *Air service operations – night flying training*
- CAO 95.4 *Exemption from provisions of the Civil Aviation Regulations 1988 – gliders, powered sailplanes and power-assisted sailplanes*
- Civil Aviation Safety Regulation 1998 (CASR) 137.155 *Operations near RPT flight*
- CASR 137.160 *Aerodrome circuit requirements*
- CASR subpart 139.B *Certified aerodromes*
- CASR subpart 139.C *Registered aerodromes*
- Aeronautical Information Publication book (AIP) GEN 3.5, section 6 *Hazardous Weather*
- AIP GEN 2.2, section 1 *Definitions*
- AIP En Route (ENR) 1.1, paragraph 57.2 *Separation Minima*
- AIP ENR 1.2, paragraph 1.1 *The Visual Flight Rules (VFR)*
- AIP ENR 1.5, paragraph 1.7 Visual Circling or During Non-Precision Approach (NPA)

- International Civil Aviation Organization (ICAO) Annex 2 to the Convention on International Civil Aviation *Rules of the Air*, Chapter 1 *Definitions*
- Civil Aviation Safety Authority (CASA) Day VFR syllabi for aeroplanes, helicopters and balloons
- CASA Flight Radiotelephone Operator Licence (FROL) syllabus of training
- CASA Aircraft Radiotelephone Operator Certificate of Proficiency (AROCP) syllabus of training
- Minister's Australian Airspace Policy Statements 2007 and 2010
- Civil Aviation Advisory Publication (CAAP) 5.13-2(0) *Night Visual Flight Rules Rating*
- CAAP 166-2(0) *Pilots' responsibility for collision avoidance in the vicinity of non-towered (non-controlled) aerodromes using 'see and avoid'*

To whom this CAAP applies

This CAAP applies to all student, private, commercial, air transport, sport and recreational pilots who operate at, or in the vicinity of, non-towered aerodromes. This includes gliders, ultralights, balloons, and gyroplanes flown on pilot certificates issued by the Australian Ballooning Federation Inc. (ABF), Australian Sport Rotorcraft Association Inc. (ASRA), Hang Gliding Federation of Australia Inc. (HGFA), Gliding Federation of Australia Inc. (GFA), and Recreational Aviation Australia Inc. (RA-Aus).

Why this publication was written

CASA is committed to carrying out the Australian Government's National Airspace System (NAS) Reform objectives in accordance with the Australian Airspace Policy Statement 2010. NAS involves a number of characteristics to be implemented over several years.

The purpose of this CAAP is to support NAS Characteristic no. 29 *Common Traffic Advisory Frequency Procedures*. The CAAP provides guidance on a code of conduct (good airmanship) to allow greater flexibility for pilots when flying at, or in the vicinity of, non-towered aerodromes.

This CAAP also supports CAAP 166-2(0).

Status of this CAAP

This is the first CAAP written on this subject.

For further information

Email the CAR 166 Project Leader at nprm0908os@casa.gov.au.

1. Acronyms

AFRU	Aerodrome Frequency Response Unit
AIP	Aeronautical Information Publication
AIP ENR	AIP—En Route
AIP GEN	AIP—General
airprox	aircraft proximity
ATC	air traffic control
CA/GRS	Certified Air/Ground Radio Service
CAAP	Civil Aviation Advisory Publication
CAO	Civil Aviation Order
CAR	Civil Aviation Regulation 1988
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation 1998
CERT	Certified aerodrome *[ERSA]*
CTAF	Common Traffic Advisory Frequency
ERSA	En Route Supplement Australia
FROL	Flight Radiotelephone Operator Licence
GA	general aviation
ICAO	International Civil Aviation Organization
IFR	instrument flight rules
MIL	Military aerodrome *[ERSA]*
NAS	National Airspace System
NOTAM	Notice to Airmen
NPA	non-precision approach
NVFR	night visual flight rules
POH	Pilot's Operating Handbook (see also AFM)
REG	Registered aerodrome *[ERSA]*
RPT	regular public transport
SOP	Standard Operating Procedure
UNCR	Uncertified and unregistered aerodrome *[ERSA]*
UNICOM	Universal Communications
VFR	visual flight rules
VHF	very high frequency
VMC	visual meteorological conditions

2. Definitions

Active runway: Preferably the runway most closely aligned into the prevailing wind. In nil wind, or when predominantly all crosswind, it is the runway in use.

Aerodrome elevation *[AIP GEN 2.2]**:*** The elevation of the highest point of the landing area.

Aerodrome traffic *[ICAO Annex 2, Chapter 1 Definitions]**:*** All traffic on the manoeuvring area of an aerodrome and all traffic in the vicinity of an aerodrome.

Aerodrome traffic circuit *[AIP GEN 2.2]:* The specified path to be flown by aircraft flying in, entering, or leaving the traffic circuit.

Airmanship *[ICAO Annex 1, Section 1.1 Definitions]:* The consistent use of good judgement and well-developed knowledge, skills and attitudes to accompany flight objectives.

Airprox *[ICAO Document (DOC) 4444, Chapter 1—Definitions]:* A situation in which, in the opinion of a pilot or air traffic services personnel, the distance between aircraft as well as their relative positions and speed have been such that the safety of the aircraft involved may have been compromised.

Certified Air/Ground Radio Service (CA/GRS) *[AIP GEN 3.4]:* An aerodrome-based radio information service, which may operate at non-towered aerodromes. The service is a safety enhancement facility which provides pilots with operational information relevant to the particular aerodrome. The service is operated by or for the aerodrome operator to published hours, on the Common Traffic Advisory Frequency (CTAF) assigned to the particular aerodrome. It is not an Airservices Australia or Royal Australian Air Force-provided air traffic service.

Certified aerodrome*:* An aerodrome certified by CASA under CASR subpart 139.B. A certified aerodrome has a runway suitable for aircraft with more than 30 passenger seats or able to carry 3400 KG and is available for regular public transport (RPT) or charter operations by such aircraft. It has higher operating standards than a registered aerodrome. The carriage of radio is required at certified aerodromes. (See also *Registered aerodrome*.)

Class G airspace *[AIP ENR 1.4]:* Non-controlled airspace. Note: In Class G airspace, instrument flight rules (IFR) and VFR flights are permitted. IFR flights receive traffic information and flight information service. VFR flights receive a flight information service if requested.

Code of conduct: A set of conventional principles and expectations that are considered binding on any person who is a member of a particular group.

Designated aerodrome *[CAR 166D]:* In addition to requiring the carriage of radio at certified, registered and military aerodromes, CASA may issue an instrument that states that a specified non-controlled aerodrome is a designated aerodrome. When operating in the vicinity of a designated aerodrome the carriage of radio is required. CASA will identify and publish designated aerodromes in the AIP (En Route Supplement Australia (ERSA)) and/or NOTAMs.

In the vicinity *[CAR 166]:* An aircraft is in the vicinity of a non-towered aerodrome if it is within:

- airspace other than controlled airspace; and
- a horizontal distance of 10 NM from the aerodrome (reference point); and
- a height above the aerodrome (reference point) that could result in conflict with operations at the aerodrome.

Military aerodrome *[CAR 2(1)]:* An aerodrome under the control of any part of the Australian Defence Force. Note: Criteria for military aerodrome operations are published in ERSA. The carriage of radio is required at military aerodromes at all times.

Non-towered aerodrome: An aerodrome at which air traffic control is not operating. This can be either:

- an aerodrome that is always in Class G airspace;
- an aerodrome with a control tower where no air traffic control (ATC) service is currently provided; or
- an aerodrome which would normally have ATC services provided but such services are presently unavailable.

Notice to Airmen (NOTAM): A notice containing information concerning establishment, condition or change in facility, service, procedure or hazard which is essential to personnel concerned with flight operations.

Standard operating procedures (SOPs): Any procedures described in the operations manual of an Air Operator's Certificate (AOC) holder or a self-administering organisation.

Radio: Very high frequency (VHF) airband two-way radio.

Registered aerodrome: An aerodrome registered by CASA under CASR subpart 139.C. A registered aerodrome meets certain minimum operating standards and is regularly inspected. The carriage of radio is required at registered aerodromes. (See also *Certified aerodrome*.)

Universal Communications (UNICOM) *[AIP GEN 3.4]:* A non-air traffic services (ATS) communications service provided to enhance the value of information normally available about a non-towered aerodrome.

3. Introduction

3.1 CARs 166-166E detail the requirements for operating in the vicinity of a non-towered aerodrome. For aerodromes where the carriage of radio is required or where special procedures relating to the circuits at individual aerodromes apply, pilots should consult the current ERSA and check the latest NOTAMs before flight. CAR 243 details the requirements for pilots when an aircraft is fitted with a radio to maintain a listening watch at all times.

3.2 The use of 'standard' aerodrome traffic circuit procedures and radio broadcast procedures for all radio-equipped aircraft as described in the AIP is strongly recommended at all non-towered aerodromes.

3.3 At non-towered aerodromes where the carriage of radio is required, the standard radio calls described in paragraph 6.3 of this CAAP should be made. Non-towered aerodromes where the carriage of radio is required are all certified, registered and military aerodromes, as identified and published in ERSA, and any other aerodromes designated by CASA on a case by case basis, as published in ERSA or by NOTAM.

Note: As at 3 June 2010, CASA had not designated any additional aerodromes where the carriage of radio is required.

Sample extract from ERSA aerodrome chart for Parkes and Noosa

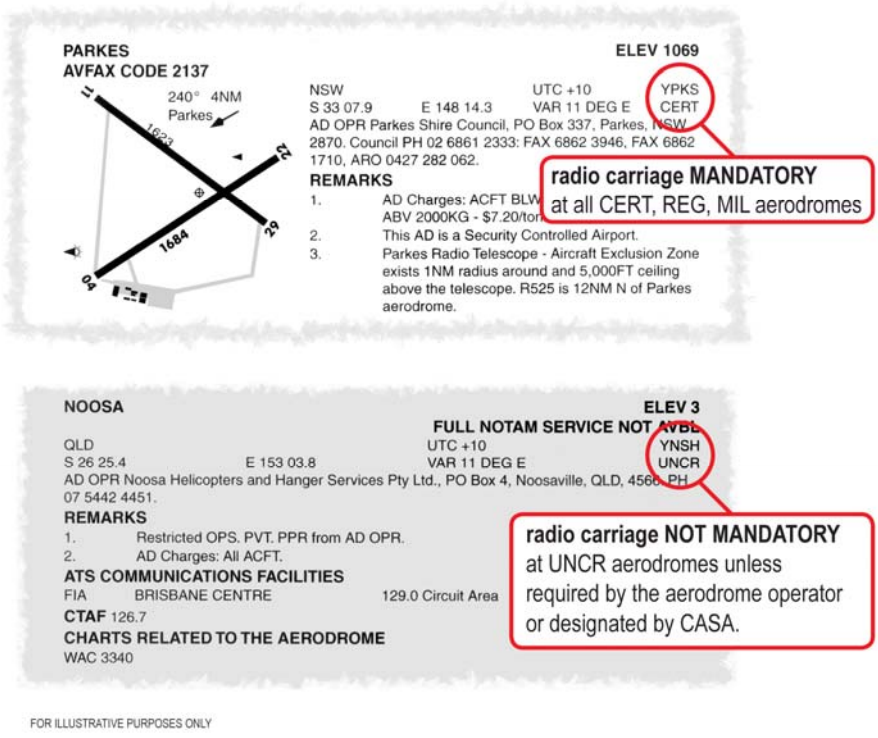


Figure 1 — How mandatory radio carriage is depicted in ERSA

3.4 This CAAP provides guidance on a code of conduct (good airmanship) which, when followed, will provide improved situational awareness and safety for all pilots when flying at, or in the vicinity of, non-towered aerodromes.

NOTE: Pilots are reminded that non-towered aerodromes include those aerodromes with Class C or D ATC services during the times when such services are unavailable. Pilots should always consult the ERSA and latest NOTAMs for operating times of ATC services at those aerodromes.

3.5 Operations at non-towered aerodromes can present many challenges to pilots who operate into, out of, or in the vicinity of these aerodromes. These can include:

- complying with standard operating procedures;
- fitting into the circuit traffic; and
- dealing with threats and hazards that may be encountered.

3.6 Non-towered aerodromes can have a mix of passenger-carrying aircraft, IFR/VFR, smaller general aviation aircraft, VFR agricultural aircraft, and various VFR sport and recreational aircraft at any one time.

3.7 Pilots are encouraged to turn on external lights, where fitted, when in the vicinty of a non-towered aerodrome, and until the aircraft has landed and is clear of all runways.

3.8 Transponders can be detected by aircraft equipped with Airborne Collision Avoidance System (ACAS) or Traffic Collision Avoidance System (TCAS), allowing them to ‘see’ other aircraft and take evasive action. Pilots of transponder-equipped aircraft should at all times ensure their transponder is switched to ON/ALT (Mode C), including when operating in the vicinity of a non-towered aerodrome. In the event of a radio failure, it is important that pilots select code 7600 and Mode C on their transponders and continue squawking.

3.9 So as not to impede commercial aviation, pilots flying recreational or sport aircraft for their own enjoyment, or pilots flying general aviation (GA) aircraft for their own leisure, should consider giving way to aircraft being used for ‘commerce’ provided that the inconvenience to their own operation is not great and it can be done safely. Operators of commercial aircraft should never expect a give way offer to be assumed or automatic. Any offer to give way must be explicit and its acceptance acknowledged.

4. Standard traffic circuit procedures

4.1 Traffic circuit direction

4.1.1 The standard aerodrome traffic circuit facilitates the orderly flow of traffic, and is normally a left circuit pattern with all turns to the left *[CAR 166A]*. When arriving at an aerodrome to land, the standard circuit will normally be joined on the upwind, crosswind or downwind legs, at or before mid-downwind. Landings and take-offs should be accomplished on an operational runway most closely aligned into the wind (the active runway).

4.1.2 If a secondary runway is being used, pilots using a secondary runway should avoid impeding the flow of traffic that is using the active runway.

4.1.3 Aerodromes that have right-hand circuit requirements are listed in ERSA.

Note: At many aerodromes at night, circuit directions are different to those applicable during the day. Generally, the differences are because of terrain or obstructions or noise abatement procedures.

4.2 Maximum speed

4.2.1 Aircraft should be flown in the circuit at an indicated airspeed (IAS) not above 200 KT.

4.3 Circuit heights (also refer to Figure 2 overleaf)

4.3.1 Aircraft by convention should fly the standard traffic circuit at the following heights above aerodrome elevation:

Type of aircraft	Standard circuit speed range	Standard circuit height
High performance (includes jets and many turboprops)	Above approximately 150 KT	1500 FT above aerodrome elevation
Medium performance (includes most piston engine aircraft)	Between approximately 55 and 150 KT	1000 FT above aerodrome elevation
Low performance	Approximately 55 KT maximum	500 FT above aerodrome elevation

Table 1 — 'Standard' circuit heights depend on aircraft performance

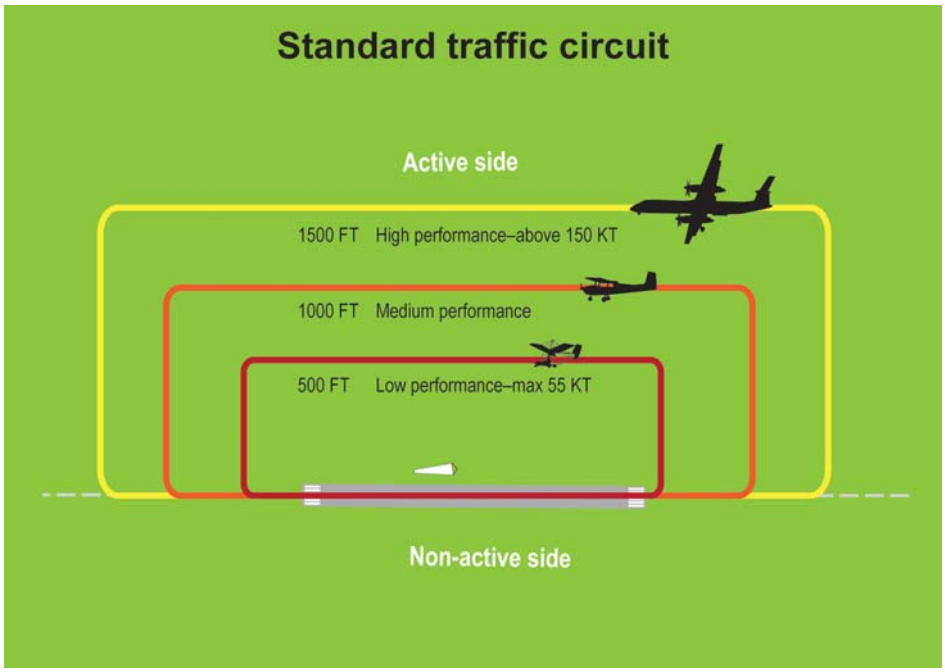


Figure 2 — 'Standard' aerodrome traffic circuit

4.3.2 During initial climbout, the turn onto crosswind should be made appropriate to the performance of the aircraft, but in any case not less than 500 FT above terrain *[CAR 166A(2)(f)]* so as to be at circuit height when turning onto downwind.

4.3.3 Pilots may vary the size of the circuit depending on:

- the performance of the aircraft;
- safety reasons; or
- in accordance with the AFM/Pilot Operating Handbook (POH) requirements or company SOPs.

4.4 Departing the circuit area

4.4.1 When departing from the aerodrome circuit area, aircraft should depart by extending one of the standard circuit legs. However, an aircraft should not execute a turn opposite to the circuit direction unless the aircraft is well outside the circuit area and no traffic conflict exists. This will normally be at least 3 NM from the departure end of the runway. The distance may be less for aircraft with high climb performance. The distance should be based on pilots being aware of traffic and the ability of the aircraft to climb above and clear of the circuit area.

Note: Pilots of departing aircraft should be aware of traffic intending to join the circuit by the recommended overfly procedure as they can be 2000 FT or higher above aerodrome elevation.

4.5 Final approach

4.5.1 The turn onto final approach should be completed by a distance and height that is common to the operations at the particular aerodrome and commensurate with the speed flown in the circuit for the aircraft type. In any case, the turn onto final should be completed by not less than 500 FT above aerodrome elevation. This should allow sufficient time for pilots to ensure the runway is clear for landing. It will also allow for the majority of aircraft to be stabilised for the approach and landing.

4.6 Arrival and departure procedures (refer Figure 3 overleaf)

4.6.1 It is expected that pilots departing and arriving at non-towered aerodromes where the carriage of radio is mandatory will monitor their radios and broadcast their intentions in accordance with the minimum calls set out in paragraph 6.3 below. Pilots should also make additional broadcasts when considered necessary to minimise any risk of collision *[CAR 166C(2)]*.

4.6.2 At aerodromes where the carriage of radio is not mandatory, good airmanship dictates that pilots of radio-equipped aircraft would also monitor their radios and broadcast their intentions in accordance with the minimum calls in paragraph 6.3. Pilots should also observe local and published noise abatement procedures and curfews.

4.6.3 Where a pilot is unfamiliar with the aerodrome layout, or when its serviceability, wind direction, wind speed, or circuit direction cannot be ascertained prior to arrival, the overfly procedure should be used. The pilot should overfly or circle the aerodrome at least 500 FT above the circuit altitude, usually 2000 FT or more above the aerodrome elevation. When the circuit direction has been determined, the pilot should position the aircraft to a point well clear (normally the non-active side of the circuit) before descending to the circuit altitude that equates to the aircraft's performance (see Figure 3). Pilots should not descend into the active side of the traffic circuit from directly above the aerodrome (see Appendix 1 of this CAAP).

4.6.4 For low performance ultralight aircraft and rotorcraft with a maximum speed of approximately 55 KT it is recommended that the aircraft overfly midfield at 500 FT above aerodrome elevation. This will minimise the risk of conflict with higher or faster traffic (see also paragraph 5.5 in this CAAP).

4.6.5 When arriving and intending to join the circuit from overhead, the aircraft should descend on the non-active side of the circuit and be established at its circuit altitude as it crosses the runway centreline on crosswind, between midfield and the departure end of the runway.

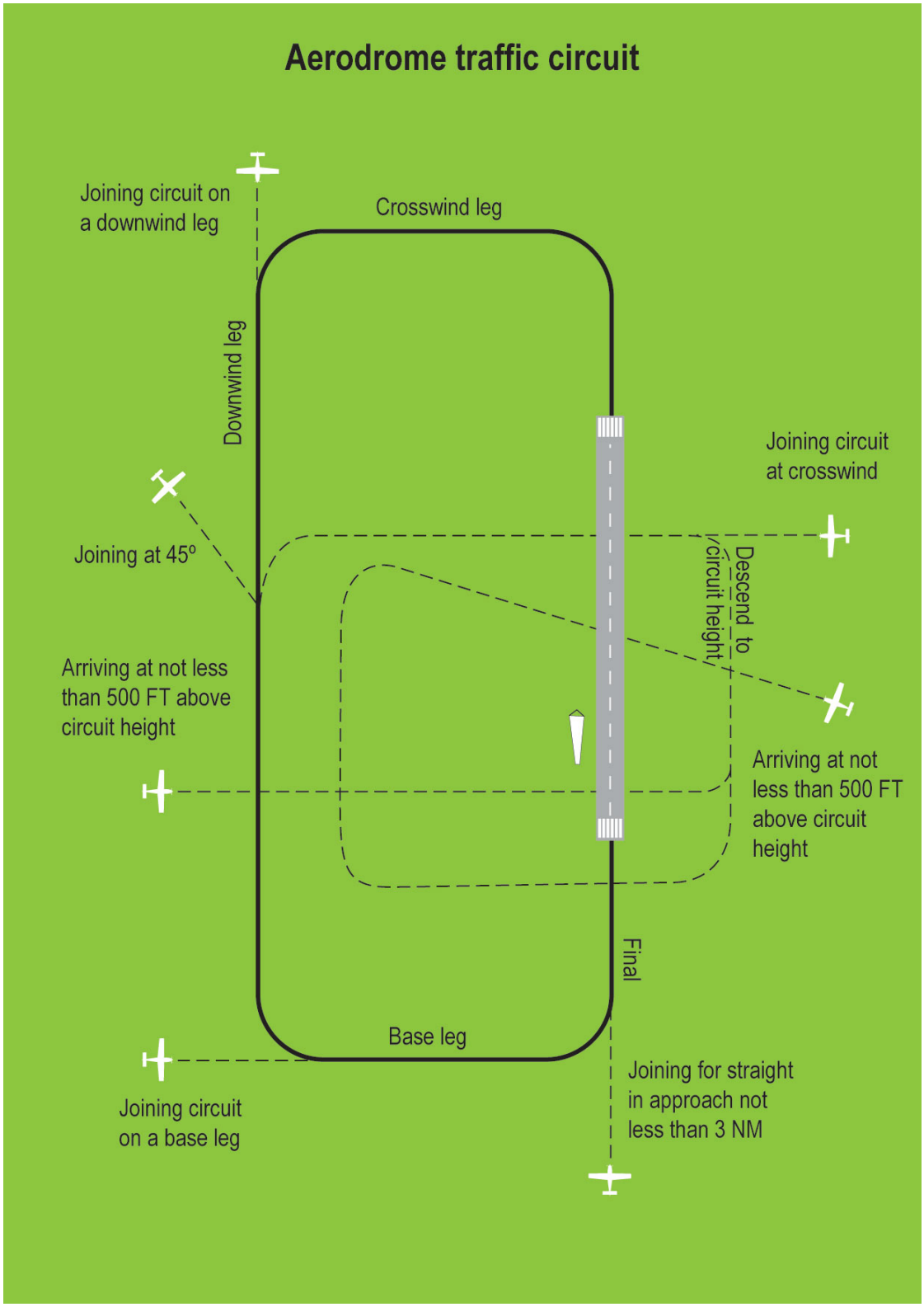


Figure 3 — Aerodrome traffic circuit showing arrivals and joining

4.6.6 When arriving on the live side, the recommended method is to arrive at the circuit altitude entering midfield at approximately 45 degrees to the downwind leg while giving way to the aircraft already established in the circuit.

4.6.7 On downwind, the applicable circuit altitude should be maintained until commencement of the base leg turn. The base leg position is normally when the aircraft is approximately 45 degrees from the reciprocal of the final approach path, measured from the runway threshold. Along the base leg, continue to lookout and maintain traffic separation.

4.6.8 When on the final leg, confirm that the runway is clear for the landing.

4.7 **Go arounds** (refer Figure 4 below)

4.7.1 A pilot who elects to abort a landing should manoeuvre to keep other traffic in sight. Maintain a safe distance from all aircraft and rejoin the circuit when it is safe to do so.

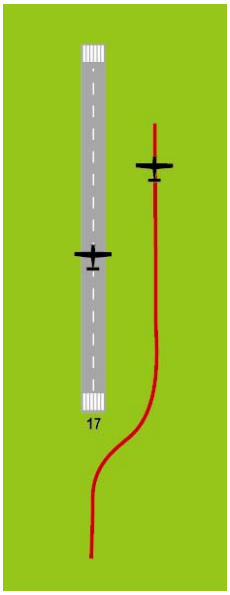


Figure 4 — Suggested go around manoeuvre

4.8 Straight-in approaches

4.8.1 Straight-in approaches, whilst not prohibited, are not a recommended standard procedure. CAR 166B does not preclude pilots from conducting straight-in approaches provided certain conditions are met. Pilots who choose to adopt a straight-in approach should only do so when it does not disrupt or conflict with the flow of circuit traffic. CAR 166B(2)(b) requires the pilot – when conducting a straight-in approach – to give way to any other aircraft established and flying in the circuit pattern at the aerodrome.

4.8.2 CAR 166B(2) requires pilots, before conducting a straight-in approach, to determine the wind direction and speed and the runway in use at the aerodrome.

4.8.3 There are several ways to determine the wind direction, speed and runway in use:

- Automatic Weather Station (AWS), Aerodrome Weather Information Service (AWIS), Automatic Aerodrome Information Service (AAIS), CA/GRS or UNICOM;
- radio contact with a ground-based radio communication service, company agent, approved observer *[CAR 120]*, or aircraft currently operating at the aerodrome; or
- visual indications if the information cannot be determined by the above means.

4.8.4 When conducting a straight-in approach, the aircraft must be established on final at not less than 3 NM from the landing runway's threshold *[CAR 166B(2)(c)]*.

4.8.5 Pilots should include their intention to conduct a straight-in approach with their inbound broadcast. A further broadcast of intentions when not less than 3 NM from the runway threshold should also be made.

4.8.6 In addition, pilots conducting a straight-in approach should observe the following:

- Pilots should not commence a straight-in approach to a runway when the reciprocal runway is being used by aircraft already established in the circuit;
- Within 3 NM minor corrections such as normal speed and track adjustments that are necessary to maintain a stable approach are all that should be required on final approach. Pilots conforming to the circuit pattern – particularly when on base – should optimise their visual scan for traffic along the final approach path;
- The aircraft's transponder should be squawking, and its external lights (where fitted) should be illuminated, when on final approach. They should remain on until the aircraft has landed and clear of all runways; and
- An aircraft established on the base or final leg for any runway has priority over an aircraft carrying out a straight-in approach.

4.9 Joining on base leg

4.9.1 Joining on base leg, whilst not prohibited, is not a recommended standard procedure, i.e. CASA recommends pilots join the circuit on either the crosswind or downwind leg. However, pilots who choose to join on base leg should only do so if they:

- have determined the wind direction and speed;
- have determined the runway in use;
- give way to other circuit traffic and ensure the aircraft can safely (no traffic conflict likely) join the base leg applicable to the circuit direction in use at the standard height (refer to paragraph 4.3.1 above); and
- broadcast their intentions.

Note: Base leg joins must be conducted in accordance with the circuit directions as published in the ERSA.

4.10 Transiting flights

4.10.1 When transiting in the vicinity of a non-towered aerodrome, pilots should monitor the designated CTAF.

4.10.2 Pilots should respond to other traffic broadcasts and advise their position and intention so as to avoid traffic conflict.

4.10.3 Pilots should avoid flying over the aerodrome at an altitude that could conflict with operations in the vicinity of the aerodrome.

Note: See also paragraph 7.6 of this CAAP.

4.11 Radio unserviceability

4.11.1 At non-towered aerodromes where the carriage of radio is required, CAR 166E allows for continuation of a ‘no radio’ arrival or departure in certain circumstances.

4.11.2 If a radio failure occurs either enroute to or in the circuit of the aerodrome, the pilot may continue to land at that aerodrome provided:

- where equipped—the aircraft’s landing and anti-collision lights, and its transponder, are turned on; and
- if enroute—the pilot uses the overfly joining procedure (see Appendix 1 of this CAAP).

4.11.3 A pilot may depart the aerodrome with an unserviceable aircraft radio and fly to another aerodrome for repairs, provided that the aircraft, where equipped, displays its landing and anti-collision lights, and has its transponder turned on.

4.11.4 A pilot should avoid planning to arrive at or depart from an aerodrome for radio repairs during the known hours of scheduled RPT operations. For aerodromes where there is a UNICOM or CA/GRS, pilots should by non-radio means where possible make contact and advise their intentions before conducting operations.

4.12 Non radio-qualified pilot or non radio-equipped aircraft

4.12.1 In exceptional circumstances, CAR 166E makes provision for a pilot who is not qualified to use an aircraft radio, or where the aircraft is not equipped with a radio, to operate in the vicinity of a non-towered certified, registered, military or designated aerodrome.

4.12.2 The aircraft must be operated:

- in visual meteorological conditions (VMC) by day; and
- to arrive or depart in the company of another aircraft that is radio-equipped and flown by a radio-qualified pilot which will allow the latter to make radio calls on behalf of both aircraft. The radio-equipped aircraft should be manoeuvred to keep the no-radio aircraft at a safe distance *[CAR 163]* and in sight at all times in order to accurately report its position.

4.13 Night circuits

4.13.1 For both IFR and night VFR (NVFR) flights, night circuits are generally more demanding than daytime circuit operations and require increased vigilance.

4.13.2 Night circuits for training shall not be conducted at a height less than 1000 FT above aerodrome elevation. Refer to CAO 29.2: *Air service operations – night flying training*.

4.13.3 NVFR pilots should refer to CAAP 5.13-2(0): *Night Visual Flight Rules Rating.*

4.13.4 IFR pilots should consult AIP ENR 1.5 for guidance when conducting a Non-Precision Approach (NPA) and visual circling manoeuvring.

5. The traffic mix

5.1 At non-towered aerodromes, there may be regular public transport and passenger charter, gliders, parachutists, helicopters, gyroplanes, ultralights, balloons, general aviation aircraft, and agricultural aircraft operations.

5.2 Regular public transport aircraft operations

5.2.1 At certain non-towered aerodromes, there can be regular public transport operations that may include large turboprop or jet aircraft. These aircraft have different operating parameters/criteria to those of many general aviation aircraft. They operate under the instrument flight rules and will be operating to their particular company standard operating procedures. It is often more difficult for pilots of large aircraft to see smaller aircraft because of their high nose attitude at slower speeds. This is especially an issue when they are making an approach. It is essential that even though the smaller aircraft pilot may have seen the large aircraft, they should continue to make broadcasts and respond to broadcasts and not just assume that the larger aircraft is aware of their position.

5.2.2 General aviation pilots should be aware that, in certain circumstances, passenger transport aircraft may not be able to use the active runway. Passenger transport aircraft are required to operate under more stringent regulations, in particular aircraft performance regulations. For example, where an aircraft departs downwind and the take-off distance is increased, it could be because of a performance limitation or increased safety margin whereby terrain clearance is taken into consideration during the initial climb out after take-off. Similarly, landing into wind may not always be possible when various performance limitations are taken into account.

5.3 Glider operations

5.3.1 Glider operations can be conducted from normal runways associated with an aerodrome or from prepared sites within the confines of an aerodrome. Gliders can be launched using a variety of methods including aero tow, vehicle tow or winch launch. In all cases, vehicles and people might be operating on or in the vicinity of the runways in use.

5.3.2 Winch operations can occur at all aerodromes and pilots should check and review ERSA and the latest NOTAMs for specific information.

5.3.3 Where gliders are operating from the active runway, they may not be able to give way to other aircraft when landing. CAO 95.4 details the flight conditions, exemptions and limitations imposed on gliding operations.

5.3.4 A double white cross displayed adjacent to the wind direction indicator at aerodromes indicates gliding operations are in progress. Aeronautical charts also use the double cross to indicate glider operations. Pilots should consult the latest NOTAMs for any additional information.

5.4 Parachuting operations

5.4.1 In Australia, in certain circumstances, parachuting operations are permitted through cloud and so can take place on overcast days [CAAP 152-1(0) – *Parachuting Through Cloud*].

5.4.2 Pilots flying parachuting aircraft will broadcast on all of the associated frequencies. For example, if the jump commences in Class G airspace and will land at a non-towered aerodrome, advisory calls will be made on both the Class G airspace frequency and the frequency in use for the aerodrome.

5.4.3 Where parachute operations occur, parachute symbols are sometimes depicted on aeronautical charts. ERSA also details the aerodromes where parachute operations are conducted. Pilots should consult the latest NOTAMs for any additional information.

5.4.4 Parachutists in free fall are almost impossible to see, so avoid overflying an aerodrome with an active drop zone. Communication with the parachuting aircraft is essential to avoid flying into a drop zone area.

5.5 Helicopters and gyroplanes operations

5.5.1 Helicopters can arrive and depart aerodromes from various directions. Pilots of helicopters can choose to operate in the circuit and fly a circuit similar to a fixed wing aircraft but may be at a height not below 500 FT above the aerodrome elevation and closer to the runway. Check ERSA for any noise abatement procedures.

5.5.2 Helicopters can also operate contra-direction circuits on the opposite side of the runway at 500 FT above aerodrome elevation. Check ERSA for circuit direction requirements. Pilots of helicopters approaching to land at a marked helipad or suitable clear area should avoid the flow of fixed wing aircraft.

5.5.3 Other pilots should be aware that, for some helicopter operations, the only suitable landing area is the runway.

5.5.4 Helicopters and gyroplanes can fly slower than fixed wing aircraft and approach at steeper angles. Both helicopters and gyroplanes can be expected to practise power-off landings (autorotations) which involve a very steep approach and high rates of descent.

5.5.5 As helicopter and gyroplane operations can be varied and flexible, pilots need to ensure they monitor and advise other aircraft of their position and intentions by radio where applicable.

5.6 Ultralight operations

5.6.1 The term 'ultralight' applies to many small recreational aircraft that include trikes, powered parachutes, and other small fixed wing aircraft that cruise at maximum speeds of up to about 55 KT. Pilots of these aircraft should conduct their standard circuit at 500 FT above aerodrome elevation.

5.6.2 Entry to the circuit should be at 500 FT above aerodrome elevation as it is normally impractical to overfly the field above all other circuit traffic. Joining the circuit at 500 FT above aerodrome elevation will provide separation from higher and faster traffic.

5.6.3 Ultralight aircraft pilots who choose to use the overfly join procedure above the circuit altitude should be aware that:

- faster larger aircraft may not be able to see you easily;
- faster larger aircraft create significant wake turbulence;
- faster larger aircraft will not be able to slow to the speeds of an ultralight aircraft and follow; and
- faster larger aircraft—prior to arriving in the circuit and when below 10,000 FT —can be at speeds up to 250 KT. Therefore, although aircraft should be at 200 KT maximum in the circuit, an aircraft reporting at 20 NM from the aerodrome could be in the vicinity of the circuit within 5 minutes.

5.6.4 Ultralight pilots should consult AIP, ERSA, relevant charts, and the latest NOTAMs for the most up-to-date information and procedures.

Note 1: Helicopters may also be operating in the circuit at 500 FT above aerodrome elevation.

Note 2: The 95 series of CAOs lists flight conditions, limitations and exemptions for ultralights, gyroplanes, and hang gliders.

5.7 Fixed wing and rotary wing aerial application (agricultural) aircraft operations

5.7.1 Pilots should be aware there are non-towered aerodromes from where 'aerial application' operations are conducted.

5.7.2 Aerial application (agricultural) aircraft are permitted to conduct aerial application operations which involve low level maneouvering after take-off and prior to landing. These low level maneouvres are not required to conform to the standard traffic circuit. However, pilots of other aircraft can expect aerial application (agricultural) aircraft to:

- maintain a listening watch and broadcast their intentions on the CTAF; and
- give priority to other traffic.

5.7.3 The requirements for these operations, and also their separation from RPT flights, are specified in CASR 137.155 and CASR 137.160.

6. Radio broadcasts

6.1 CAR 166C requires a pilot to make a broadcast whenever it is reasonably necessary to do so to avoid a collision, or the risk of a collision, with another aircraft. A broadcast must include:

- the name of the aerodrome;
- the aircraft's type and call sign; and
- the position of the aircraft and the pilot's intentions.

6.2 Effective radio communication involves using standard aviation phraseology as detailed in the Flight Radiotelephone Operator Licence (FROL) syllabus and in AIP. Pilots are expected to maintain a listening watch and respond appropriately to applicable transmissions.

6.3 When operating in the vicinity of a non-towered aerodrome, it is expected that all pilots would make the following minimum positional broadcasts from aircraft that carry a VHF airband radio:

Item	Circumstance (non-towered aerodromes)	Pilot's radio broadcasts
1	The pilot intends to take-off.	Immediately before, or during, taxiing.
2	The pilot intends to enter a runway.	Immediately before entering a runway.
3	The pilot is inbound.	10 NM or earlier from the aerodrome, commensurate with aircraft performance and pilot workload, with an estimated time of arrival (ETA) for the aerodrome
4	The pilot is ready to join the circuit.	Immediately before joining the circuit.
5	• The pilot intends to carry out a straight-in approach; or • Join on base leg.	On final approach at not less than 3 NM from the threshold. Prior to joining on base
6	The pilot intends to fly through the vicinity of, but not land at, a non-towered aerodrome.	When the aircraft enters the vicinity of the aerodrome (as defined).

Table 2 — Circumstances/Broadcasts in the vicinity of non-towered aerodromes

Note 1: Some distances above refer to the runway threshold and others to the aerodrome reference point (ARP). Pilots should be aware that a global positioning system (GPS) indication of 3 NM from an aerodrome may not be 3 NM to the runway threshold.

6.4 In addition:

- Listening to other pilot broadcasts increases situational awareness and assists the sighting and avoidance of other aircraft;

- Where it is determined there is a potential for traffic conflict, radio broadcasts should be made as necessary to avoid the risk of a collision or an airprox event. A pilot should not be hesitant to call and clarify the other aircraft's position and intentions if there is any uncertainty; and
- It is essential to maintain a diligent lookout because other traffic may not be able to communicate on the radio for various reasons — they might be tuned to the wrong frequency, selected the wrong radio, have a microphone failure, or have the volume turned down.

6.5 The standard broadcast format for low and medium performance aircraft is as per the following example:

- (Location) Traffic *Parkes Traffic*
- (Aircraft Type) *Cessna 172*
- (Call sign) *Zulu Foxtrot Romeo*
- (Position/Intentions) *One-zero miles north inbound, on descent through four-thousand-two-hundred, estimating the circuit at three-six*
- (Location) *Parkes.*

6.5.1 Pilots should be aware that a variety of radio callsigns are in use. For example:

- Passenger transport: '*Q-link 2719*'
- Recreational: '*Jabiru 5234*'
- Military: '*Stallion 22*'
- Law enforcement: '*Polair 5*'
- Foreign-registered: '*November 1 5 Yankey*'
- VH-ZFR: '*Zulu Foxtrot Romeo*'

6.5.2 Calls should be made as clearly and concisely as possible using the standard phraseology. Speak at a normal pace, as rapid speech can make transmissions difficult to understand by other pilots.

6.5.3 Be careful not to 'clip' your transmission when stating your location as confusion can arise at aerodromes that are close together sharing the same CTAF.

6.5.4 Ideally pilots should make circuit broadcasts prior to making a turn because banking aircraft are easier to see.

6.5.5 A simple strategy to remember when flying in the circuit is 'Look', 'Talk' and 'Turn'.

6.5.6 Broadcast calls should be made briefly and clearly. Think about what to say before transmitting. Positional and other broadcasts necessary to minimise traffic conflict should be made using standard phraseology—for example: joining circuit, base, and vacating the runway. Effective communication and increased traffic awareness will help prevent a collision or an airprox event.

6.5.7 Avoid the use of local terminolgy in position reports, e.g. use ‘Bundaberg’ instead of ‘Bundy’.

6.5.8 When an Aerodrome Frequency Response Unit (AFRU) is in operation, be careful not to momentarily break your transmission as the AFRU will automatically over-transmit your subsequent broadcast.

7. Hazards

7.1 Aircraft size and performance

7.1.1 General aviation pilots should be aware that aerodromes with runways of 1400 M or more in length may have operations using jet or large turboprop aircraft. For aerodromes that have high performance traffic in the circuit, the minimum overfly height should be no lower than 2000 FT above aerodrome elevation. Runway lengths are published in ERSA.

7.1.2 RPT and other professional pilots should be aware that at many of the aerodromes they operate into, other general aviation aircraft, gliders and ultralights may also be operating.

7.2 Downwind take-offs and landings

7.2.1 Take-off or landing downwind is not recommended as a standard procedure. Pilots wherever possible should use the runway most closely aligned into wind (the active runway).

7.2.2 Pilots must operate within the limitations prescribed in the Aircraft Flight Manual *[CAR 138]*.

7.2.3 Pilots should consider the following hazards if planning to take off or land downwind *[CAR 92]*:

- **Wind strength**—just above ground level may be significantly stronger than as indicated by the windsock;
- **For a take-off** with wind gradient or windshear—higher groundspeed at lift off; a longer take-off distance required; a shallower angle of climb; degraded obstacale clearance; and in the event of an emergency, landing straight ahead touchdown will be at a higher groundspeed; and
- **For landing** with wind gradient or windshear—higher groundspeed at touchdown; a longer landing distance required.

7.3 Take-off and landing separation

7.3.1 When waiting to take off behind another aircraft, pilots should be aware of the separation standards published in AIP, i.e.:

- Wait until the departing aircraft has crossed the upwind end of the runway or has commenced a turn;
- If the runway is longer than 1800 M, then wait until the departing aircraft has become airborne and is at least 1800 M ahead; or
- If both aircraft have a maximum take-off weight (MTOW) less than 2000 KG, wait until the departing aircraft has become airborne and is at least 600 M ahead.

7.3.2 For a landing aircraft, the approach should not be continued beyond the runway threshold until:

- a preceding departing aircraft has commenced a turn or is beyond the point on the runway at which the landing aircraft could be expected to complete its landing roll and there is sufficient distance to manoeuvre safely in the event of a missed approach; or
- a previous landing aircraft has vacated the runway.

7.3.3 Pilots should be vigilant when using another runway that is **not** the active runway and ensure that they do not create a hazard to aircraft that are using the active runway. Conversely, pilots using the active runway should ensure that aircraft operating on the non-active runway have held short or crossed the active runway before commencing a take-off or continuing to land.

7.4 Wake turbulence and windshear

7.4.1 Wake turbulence is produced by all aircraft and, if encountered, can be extremely hazardous. Smaller aircraft should be aware that large aircraft produce strong/severe wake turbulence, with large jet aircraft producing extreme wake turbulence.

7.4.2 In calm conditions, wake turbulence may not dissipate for several minutes. Aircraft should position within the traffic circuit with sufficient spacing to avoid encountering wake turbulence.

7.4.3 On take-off, smaller aircraft will normally require increased separation time before departing behind a larger aircraft.

7.4.4 Helicopters of all sizes, in forward flight, produce vortices similar to those produced by fixed wing aircraft. A hovering or slow air-taxing helicopter creates a rotor downwash which can be a hazard to all aircraft in its vicinity. Pilots of small aircraft should avoid operating close to helicopters. Helicopter pilots should operate at a safe distance from parked or taxying aircraft.

7.4.5 Windshear can occur anywhere in the circuit but is most dangerous when close to terrain. For example, dust devils ('willy willies') are visible windshear and can be common at outback aerodromes. Pilots encountering a windshear event should immediately consider a maximum performance climb to fly out of the situation.

7.5 Collision avoidance (maintaining separation in the circuit)

7.5.1 The most hazardous area is within 5 NM of an aerodrome and up to 3000 FT above aerodrome elevation. It is important for all pilots to maintain a good situational awareness. Inbound pilots should have the cockpit and their mind clear of distractions. Passengers should be briefed not to distract the pilot. However, if a passenger becomes aware of imminent danger, then he/she should inform the pilot.

7.5.2 Pilots should be familiar with the aerodrome layout and have radio frequencies set so their attention can be directed outside the aircraft. Pilots should be alert, looking for other traffic, maintaining a listening watch and responding appropriately to applicable transmissions. Pilots should broadcast their intentions by making the standard positional broadcasts and other broadcasts as necessary in the interest of safety.

7.5.3 Most collisions occur on downwind or on final approach. There are many distractions that include configuring the aircraft, completing checklists, setting equipment and communicating, however, this is precisely the time to be looking outside. Early completion of checklists will help to avoid distractions. Good height and speed control to maintain separation (including use of flaps) is essential. If a pilot determines that adequate separation cannot be maintained during any part of the approach, a go around should be initiated sooner rather than later.

7.5.4 CAR 161 and CAR 162 detail the rules and procedures for right of way and prevention of collisions. Pilots should have a sound understanding of these rules when giving way, approaching head on, and overtaking in the circuit. The CARs are published on the ComLaw website at the following internet address:

http://www.comlaw.gov.au/comlaw/management.nsf/lookupindexpagesbyid/IP200400553?OpenDocument

7.6 Collision avoidance (maintaing separation in the 'vicinity'of a non-towered aerodrome)

7.6.1 Increased collision risks exist for both IFR and VFR traffic when instrument approaches are conducted at a non-towered aerodrome where there is cloud, or visibility is reduced due to haze or smoke but VFR conditions exist below the low visibility layer.

When these situations exist, it is possible for a pilot flying an instrument approach in cloud to become visual and suddenly encounter a VFR aircraft in the circuit. Diligent radio broadcasts and continuous visual scanning are essential in avoiding an airprox situation.

7.6.2 It would be expected that VFR pilots, on hearing an IFR pilot broadcast his/her intention to make an instrument approach, would establish contact to provide situational awareness to the IFR pilot. Information which would be useful to the IFR pilot includes aircraft type, position in the circuit or vicinity, with intentions.

7.6.3 Pilots operating under the VFR must remain clear of cloud and have in-flight visibility in accordance with VMC criteria *[AIP ENR 1.2]*.

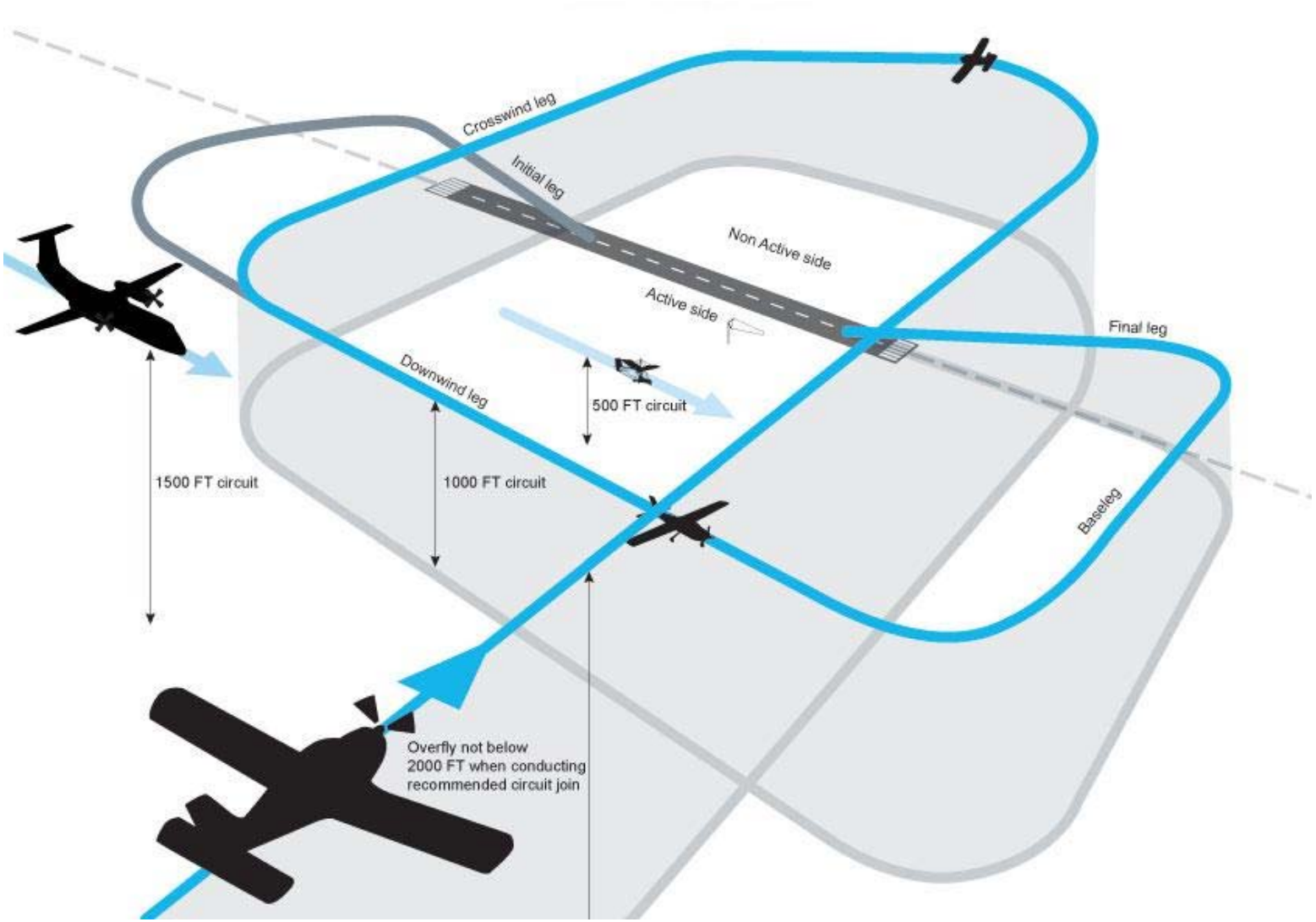
7.7 Practice instrument approaches

7.7.1 Pilots who wish to conduct practice instrument approaches in VMC should be particularly alert for other aircraft in the circuit so as to avoid impeding the flow of traffic. **IFR pilots should give position reports in plain English to be easily understood by VFR pilots who generally have no knowledge of IFR approach points or procedures**, e.g. positions should include altitudes and distance and direction from the aerodrome. Providing position reports to VFR pilots that contain outbound/inbound legs of the approach or area navigation (RNAV) fixes will generally be of little assistance to establish traffic separation.

Note 1: At all times, in a training situation, one of the pilots in the aircraft should have an unrestricted view outside. Therefore instrument simulation should only be by a 'hood' or 'foggles', i.e. not by covering any part of the windscreen.

Note 2: For an aeroplane with a single pilot conducting practice instrument approaches, it would be unacceptable to conduct an approach without a safety pilot if the pilot intended to solely refer to the aircraft instruments i.e. under a 'hood' or with 'foggles'.

APPENDIX 1 – Recommended Circuit Join



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Australian Government
Civil Aviation Safety Authority

Civil Aviation Advisory Publication

Effective 3 June 2010

Pilots' responsibility for collision avoidance in the vicinity of non-towered (non-controlled) aerodromes using 'see-and-avoid'

This publication is advisory and provides guidance on how to comply with the *Civil Aviation Regulations 1988 (CAR)*.

Pilots are strongly advised that it is in their best interest to read this advisory publication that support the regulations.

Contents

The relevant regulations and other references

- CAR 161 *Right of way*
- CAR 162 *Rules for prevention of collision*
- CAR 163 *Operating near other aircraft*
- CAR 166 *Definitions for Subdivision 2*
- CAR 166A *General requirements for aircraft on the manoeuvring area or in the vicinity of a non-controlled aerodrome*
- CAR 166B *Carrying out a straight-in approach*
- CAR 166C *Responsibility for broadcasting on VHF radio*
- CAR 166D *Designation of non-controlled aerodromes*
- CAR 166E *Requirements for operating on or in the vicinity of certified, military, registered or designated non-controlled aerodromes*
- CAR 167 *General requirements for aerodrome traffic at controlled aerodromes*
- CAR 243 *Listening watch*
- Civil Aviation Advisory Publication (CAAP) 5.59-1(0) *Teaching and Assessing Single-Pilot Human Factors and Threat and Error Management* (http://casa.gov.au)
- Australian Transport Safety Bureau (ATSB) Aviation Research Report published 1 April 1991 *Limitations of the See-and-Avoid Principle* (http://atsb.gov.au)
- Federal Aviation Administration (FAA) Advisory Circular (AC) 90-48C *Pilots' Role in Collision Avoidance* (http://rgl.faa.gov)
- FAA Advisory Circular (AC) 90-66A *Recommended Standards Traffic Patterns for Aeronautical Operations at Airports without Operating Control Towers* (http://rgl.faa.gov)

To whom this CAAP applies

This CAAP applies to all student, private, commercial, air transport, sport and recreational pilots who operate at, or in the vicinity of, non-towered aerodromes. This includes gliders, ultralights, balloons, and gyroplanes flown on pilot certificates issued by the Australian Ballooning Federation Inc. (ABF), Australian Sport Rotorcraft Association Inc. (ASRA), Hang Gliding Federation of Australia Inc. (HGFA), Gliding Federation of Australia Inc. (GFA), and Recreational Aviation Australia Inc. (RA-Aus).

Why this publication was written

This publication was written to provide advice on the limitations of 'see-and-avoid', and on the use of radio to provide 'alerted see-and-avoid', in order to enhance and maintain separation in a busy air traffic environment. It provides practical advice to pilots on their role in collision avoidance through the see-and-avoid principle to prevent mid-air collisions or airprox events, particularly in the vicinity of non-towered aerodromes.

This publication will support CAAP 166-1(0) *Operations in the vicinity of non-towered aerodromes* when it becomes effective on 3 June 2010.

Status of this CAAP

This is the first CAAP to be written about the see-and-avoid principle as a single subject.

Flying instructors should also refer to CAAP 5.59-1(0) *Teaching and Assessing Single-Pilot Human Factors and Threat and Error Management* from which much of the material for this CAAP was drawn.

For further information

Email the CAR 166 Project Leader at nprm0908os@casa.gov.au.

1. Acronyms

AC	Advisory Circular
ACAS	Airborne Collision Avoidance System
airprox	aircraft proximity
ATC	air traffic control
ATSB	Australian Transport Safety Bureau
CAAP	Civil Aviation Advisory Publication
CAR	Civil Aviation Regulations 1988
CASA	Civil Aviation Safety Authority
FAA	Federal Aviation Administration (of the United States of America)
GA	general aviation
ICAO	International Civil Aviation Organization
QNH	Q code for Nil Height (altimeter subscale setting to obtain elevation or altitude)
TCAS	Traffic Collision Avoidance System (see ACAS)
VHF	very high frequency

2. Definitions

Airmanship *[ICAO Annex 1 to the Convention on International Civil Aviation, Section 1.1 Definitions]**:*** The consistent use of good judgement and well-developed knowledge, skills and attitudes to accompany flight objectives.

Airprox *[ICAO Document (DOC) 4444, Chapter 1 Definitions]**:*** A situation in which, in the opinion of a pilot or air traffic services personnel, the distance between aircraft as well as their relative positions and speed have been such that the safety of the aircraft involved may have been compromised.

Error *[CAAP 5.59-1(0)]:* Flight crew actions or inactions that:

- lead to a deviation from crew or organisational intentions or expectations;
- reduce safety margins; and
- increase the probability of adverse operational events on the ground and during flight.

Manage(ment) *[CAAP 5.59-1(0)]* To plan, direct and control an operation or situation.

Non-towered aerodrome: An aerodrome at which air traffic control is not operating. This can be either:

- an aerodrome that is always in Class G airspace;
- an aerodrome with a control tower where no air traffic control (ATC) service is currently provided; or
- an aerodrome which would normally have ATC services provided but such services are presently unavailable.

Safe(ly) *[CAAP 5.59-1(0)]* A manoeuvre or flight is completed without injury to persons, damage to aircraft or breach of aviation safety regulations while meeting the standards specified by the Civil Aviation Safety Authority (CASA).

Threat *[CAAP 5.59-1(0)] (University of Texas/GAPAN definition for multi-crew/LOSA operations)**:***

Events or errors that:

- occur outside the influence of the flight crew;
- increase the operational complexity of the flight; and
- require crew attention and management if safety margins are to be maintained.

Threat *[CAAP 5.59-1(0)] (CASA modified definition for single pilot operations)**:***

A situation or event that has the potential to impact negatively on the safety of a flight, or any influence that promotes opportunity for pilot error(s).

Threat and Error Management (TEM) *[CAAP 5.59-1(0)]:* The process of detecting and responding to threats and errors to ensure that the ensuing outcome is inconsequential, i.e. the outcome is not an error, further error or undesired state.

3. Introduction

3.1 'See-and-avoid', as a means of separation and collision prevention for two or more vehicles, is an ancient principle and one that in the maritime environment predates aviation by many centuries.

3.2 In the early history of aviation, see-and-avoid was the only means for avoiding collision, but as aviation advanced, its limitations have become apparent. Since the early days of flight, additional measures have been sought to reduce the risks of mid-air collision. In parallel with aviation, the maritime industry has adopted, where circumstances have warranted, many of the same means to avoid collisions on the water.

3.3 In modern aviation, see-and-avoid is the last line of defence, but usually not the only mechanism for avoiding a collision or an airprox event.

4. Unalerted see-and-avoid

4.1 Unalerted see-and-avoid is a flight that relies totally on the crew with no other assistance for separation. Unalerted see-and-avoid is only viable in a minority of circumstances when all of the following factors are present to defend against a mid-air collision or airprox event:

- potential horizontal closure rates are slow enough for human reaction;
- potential vertical closure rates are slow enough for human reaction;
- aircraft are of sufficient profile to be seen with the available ambient light, or are made sufficiently conspicuous using artificial lighting;
- aircraft and/or the ground are sufficiently well lit or ambient light provides sufficient contrast; and
- the aircraft structure is such that the pilot's visibility is unhindered in all directions (a near practical impossibility).

4.2 If traffic densities are high enough, humans inevitably fail in their ability to identify and process all the traffic, and thus the risk of collision becomes unacceptably high.

4.3 Improved visual acquisition by pilots alerted to traffic presence (by radio or other means) raises the level of traffic density that can be safely tolerated.

4.4 However, in spite of all its limitations, unalerted see-and-avoid is still a defence against mid-air collisions, and for aircraft without a radio it is the only defence. Good airmanship dictates that all pilots should be looking out and not be solely reliant on radio for traffic separation.

4.5 Unalerted see-and-avoid is an important mechanism for distinguishing aircraft that have a high surface area, particularly if they move slowly. Balloons, airships, powered parachutes and paragliders can generally be seen in most circumstances by pilots of other aircraft of similar speeds. However, pilots of faster aircraft may find (generally with the exception of balloons) these aircraft can be quite difficult to see.

4.6 Gliders and aircraft conducting aerobatics can sometimes be observed more easily because of their constantly changing profile direction, attitude and altitude. These aircraft generally do not remain on a fixed course for a long time, providing the human eye the opportunity to more easily obtain a fix than is the case where speed and direction remain constant.

However, glider and aerobatic pilots should be aware that pilots of other aircraft may find their aircraft difficult to spot. This is especially the case if they are unaware of the glider or aerobatic activity.

5. Alerted see-and-avoid

5.1 As aviation developed, increasing performance, traffic density and flight in non-visual conditions caused limitations of see-and-avoid to surface. The need to enhance a pilot's situational awareness has led to the principle of 'alerted see-and-avoid'.

5.2 The primary tool of alerted see-and-avoid that is common across aviation—from sport and recreational to air transport—is radio communication. Radio allows for the communication of information (in this instance traffic information) to the pilot from the ground (e.g. air traffic control) or from other aircraft.

5.3 For this reason, very high frequency (VHF) radio carriage will become mandatory at and in the vicinity of all registered, certified and military aerodromes (and additional aerodromes as designated by CASA according to risk) from 3 June 2010. These aerodromes will be identified/published in the En Route Supplement Australia (ERSA) and/or by Notice to Airmen (NOTAM).

5.4 Other tools of alerted see-and-avoid include:

- ACAS—Airborne Collision Avoidance System;

  Note: ACAS (and Traffic Collision Avoidance System (TCAS)) relies on transponder information from other aircraft for its pilot alerting and collision avoidance function.

- PCAS—Portable Collision Avoidance System;
- ADS-B—Automatic Dependent Surveillance Broadcast;
- FLARM—flight alarm, a low-cost collision avoidance system originally designed for gliders; and
- Ground-based radar (with traffic information being relayed back to pilots via radio).

5.5 Due to their design, packaging, power requirements or cost, not all the tools listed above are suitable in all circumstances. All, however, provide significant safety gains in the aviation environments for which they are designed.

6. Effective lookout

6.1 Lookout is the principle method of implementing see-and-avoid. Effective lookout means seeing what is 'out there' and assessing the information that is received before making an appropriate decision.

6.2 Vision is the primary source of information for a pilot. Whether it is aircraft attitude, position, physical hazards or other traffic, what a pilot sees is processed by the brain and used to build up situational awareness. In this context, lookout must not be thought of as just scanning the skies to locate other traffic; it also involves the internal and external environment of the aircraft. Vision is used inside an aircraft to interpret flight instruments, flight controls and aircraft systems, and externally to observe and interpret weather, terrain, aircraft attitude and position.

6.3 The multitude of factors that can adversely affect vision and lookout includes the amount of ambient light, window posts, the cleanliness and crazing of windscreens, and other physiological and psychological concerns. Failure to address these issues could result in limitations to effective lookout.

6.4 Workload mismanagement can lead to excessive 'head in the cockpit' with less time spent looking outside the aircraft during busy periods. Pilots need to move their head to see beyond window posts and any other obstructions such as pilots or passengers in the adjacent seat/s.

7. Seeing and interpreting

7.1 Not only is seeing important, but accurately interpreting what is seen is equally vital. The concept of see-and-avoid is far from reliable *[ATSB]*. By employing an effective scanning technique and understanding how to enhance visual detection of other traffic, a pilot is more likely to reduce the likelihood of collision. Size and contrast are the two primary factors that determine the likelihood of detecting other aircraft, size being the more important factor. As general aviation (GA), sport and recreational aeroplanes and rotorcraft are usually small or have low visual profiles in certain circumstances, the problem of detecting those aircraft is exacerbated.

7.2 AC 90-48C published by the FAA details a scanning technique that involves eye movements in sectors of 10 degrees, of one-second duration per sector. However, scanning a 180 degree horizontal and 30 degree vertical sector would take a minimum of 54 seconds. US military research found that it takes a pilot 12.5 seconds to avoid a collision after target detection. Therefore, it can be deduced that considerable time gaps exist where traffic may not be detected during a normal scan period. Such a structured and disciplined scan technique may also be difficult to achieve. Pilots must develop an effective scan that provides maximum opportunity to see traffic. Passengers in small aircraft may also be utilised to help improve lookout.

7.3 Pilots should remain mindful that certain circumstances will make it difficult for their aircraft to be seen. An aircraft (a small one in particular) will often be rendered difficult to see by the patterns in the surface of the earth when viewed from above, and particularly when over urban areas. Conversely, an aircraft when viewed from below can potentially be much more easily sighted against a uniformly overcast cloud background or blue sky. All pilots would be aware of the difficulty seeing aircraft that have the sun directly behind them.

7.4 Pilots should also be aware that two aircraft converging on a point have the potential to remain fixed in one or both pilots' field of view, i.e. their relative position (in the windscreen) won't change until moments before impact.

8. Traffic separation by radio

8.1 Accurate provision and interpretation of traffic information for the purposes of separation to or from another aircraft is an essential pilot skill. Four commonly used ways of providing and interpreting traffic information by radio communication for the purpose of airborne separation are practised at non-towered aerodromes. All methods have their advantages depending upon circumstances.

- Separation by 'clock code'—Pilots maintain traffic separation by reference to the central axis and numbers of an analogue clock face. Particular care must be given to identifying which aircraft is the central axis of the clock. *You are at my 2 o'clock and low* has the opposite meaning to *I am at your 2 o'clock and low.* The weakness of this method of separation is that it requires at least one pilot to have seen, identified and made contact with the other aircraft.
- Separation by ground reference—Pilots maintain separation by radio by either identifying that each is in different places relative to a ground feature(s), or by agreeing to remain on different sides of a readily identifiable ground feature such as a runway extended centreline, road, town or railway line. The advantage of this method of separation is that it does not require either aircraft to have actually seen each other (although this is desirable). The weakness of this method of separation is that ground features could be misidentified. The uncertainty or confusion can lead to distracting from the effort of retaining separation through see-and-avoid.

  Pilots who offer indistinct local landmarks as separation reference points to other pilots (where they cannot be certain of mutual understanding) may be offering information of limited use.
- Separation by altitude reference—Pilots maintain separation by radio by identifying that each is at a different altitude or by one aircraft descending/climbing to another level. Provided that both aircraft altimeters are set to the correct subscale reference (QNH) for the locality, this method should provide separation for both aircraft regardless of visual contact.
- Separation by navigational or avionic reference—Pilots maintain separation by identifying that each is in a different place relative to a known navigational point or line (radial), or separated by distance from a fixed point (e.g. global positioning system (GPS) or VHF omni-directional radio range (VOR)). This method of separation does not require either aircraft to have actually seen each other (although this is desirable). The weakness of this method of separation is that differing avionic equipment or pilot navigational skill can lead to incorrect assumptions being made about the usability of the separation information offered.

  Pilots who offer instrument flight rules (IFR) reference points as separations to gliders, ultralights or small GA aircraft may not be offering information that is readily usable.

9. Alerted search

9.1 An alerted search is visual scanning when air traffic information has been provided and a pilot knows where to look. Air traffic services or other pilots could provide this information. Transponders are detected by aircraft fitted with ACAS (TCAS) allowing them to 'see' other aircraft and take evasive action if necessary.

The effectiveness of a search for other traffic is eight times greater under alerted circumstances than when just unalerted *[ATSB]***.**

9.2 Technology can assist lookout and pilots should not disregard the benefits that the engagement of an autopilot can provide to visual scanning.

9.3 As threats are external to the aircraft, an effective lookout must be maintained. The pilot must:

- consistently look outside the aircraft;
- search the available visual field to detect threats that will probably appear in the peripheral vision;
- shift vision directly to the threat and, if identified as a collision risk, decide on what effective evasive action to take; and
- manoeuvre the aircraft to avoid collision or an airprox event.

9.4 Pilots must realise that this process takes time; and human deficiencies can reduce the chances of a threat being detected and avoided. The factors affecting lookout may not be errors or poor airmanship, but limitations of the human visual and information processing systems which are present to various degrees in all humans.

9.5 There are two main elements to effective traffic avoidance. Firstly, to see an 'object', and secondly, to react accordingly to what has been seen. An object could range from looking like a speck in the windscreen that is actually an aircraft at long range, to a large feature. The next step would be to determine if the object is a threat, and then take avoiding action.

10. What is situational awareness?

10.1 Simply defined, situational awareness is *knowing what is going on around you, and being able to predict what could happen.* Colloquially, this can be described as 'street smart'.

10.2 A more comprehensive and technical definition is *the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of the status in the near future.*[1]

10.3 The first definition is generic, applies to life in general, and to most occupations. The second definition is more specific to aviation and is often assigned three levels:

- Level 1: Perception of the current environment;
- Level 2: Interpretation of the immediate situation; and
- Level 3: Anticipation of the future environment.

10.4 Monitoring and gathering information from both within the cockpit and outside the aircraft, and the processing on all three levels, is required to build and maintain comprehensive situational awareness.

11. Interaction with other aircraft at, or in the vicinity of, a non-towered aerodrome

11.1 Rules of the air regarding right of way and rules for prevention of collisions should always be respected *[CARs 161 and 162]*. Pilots of powered aircraft should not normally seek right of way from non-powered aircraft, although the offer of right of way may come if conditions are favourable.

11.2 So as not to impede commercial aviation, pilots flying recreational or sport aircraft for their own enjoyment, or pilots flying GA aircraft for their own leisure, should consider giving way to aircraft being used for 'commerce' provided that the inconvenience to their own operation is not great and it can be done safely. Operators of commercial flights should never expect a give way offer to be assumed or automatic. Any offer to give way must be explicit and its acceptance acknowledged.

11.3 Operators of commercial flights should also not assume that a sport or recreational aircraft is being operated for purely non-commercial reasons. Hundreds of individuals Australia-wide derive their income conducting flying training in sport or recreational aircraft.

11.4 Although the conduct of a non-standard circuit join (such as a straight-in approach) may have operational and economic advantages, pilots should be aware that any variations to the recommended circuit join may carry increased collision risks. When varying any standard procedure, it is essential that situational awareness is assessed and maintained.

[1] M. R. Endsley (1988)

11.5 Pilots should be mindful that transmission of information by radio does not guarantee receipt and complete understanding of that information. Many of the worst aviation accidents in history have their genesis in misunderstanding of radio calls, over-transmissions, or poor language/phraseology which undermined the value of the information being transmitted.

11.6 Without understanding and confirmation of the transmitted information, the potential for alerted see-and-avoid is reduced to the less safe situation of unalerted see-and-avoid.

11.7 There are practical limits on how much voice traffic a VHF frequency can efficiently carry. Excessively long radio broadcasts or broadcasts that do not add value to situational awareness have the potential to block transmissions being made by other pilots. Radio communications should be to the point, clear, accurate, and necessary. An unnecessary radio transmission that over-transmits another transmission is as hazardous as making no transmission at all.

11.8 Under no circumstances should a pilot attempt to direct other traffic. Direction of air traffic (as opposed to alerting, requesting or advising) is an ATC function and should not be performed by pilots in flight or on the ground. Pilots who seek to direct other pilots as a pseudo air traffic controller, either innocently or to obtain expedited traffic movement, are acting beyond common courtesy and are potentially operating outside the law. Such actions may expose pilots to liability if their direction results in an undesirable outcome.

Example of appropriate request or advice: "Alpha Bravo Charlie, could you maintain five thousand? We will maintain six thousand until we have passed you."

11.9 Pilots are expected to operate in a courteous and professional manner at all times. Aviation safety relies upon a cooperative approach between all pilots, particularly on and in the vicinity of aerodromes in times of busy traffic.

Note: CAAP 166-1(0) is effective from 3 June 2010 and provides more details on straight in approaches and joining the circuit on the base leg.

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