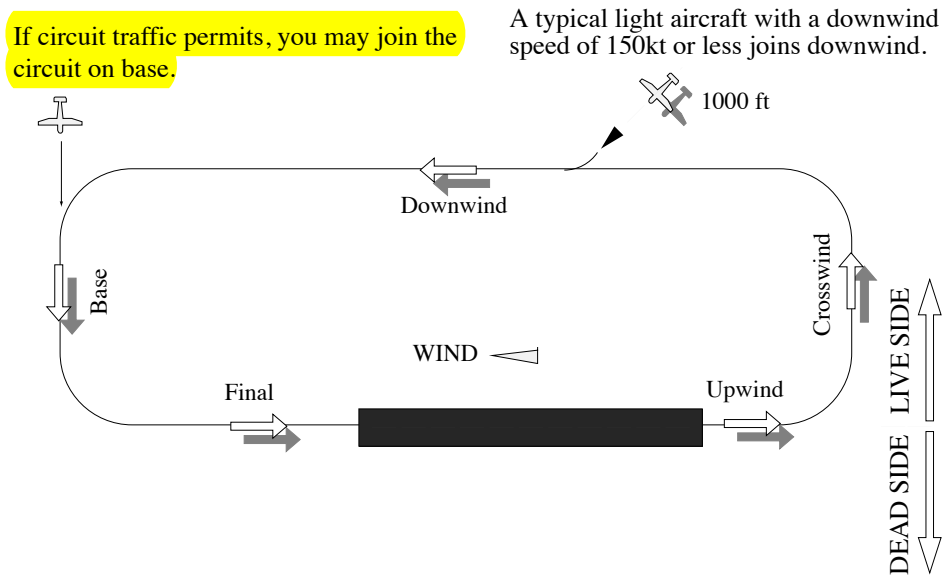
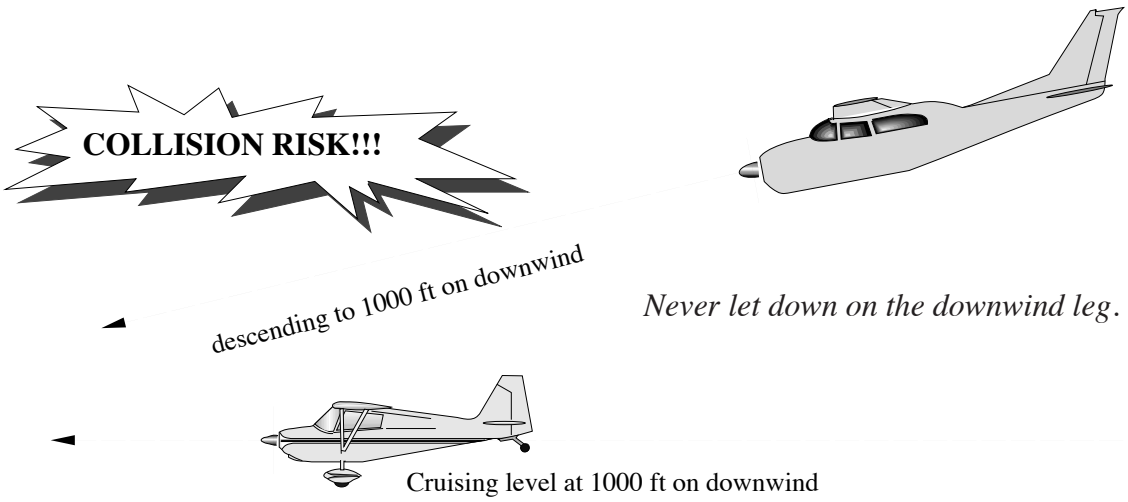


For the purpose of this discussion let's assume we are flying a typical general aviation training aircraft with a speed somewhere between 55kt and 150kt. The circuit height prescribed for aircraft of this performance is 1000ft.

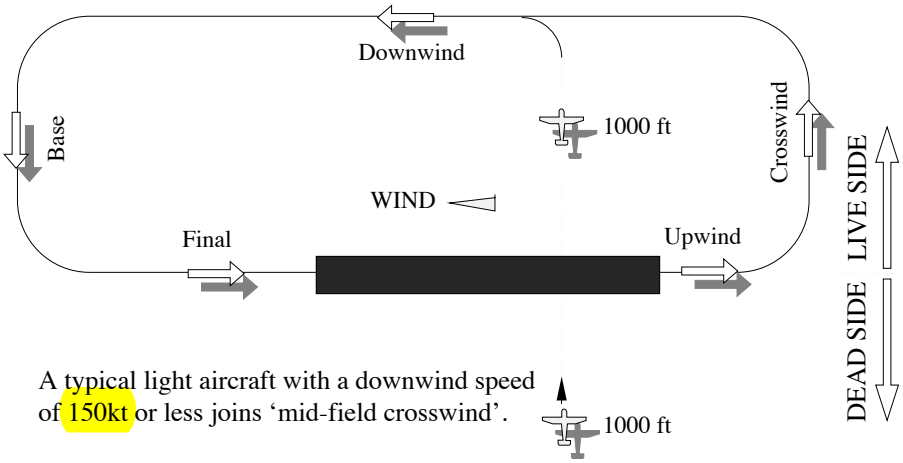
The circuit joining procedure varies according to the direction from which the arriving aircraft approaches the aerodrome. An aircraft approaching from the live side should manoeuvre as required to join the circuit at 45° to the downwind leg, intercepting the downwind leg at the midfield position [see diagram above]. Alternatively, a pilot may join on an extended base leg providing he/she is satisfied that there will not be conflict with traffic already established in the circuit. In both cases [downwind or base], a broadcast should be made on the CTAF prior to joining the circuit.

The descent should be planned so as to reach 1000ft *before entering the downwind or base leg*. An aircraft that is still descending while flying the downwind or base leg has little chance of sighting a slower aircraft ahead at circuit height. The risk of collision is greatly increased.



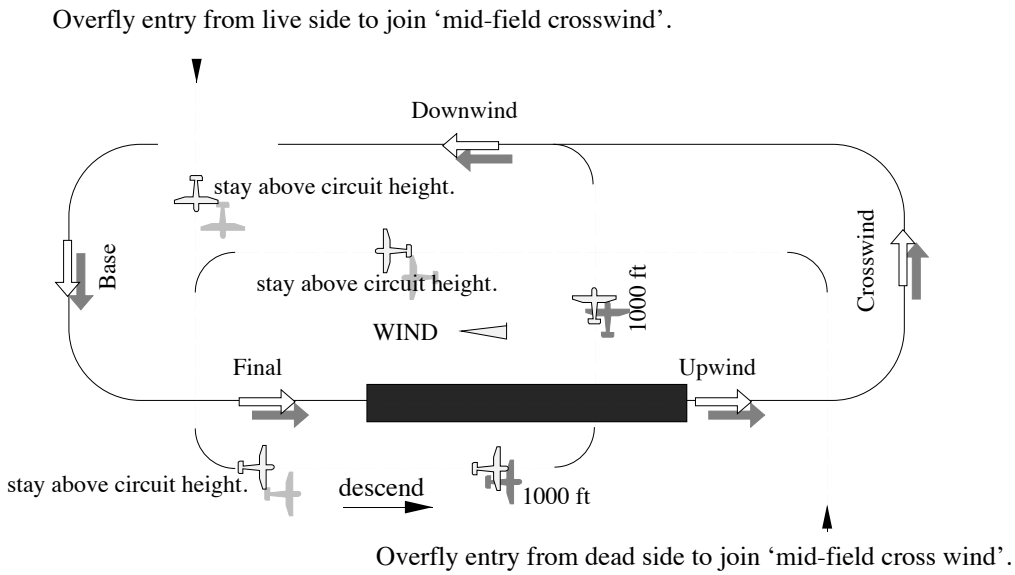
Aircraft entering 45° downwind or base must give way to aircraft already established in the circuit.

Aircraft approaching the aerodrome from the dead side [see diagram below], manoeuvre as required to cross the runway at right angles somewhere between the centre and the upwind threshold. These aircraft should descend to 1000ft before crossing to the live side to maximise the chance of sighting other aircraft in the circuit. This joining procedure is known as 'mid-field crosswind'.



Aircraft joining mid-field crosswind should give way to aircraft already established in the circuit and to aircraft joining 45° downwind.

On some occasions it may not be possible for an approaching aircraft to be certain of the wind direction and the runway in use. Attempting to join directly on the downwind or mid-field crosswind legs could cause some drama if the actual circuit direction is opposite to that on which the pilot is baseing his procedure. On these occasions it would be wise to overfly at a level at least 500ft above circuit height to check the wind direction and determine the active runway [see diagram below].



After the circuit direction has been determined, descent to 1000ft is made on the dead side of the circuit and a mid-field crosswind circuit join is flown.

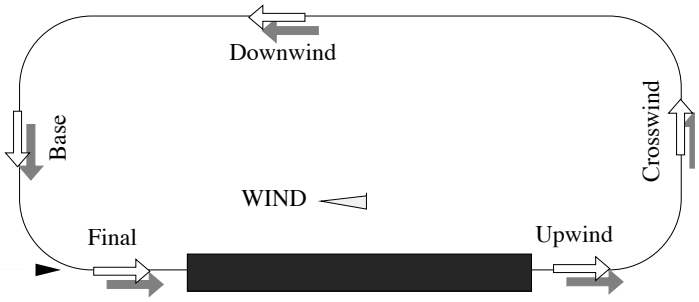
Straight-in approach. Providing the circuit direction has been established in advance, you may carry out a straight-in approach to the active runway at any certified aerodrome. If this procedure is to be used you should announce your intention to carry out a straight-in approach before 10nm. You should track to establish your aircraft on the extended centreline of the runway by 3nm and commence the straight-in approach from that point. You should also broadcast your position along with your intentions on the CTAF frequency at 3nm.

A straight-in approach - Aircraft must:-

Announce intentions by 10nm.

Be established on final approach track by 3nm.

Give a radio call at 3nm.



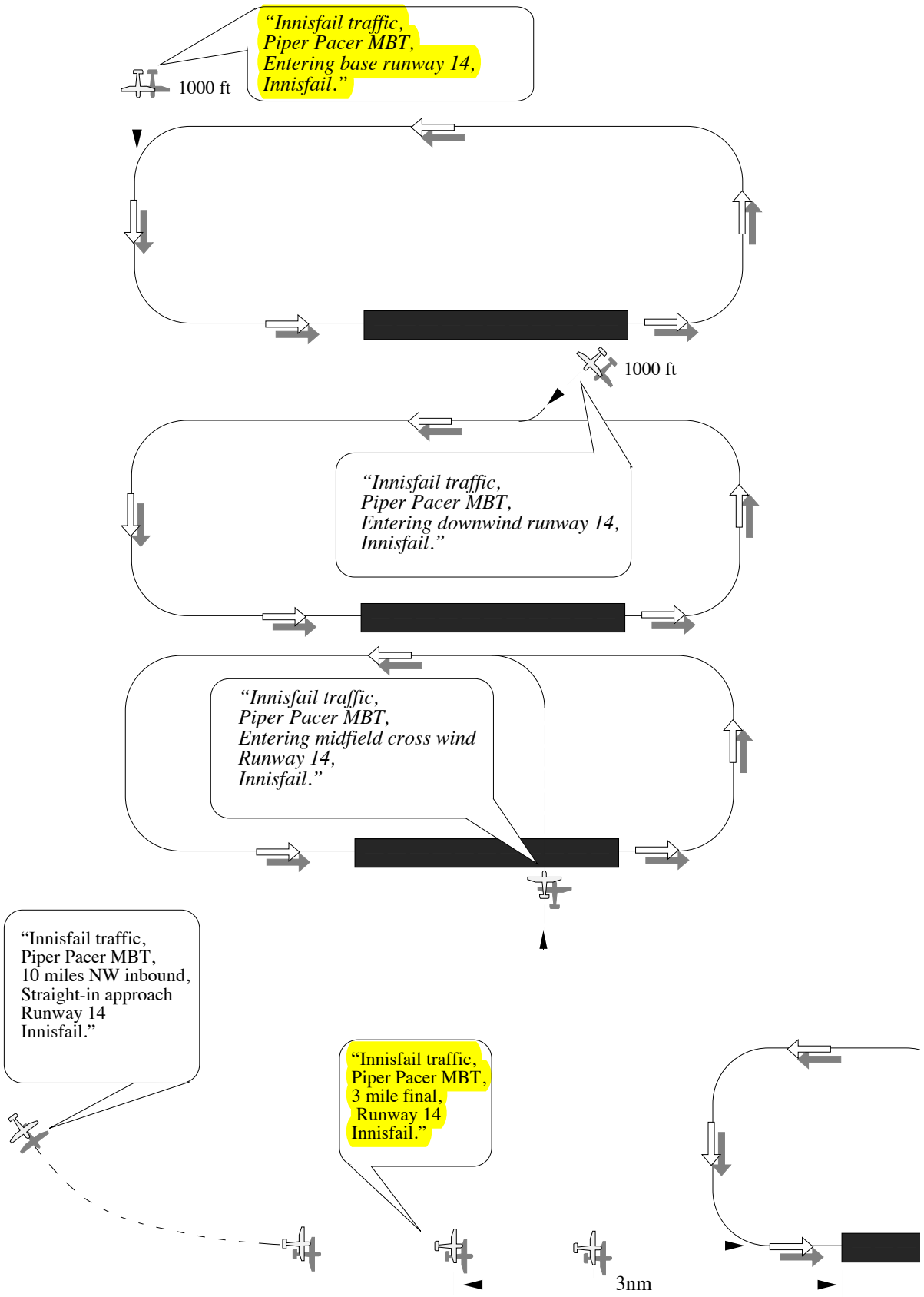
Aircraft carrying out a straight-in approach should give way to all aircraft established in the circuit.

CIRCUIT HEIGHTS. The height at which the downwind leg of the circuit should be flown depends upon the speed of the aircraft.

> *Jets, Turbo-prop and high performance single engine aircraft with a downwind speed greater than 150kt fly the circuit at* ***1500ft AGL.***
>
> *Typical general aviation aircraft with a downwind speed of between 55kt and 150kt fly the circuit at* ***1000ft AGL.***
>
> *Helicopters and ultra-lights with a maximum speed of 55kt or less fly the circuit at* ***500ft AGL.***

RADIO BROADCASTS. Part and parcel of the circuit joining procedures is the use of radio at key points to alert other circuit traffic to your current position and intentions. Radio broadcasts should commence with the name of the aerodrome at which you are operating followed by the word 'traffic', then your aircraft type and callsign, your position and intentions then finishing with the name of the aerodrome again.

> *[Location]* Traffic
>
> *[Aircraft Type]*
>
> *[Call sign]*
>
> *[Position/Intentions]*
>
> *[Location]*

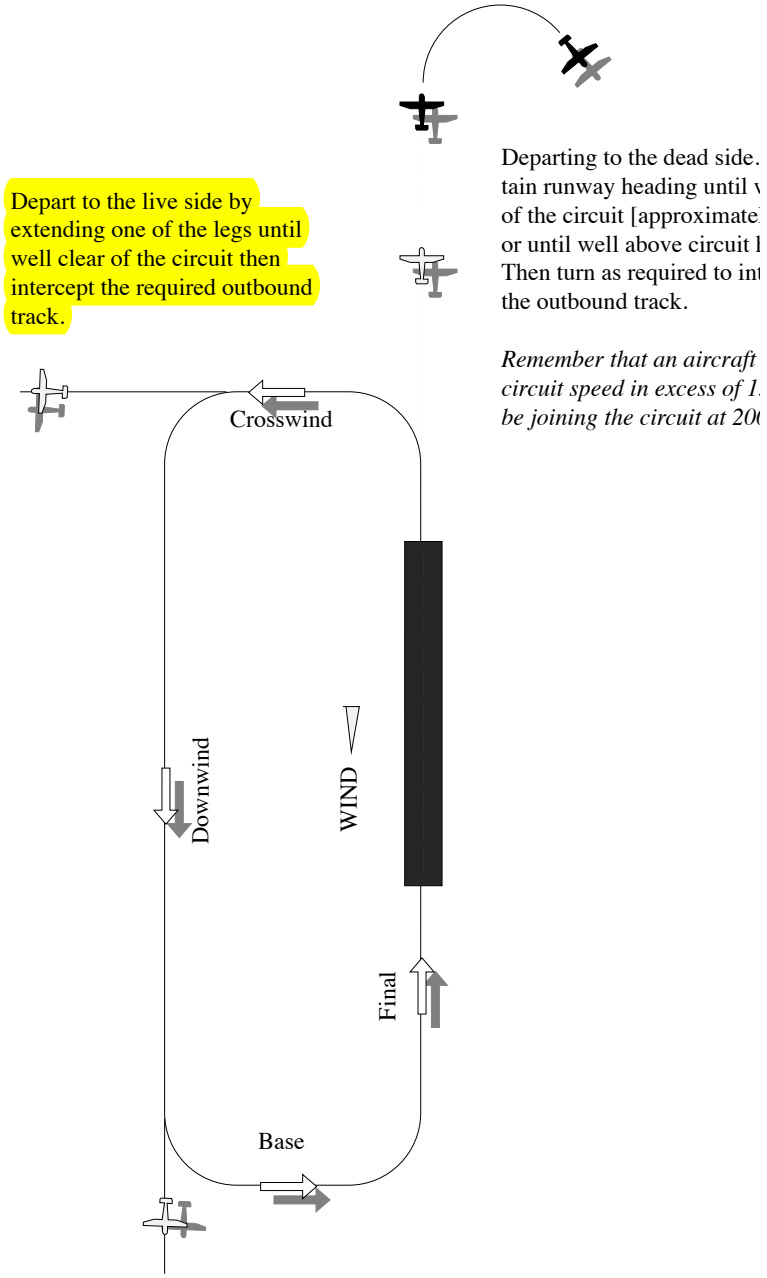


Similar radio calls should be given by circuit traffic when turning base with intentions [eg 'full stop' or 'touch and go']. Calls should also be made at any other point in the circuit when considered necessary due to conflicting traffic.

DEPARTURE FROM A NON-TOWERED AERODROME. When departing a non-towered aerodrome, a broadcast should be made on the CTAF before entering and/or backtracking a runway, nominating the runway to be used and the direction of the departure track.

When departing to the live side, maintain runway heading until past the upwind threshold and at circuit height. Turn 45° into the circuit and maintain that track until clear of the circuit, then turn as required to intercept the departure track. If the departure track is less than 45° from the runway heading, turn onto the departure track directly.

If departing contrary to the circuit direction maintain runway heading until 500ft above circuit height, then turn to intercept the departure track. When departing contrary to the circuit direction make a broadcast on the CTAF when making the turn off runway heading. This broadcast should include advice that you are departing the circuit, the departure runway, the direction of turn and the direction of the departure track.



CLASSIFICATION OF AIRSPACE. Just as rules and regulations are required for motor vehicles using our roads, some degree of regulation is required to ensure a smooth flow of air traffic in our skies. These rules are designed to facilitate the safe and efficient movement of aircraft, especially in the vicinity of aerodromes.

One way of achieving this is to require that all aircraft operate according to the instructions issued by a ground based controller. The controller allocates to each aircraft a specific height and track to fly with a time or place to commence a climb or descent. The height, track and climb or descent instructions are the main elements of an *airways clearance*.

Obviously we do not have the resources, nor would it be necessary, to control all aircraft in all airspace by this method. We therefore designate some airspace as **controlled airspace.** The vertical and lateral boundaries of this controlled airspace is clearly marked on ERC and VTC charts. All of the airspace over Australia is classified as either controlled or uncontrolled.

Uncontrolled airspace is called **Class G** airspace, and all aircraft operating in this type of airspace use the 'see and avoid' principle to maintain separation from each other. This system relies on each pilot keeping a sharp lookout for other aircraft and maintaining a listening watch on the appropriate radio frequencies to build up a mental picture of the traffic situation.

Controlled airspace in a different story however. It is classified as **Class A, Class C, Class D or Class E** airspace.

CLASS A controlled airspace. This is controlled airspace designed mainly for high performance aircraft cruising at high levels. These aircraft operate to the Instrument Flight Rules [IFR]. The actual height at which the Class A airspace begins varies depending on whether or not radar coverage is available. **VFR flights are not permitted** in Class A airspace under any circumstances. Outside radar coverage Class A controlled airspace extends from 24500ft to 60000ft. A bit out of the reach of the average Cessna 152! [See Fig 1]

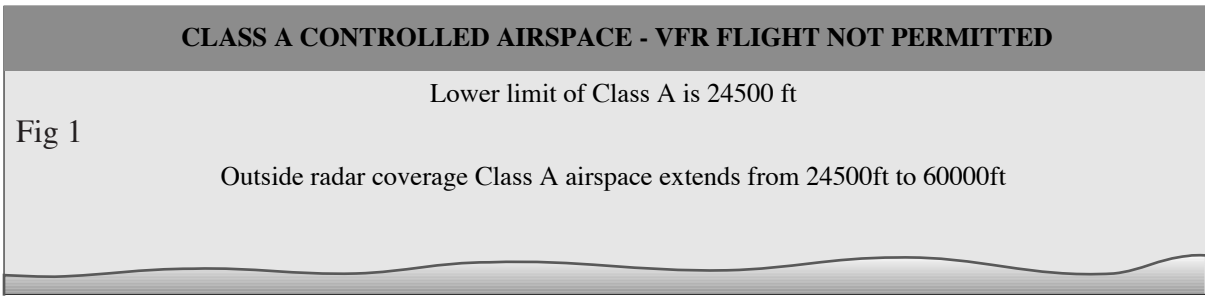


Fig 1

Within radar coverage the lower limit of Class A controlled airspace is lowered to 18000ft. [See Fig 2].

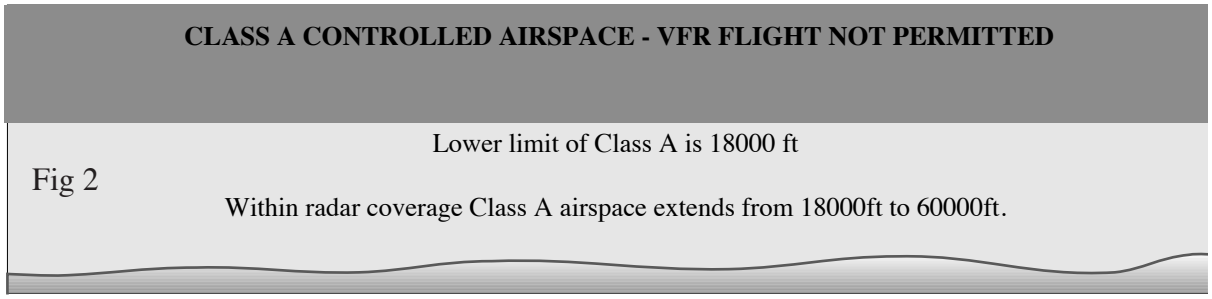
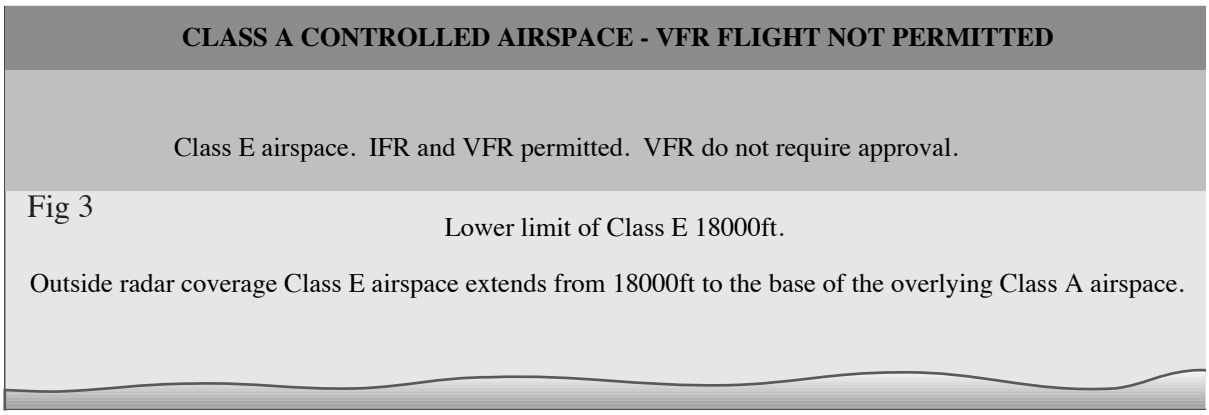
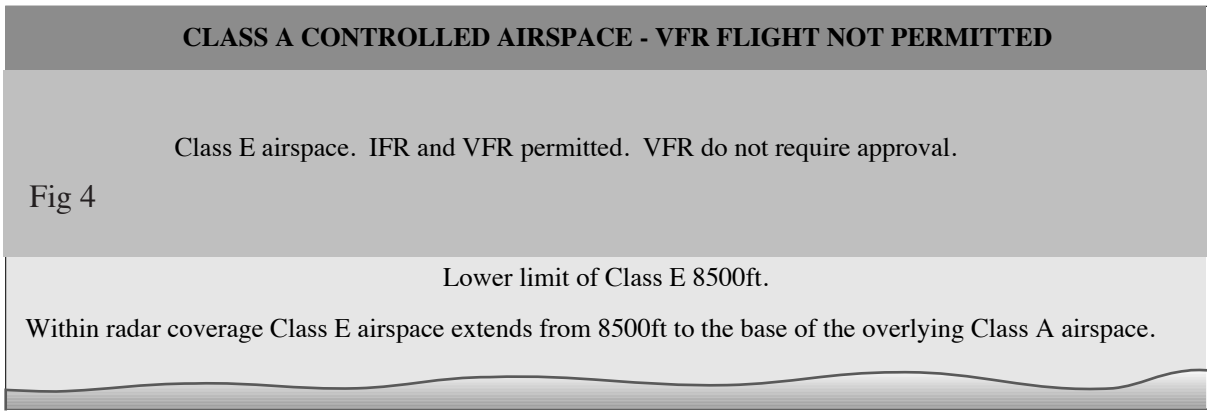


Fig 2

CLASS E controlled airspace. Beneath the band of Class A airspace there is another layer of controlled airspace called Class E airspace. In Class E airspace both IFR and VFR flights are permitted. However VFR flights may operate in Class E without approval. All that is required of VFR flights in Class E airspace is to fly at an appropriate VFR level, always remain in VMC, turn on the transponder to 'ON/ALT' with code 1200 selected and keep a sharp lookout. The pilot of a VFR flight in any airspace should also keep a listening watch on the appropriate radio frequency. Outside radar coverage the Class E airspace extends from 18000ft to the base of the overlying Class A airspace. [See Fig 3].



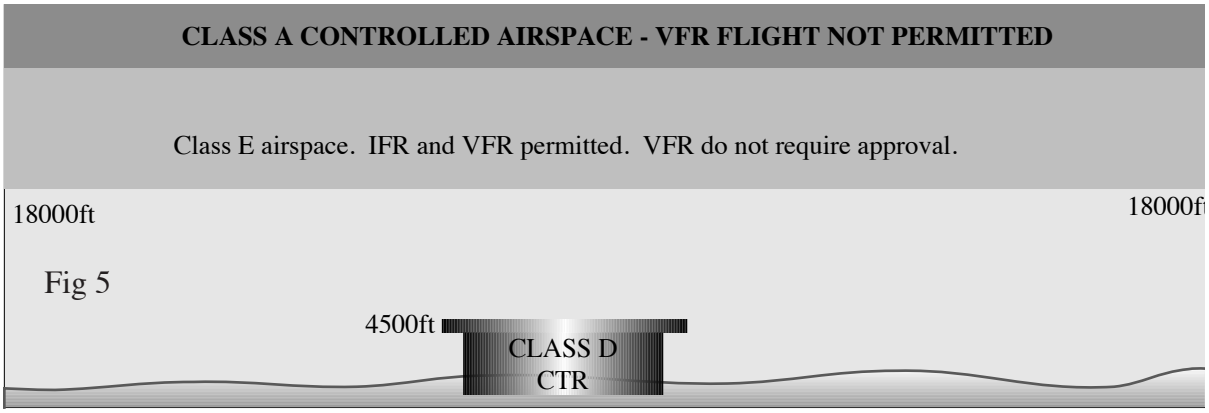
Within radar coverage Class E controlled airspace extends from 8500ft to the base of the overlying Class A [or sometimes Class C] airspace. [See Fig 4].



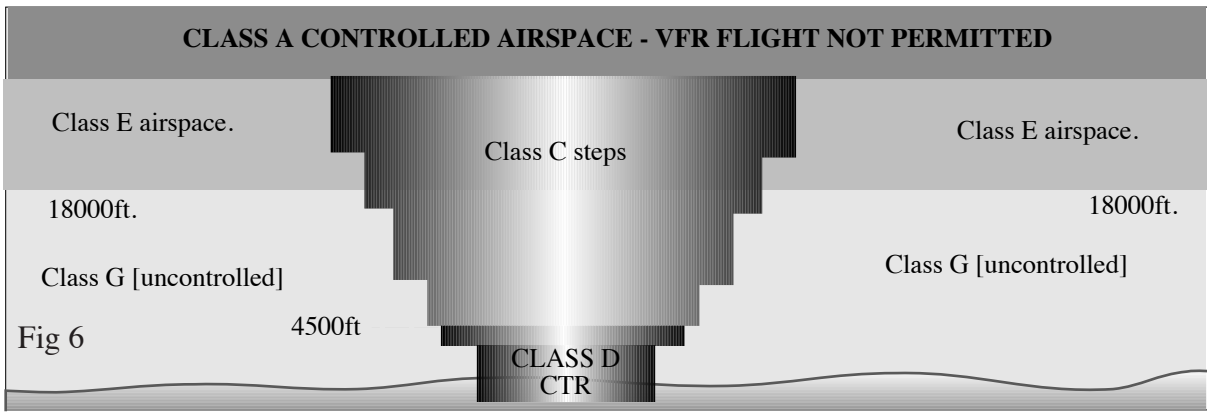
CLASS D Controlled Traffic Regions or CTRs. Controlled airspace regions are often created in the vicinity of busy regional airports. These are called controlled traffic regions [CTRs] or control zones. They are controlled by a tower controller who issues airways clearances to aircraft operating within the region. These clearances contain instructions on the height and track to fly to maintain a safe and efficient flow of traffic.

Because the tower controller in Class D CTRs does not use radar as a primary means of providing separation, he/she relies on pilots complying with the terms of their airways clearance. This method is referred to as procedural separation and aircraft must be kept more widely separated than is possible in Class C airspace where radar is used to provide separation.

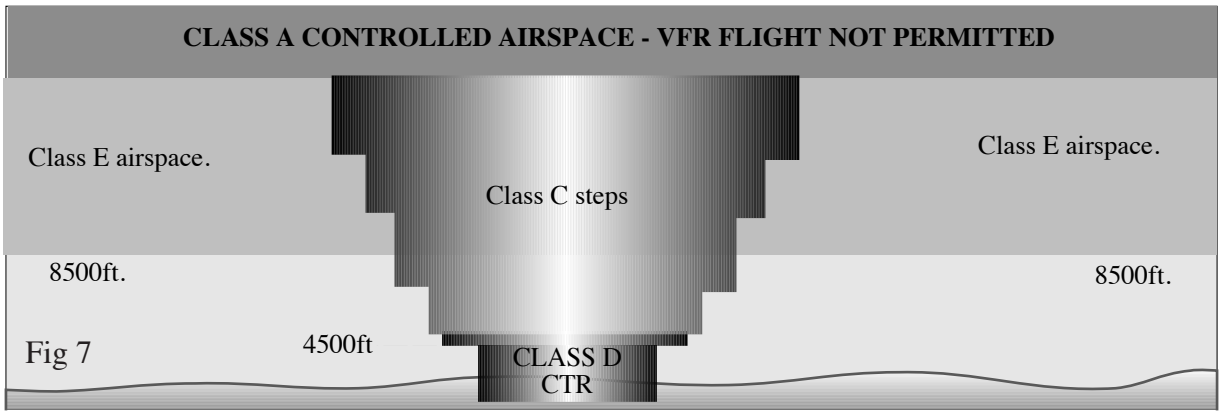
Class D CTRs have defined lateral boundaries and extend from ground level to 4500 feet. All aircraft operating within Class D CTRs must obtain an airways clearance before entering and must comply with the terms of the clearance. VFR aircraft must remain in VMC.



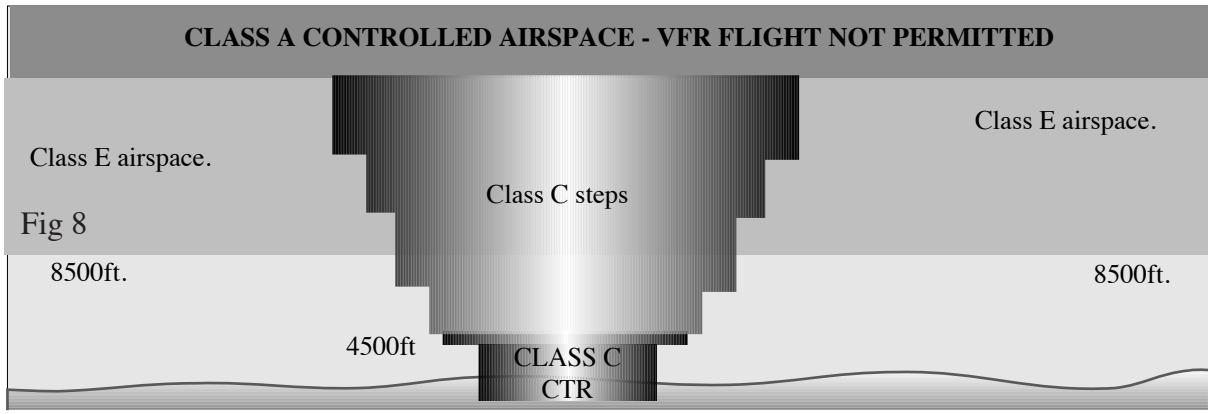
Above the Class D CTR Class C control area steps are created to allow IFR aircraft to transit between the overlying Class E or Class A airspace and the CTR with the protection of controlled airspace. [See Fig 6]. Within this airspace IFR aircraft are separated from other IFR aircraft and from VFR aircraft. VFR aircraft receive traffic information on other aircraft.



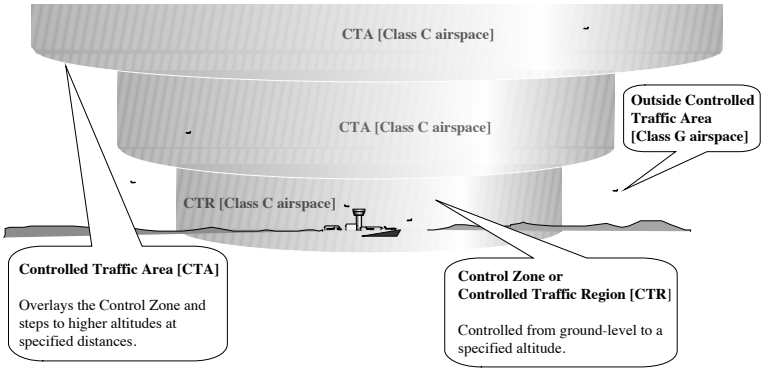
These steps extend through the Class E layer to the base of the Class A [or sometimes Class C] en route airspace above. When within radar coverage, the base of the overlying Class E airspace is lowered to 8500 feet [see Fig 7]. VFR aircraft require an airways clearance to enter either Class C or Class D airspace. However VFR aircraft may operate in Class E airspace without a clearance providing they are transponder equipped and the transponder is operating in the 'ON/ALT' mode with code 1200 selected and a listening watch is maintained on the appropriate frequency.



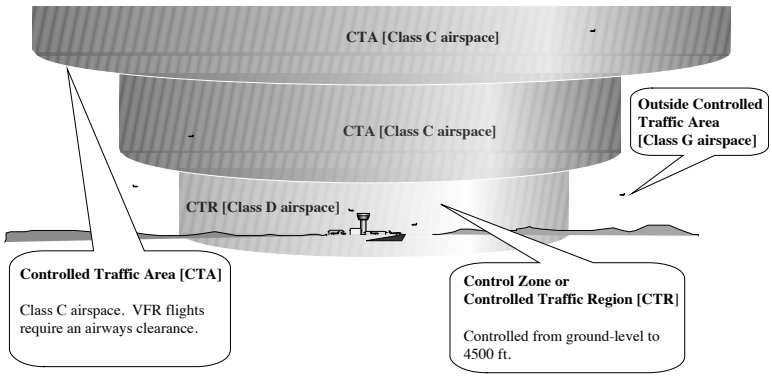
CLASS C Controlled Traffic Region. Radar is used for separation within all Class C airspace, including the CTR [ie down to ground level]. In the case of major airports, such as international airports, the CTR and the overlying steps are designated Class C.



All aircraft operating in Class C airspace require an airways clearance and a transponder. ATC provide separation for VFR from all IFR flights and a traffic information service about other VFR flights. The Class C CTR and associated Class C steps provide for heavy jets and other RPT traffic to cruise in Class A airspace and during climb or descent to the CTR, still have the full protection of ATC separation from all IFR and VFR flights within the airspace [See Fig 8].



[Left] Most major airports have Class C control zones or Controlled Traffic Regions - CTRs as they are sometimes called. In these areas the overlaying control area is also Class C extending up in steps to Class A airspace above. This allows heavy IFR aircraft to have the protection of full control based on radar separation.



[Left] When CTRs are created about regional airports, they are classified as Class D. At such airports Class C steps provide for separation of IFR aircraft in transit from the overlying Class C airspace to the Class D CTR.

VFR aircraft require a clearance to operate in the Class C airspace.

See AIP ENR 1.4 page 8 & 9

SUMMARY OF AIRSPACE REQUIREMENTS FOR VFR FLIGHTS.

	CLASS A	CLASS C	CLASS D	CLASS E	CLASS G
Airways clearance required?	**VFR not permitted**	**YES**	**YES**	**NO**	**NO**
Continuous two-way VHF radio required?	**VFR not permitted**	**YES**	**YES**	**YES**	**YES - if: above 5000ft or in a CTAF or in reduced VMC**
Controller provides separation?	**VFR not permitted**	**YES VFR from IFR**	**No separation for VFR flights unless 'special VFR'**	**No separation for VFR flights**	**No separation for any flights**
Services provided by air traffic control?	**VFR not permitted**	**Air Traffic Control service provides positive separation from IFR flights. Traffic information service provided for separation from other VFR flights [and traffic avoidance advice on request]**	**Air Traffic Control service provided. VFR flights get traffic information only on IFR and VFR flights**	**Radar information service provided on request to VFR flights**	**Flight Information Service and Flight Watch available.**

Try these questions on airspace classification and procedures. **[Answers on Page 2.29]**

Read AIP ENR 1.4 para 1.1 to para 4.7.2
(ATC AU-201 para 1.1 to 7.1)

Question No 1
Select the class of controlled airspace in which VFR aircraft may operate without an airways clearance-

[a] Class A
[b] Class D
[c] Class C
[d] Class E

Question No 2
Select the class of controlled airspace in which VFR aircraft are never permitted to operate-

[a] Class A
[b] Class D
[c] Class C
[d] Class E

Question No 3
When operating in Class E airspace, a VFR pilot should set the transponder to-

[a] Stand-by mode and select code 1200.
[b] On/Alt mode and select the transponder to 1200
[c] Stand-by mode and select the discrete code issued by ATC
[d] On/Alt mode and select the discrete code issued by ATC

Question No 4
As a VFR flight operating in Class E airspace you can expect ATC to provide-

[a] separation from other VFR aircraft
[b] separation from all IFR aircraft
[c] traffic information on all flights in your vicinity
[d] traffic information on request

Question No 5
A VFR flight operating on Class C airspace will be provided with-

[a] separation from IFR flights and traffic information on other VFR flights
[b] traffic information on IFR flights and separation from other VFR flights
[c] separation from both IFR and VFR flights
[d] traffic information only on both IFR and VFR flights

Question No 6
Select the class of airspace in which special VFR [SVFR] flight is not permitted-

[a] Class C
[b] Class E and Class G
[c] Class D
[d] Class D and Class G

Question No 7
Within radar coverage, the lower limit of Class E airspace is set at

[a] FL245
[b] FL180
[c] 8500ft
[d] 4500ft

Question No 8
A VFR flight at 9500ft in Class G airspace is approaching the lateral boundary of Class E airspace. Select the most appropriate procedure for the pilot to adopt

[a] select the transponder to ON/ALT and select code 1200, maintain a careful watch for other aircraft, listen out on the CTR frequency and stay in VMC
[b] select the transponder to ON/ALT and select code 1200, request an airways clearance, listen out on the CTR frequency and stay in VMC
[c] select the transponder to Stand-by and select code 1200, maintain a careful watch for other aircraft, listen out on the CTR frequency and stay in VMC
[d] select the transponder to ON/ALT and select code 1200, maintain a careful watch for other aircraft, make an 'all stations' broadcast on the CTR frequency and stay in VMC

Question No 9
A VFR flight which is departing an aerodrome within a Class D CTR

[a] requires an airways clearance unless the intended cruise level is below 4500 feet
[b] always requires an airways clearance
[c] does not require an airways clearance from ATC
[d] does not require a clearance if the subsequent operation will be in Class E airspace

Question No 10
A special VFR [SVFR] flight operating in Class C airspace will receive separation from all

[a] other flights
[b] VFR flights
[c] SVFR flights
[d] IFR flights

Answers to questions on airspace classification and procedures:

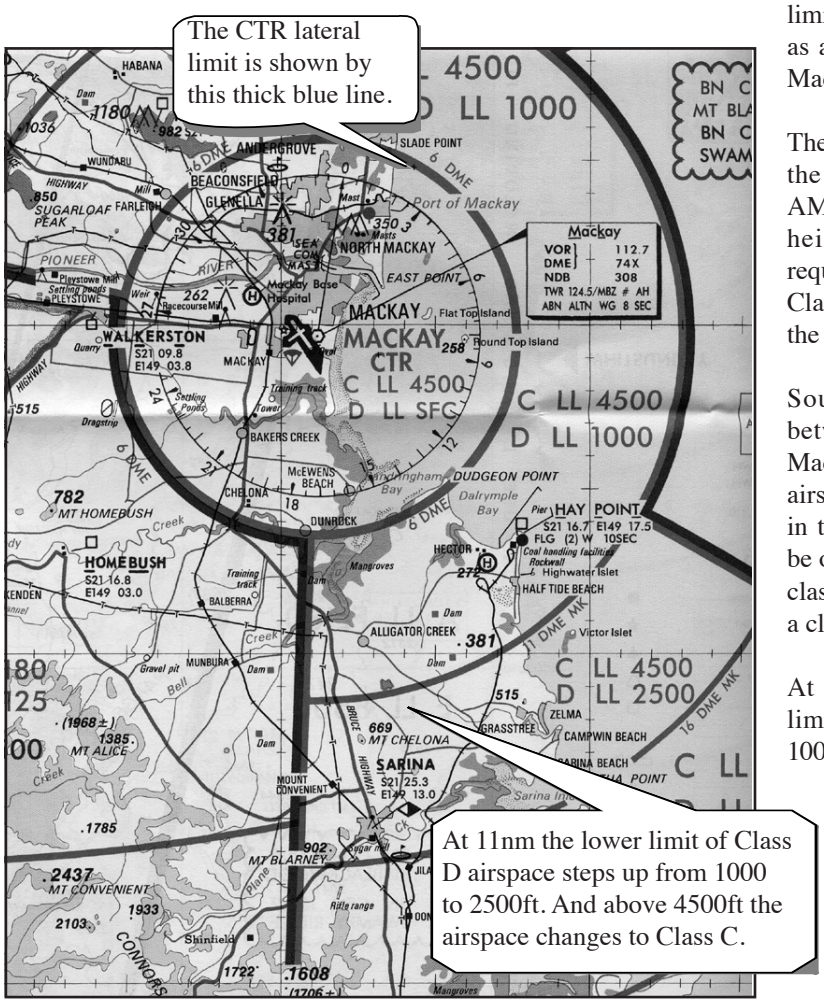
1 [d] 2 [a] 3 [b] 4 [d] 5 [a] 6 [b] 7 [c] 8 [a] 9 [b] 10 [c]

PROCEDURES IN CLASS D AIRSPACE.

The main difference between Class D airspace and other types of controlled airspace is that in Class D airspace the control service is provided without the use of radar. The controller issues instructions to pilots and trusts that those instructions are being complied with. This is known as 'procedural separation'.

Although some Class D towers have radar monitors to assist, the controller does not use radar as a *means* of achieving separation.

Class D airspace consists of a control traffic region [CTR] which extends laterally, usually up to 6 or 8 nautical miles from a regional aerodrome. The CTR then extends vertically, usually up to 4500ft. Both the lateral and vertical limits of the CTR vary with location and are shown on the relevant VTC. Class C controlled airspace usually sits above the Class D CTR. Consider the example given below.



The Mackay VTC shows the lateral limits of the Mackay CTR [control zone] as a thick blue line at 6nm around the Mackay aerodrome.

The Class D control zone extends from the surface to an altitude of 4500 ft AMSL. Any aircraft operating at any height inside this boundary would require an airways clearance since the Class D controlled airspace extends all the way to the ground.

South of the Mackay control zone between the 6 and 11nm arcs from Mackay, the lower limit of the Class D airspace is 1000 ft. Aircraft operating in this area at or below 1000 ft would be outside the controlled traffic area [in class G airspace] and would not require a clearance.

At 11nm South of Mackay the lower limit of Class D CTA steps up from 1000ft to 2500ft. Aircraft in this region at or below 2500ft would not require a clearance. Note that at 4500ft the airspace changes from Class D to Class C. Aircraft operating within the lateral boundary of CTA and above 4500ft, would require a transponder since all Class C airspace is radar controlled.

[Read AIP ENR 1.4- para 1.1 to 1.5] ATC AU-201 para 1.1 to 1.5)

Entry Points. Aircraft wishing to enter the Class D CTR are advised to track via one of the VFR approach points, marked on the VTC with a half-shaded diamond [See **'SARINA'** in the above illustration]. Entry from any other direction is permitted, however the controller may [is likely to] direct aircraft coming in from other directions to divert and track via one of the approach points. The VFR approach points are selected because they are prominent landmarks which will assist VFR navigation and help ATC maintain an orderly flow of traffic. In some cases they also help to keep aircraft away from nearby Class C airspace or restricted areas.

The maximum indicated airspeed permitted when operating in Class D airspace is 200kt.

Clearances. You must obtain a clearance before entering a Class D CTR [also called a Class D control zone]. You should call the tower approaching the VFR approach point, or at 10nm if you intend to enter via another route. Your inbound call should include:

* aircraft call sign
* aircraft type
* position
* level
* receipt of the ATIS code
* intentions [for example 'inbound' or 'transiting']

On receipt of your inbound call, ATC may simply acknowledge with your call sign. This acknowledgement may be taken as a clearance to enter the Class D CTR. At some point [usually along with the acknowledgement] ATC will give further instructions such as 'join crosswind/downwind/base', 'overfly' or 'report at'. Note that neither you nor ATC need to use the phrase 'airways clearance'.

When operating within the Class D control zone specific individual clearances are required to:

* taxi
* take-off or land
* enter, cross or taxi along any runway
* turn in a direction opposite to the normal circuit direction
* fly a circuit at a height other than 1000ft AGL.

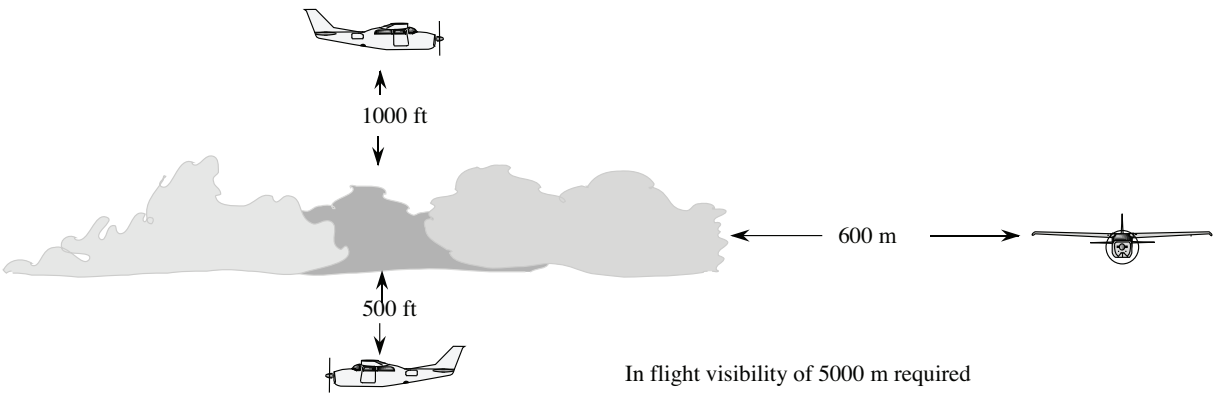
You must read back any clearance in full.

When operating within a Class D control zone you must sight and maintain separation from other aircraft, comply with all ATC instructions, advise ATC if you find that you are unable to comply with any instruction and advise ATC if you are unable to see, or have lost sight of other aircraft which have been given as traffic.

VMC criteria in Class D airspace. VFR operations in a Class D CTR are restricted to the following conditions:

* in flight visibility of not less than 5000m
* horizontal distance from cloud not less than 600m
* vertical distance from cloud 1000ft above and 500ft below

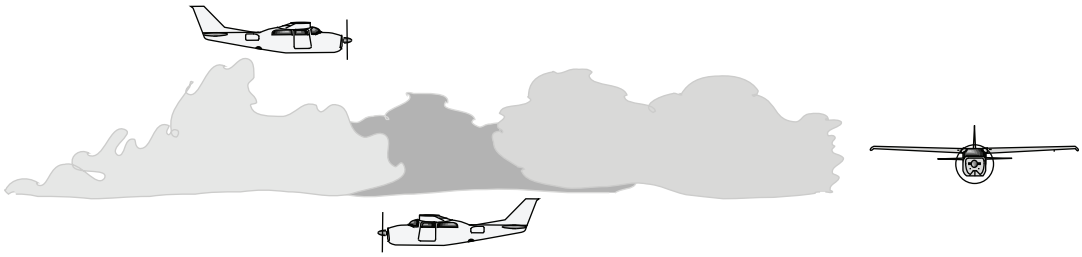
TO MAINTAIN VMC IN CLASS D YOU MUST BE 1000' ABOVE OR 500' BELOW CLOUD
AND 600m HORIZONTALLY FROM CLOUD AT YOUR LEVEL .



Special VFR. Under some circumstances it may not be possible to operate with the above separation from cloud standards. For example overlying Class C airspace may make it impossible to maintain 1000ft vertical separation from cloud without penetrating the Class C lower limit. Also 500ft below cloud may make it impossible to also maintain 500ft separation from terrain.

Under these circumstances, the pilot may request a 'special VFR' clearance. If granted, this will allow the aircraft to operate with reduced separation from cloud and visibility requirements while within the Class D CTR. The requirements to allow 'special VFR' operations are to remain clear of cloud [with no specific separation distance required], and to maintain an in-flight visibility of not less than 1600m [about 1nm].

SPECIAL VFR IN CLASS D YOU MUST BE CLEAR OF CLOUD



In flight visibility of 1600 m required

Provision of separation. For aircraft operating within Class D airspace, ATC will provide positive separation for all IFR and special VFR flights. Normal VFR flights will receive traffic information only and the responsibility for separation from all other aircraft rests with the pilot. This includes separation from the wake turbulence gererated by preceding heavy aircraft.

Surface movement control. The 'ground' controller at a Class D CTR oversees all ground operations. Before commencing to taxi, you must make contact with the ground controller and obtain a clearance to taxi. Your request should include:

* call sign
* your location on the aerodrome
* intentions [for circuits, for departure north/south/east/west]
* dual or solo [if a training flight]
* receipt of ATIS code
* request taxi

A clearance to taxi includes approval to enter a run-up bay and conduct pre-takeoff checks, however it DOES NOT include approval to cross or taxi along any runway - that always requires a specific clearance.

When pre-takeoff checks are complete, you should taxi to the holding point of the designated runway, change to the tower frequency and report 'ready' along with the runway identifier. e.g. "Mike Bravo Tango, ready runway one zero left".

After landing, you should vacate the runway at the first available taxiway. If the runway you have landed on intersects another runway, you may cross that runway without further clearance. However you must not re-enter or taxi along any runway without specific clearance from SMC.

Circuit operations. If the tower includes a reqirement to follow a preceding aircraft with your take-off clearance, you must sight and follow that aircraft, maintaining separation by extending a leg of the circuit or slowing down if necessary. Unless otherwise instructed by the tower, you should report when starting the downwind leg of the circuit giving your call sign and your intentions [touch and go or full stop]. If you intend to fly a non-standard circuit such as a glide approach, that should be included in your downwind call.

If at any stage you lose sight of an aircraft you have been sequenced to follow, or if you find that for any reason you are unable to maintain separation from another aircraft, you must advise the tower immediately.

Departing a Class D CTR. A VFR aircraft leaving a Class D CTR into Class G airspace should do so by extending one of the legs of the normal circuit pattern until well clear of the circuit, then tracking well clear of any VFR approach points. A VFR aircraft need not make a departure call after take-off and the pilot may change to the appropriate area frequency at his/her discretion.

If departing into the overlying Class C airspace, a clearance will be given by the tower.

REVIEW QUESTIONS - SET 3

Question No 1 *AIP ENR 1.1- para 33.2*
Unless otherwise instructed, a downwind report to the Air Traffic Service is mandatory at
[a] all non-towered aerodromes when joining the circuit
[b] all Class D control zones when departing the zone
[c] all Class C control zones at all times
[d] Class D CTRs when flying circuits

Question No 2 *AIP ENR 1.1 para 11.5.5 (a)2*
When operating VFR by day and instructed by ATC to "make a visual approach", which condition applies to the descent?
[a] you must not descend below the lowest level permitted for VFR flight.
[b] you must be within 5 nm and have the aerodrome in sight
[c] you must remain at least 1000 ft above the lower limit of CTA
[d] you must commence the descent within one minute of receiving the instruction

Question No 3 *AIP ENR 1.7 para 4.1 & 1.1 para 3.2*
Which of the following applies to changes of level in controlled airspace?
[a] you should change level only when authorised to do so, and within one minute of receiving the instruction
[b] you must advise ATC of any change of level that you make
[c] you must advise ATC only if the level you change to is not in accordance with the table of cruising levels
[d] you may change level providing the level change was indicated on your flight plan

Question No 4 *AIP ENR 1.1 para 11.5.4*
When authorised to make a visual approach by day, the earliest point at which you can deviate from your assigned route is
[a] when you first have the aerodrome in sight
[b] when you are within 5 nm of the aerodrome
[c] when you are within 15 nm of the aerodrome
[d] when inside the control zone boundary

Question No 5 *AIP ENR 1.1 para 3.1 & ERSA EMERG 1*
When operating in CTA a pilot may leave an assigned level without approval if
[a] there is extreme turbulence
[b] the level assigned is not convenient
[c] the flight is VFR operation on a SARTIME
[d] VMC cannot be maintained and the radio has failed

Question No 6 *AIP ENR 1.7 para 4.1.6*
When instructed to climb at a 'standard rate' the rate of climb employed should be
[a] 500 ft per min
[b] not less than 500 ft per min with the last 1000 ft at 500 ft per min
[c] the best climb rate for the aircraft type
[d] at 500 ft per min with the last 1000 ft not less than 500 ft per min

Question No 7 *AIP ENR 1.4 para 6.1.1*
One requirement when flying in a lane of entry is that the aircraft shall
[a] remain below the upper limit of the lane
[b] request a clearance before entering the lane
[c] keep to the left of the lane
[d] keep to the right of the lane

Question No 8 *AIP ENR 1.1 para 67.2.2*
If you are a SARTIME aircraft, ATS will

[a] provide you with traffic information
[b] provide you with separation from other aircraft
[c] request regular position reports while you are in controlled airspace
[d] cancel your SARTIME when you request it

Question No 9 *AIP ENR 1.1 para 27.1.1*
Which of the following clearances in not required when operating at Class D aerodrome?

[a] take-off clearance
[b] landing clearance
[c] clearance to cross or taxi along any runway
[d] all of the above

Question No 10
The following information is displayed on your maintenance release:

Expires 30/7/2005 or 2550 TTIS [Total Time in Service].
Aircraft TTIS at time of issue 2450.
Maintenance required - propeller overhaul 2490.
TTIS at the daily inspection on 8/6/2005 2460.
The hours of operation available at the time of the daily inspection on 8/6/2005 are -

[a] 100 hours.
[b] 50 hours.
[c] 70 hours.
[d] 30 hours.

Question No 11
The hours of activation of D456 are:

[a] from 6.00 am to 6.00 pm every day.
[b] from end of daylight to beginning of daylight on week days.
[c] from beginning of daylight to end of daylight on week days and Saturdays.
[d] from end of daylight to beginning of daylight every day.
[e] from beginning of daylight to end of daylight every day

Question No 12
The hours of activation of D527 are:

[a] from 6.00 am to 6.00 pm every day.
[b] from sunrise to sunset on week days.
[c] from sunrise to sunset on week days.
[d] from sunset to sunrise Monday to Saturday.
[e] from sunrise to sunset every day except Sunday.

ANSWERS

1 [d]	*2 [a]*	*3 [a]*	*4 [b]*	*5 [d]*	*6 [b]*	*7 [d]*	*8 [d]*
9 [d]	*10 [d]*	*11 [c]*	*12 [e]*				