1 INTRODUCTION

This tutorial is specifically designed for Microsoft Flight Simulator pilots flying VFR flight in the UK. It is part of a series of tutorials being produced by the Cix VFR Club.

If you are confused by any issue, Cix VFR Club members may post a message in the Cix Conference or Web Forum, or email the Club CFI (see web site), and we will try to clarify any points you are having difficulty with. Because you don't have the benefit of an instructor to bounce questions off, you are actively encouraged to discuss the material in this way.

Basic Navigation Theory for Flight Simulator pilots is covered in Exercise 16, and Practical VFR Navigation is dealt with in Exercise 17. This tutorial moves on one stage and describes how put this information into practice by setting off on a cross country navigation exercise.

2 STANDARD JOINING PROCEDURES

Having read Exercise 19, I hope you are now totally convinced of the need to plan your joining procedure. There are four standard joining procedures which are used in British civil aviation: -

- The downwind join,
- The base leg join,
- The straight in approach, and
- The overhead join,

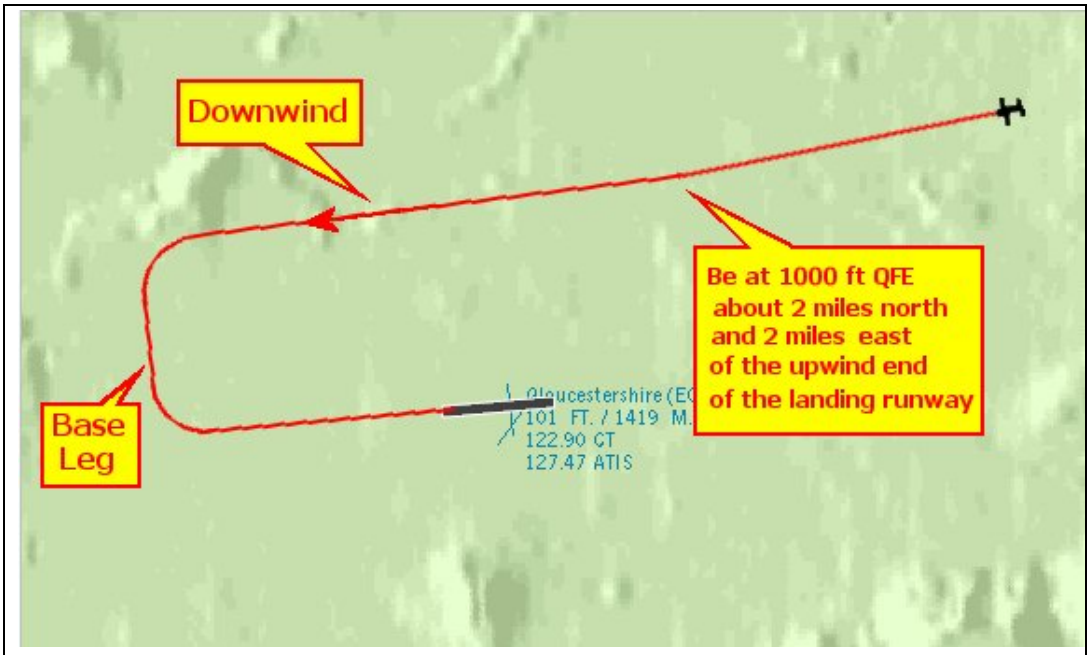
2.1 The Downwind Join

2.1.1 The Left-Hand Downwind Join

The downwind join is probably the simplest of the four approach methods. Let us plan an approach to runway 09 at Gloucester. The circuit direction for 09 is published as being left-hand, so that's what we will prepare. The very first question is "on what heading will I approach the airfield?" For 09 the downwind heading in nil wind is 270°. So your approach heading should be within 30° either side of 270°, and you should plan to turn onto the downwind leg of the circuit about 2 miles east of the runway.

This means positioning about 2 miles north of the airfield as well as east of course. If you can find a suitable identifiable feature on the chart, you could look for that, but more commonly you will estimate the 2 mile position North and east of the upwind end of the runway. You also should make sure that you know which is the upwind end.

Don't fall into the trap of thinking that "of course I know which one that is". Make sure you know that it is the end with the numbers 27 painted on the tarmac.

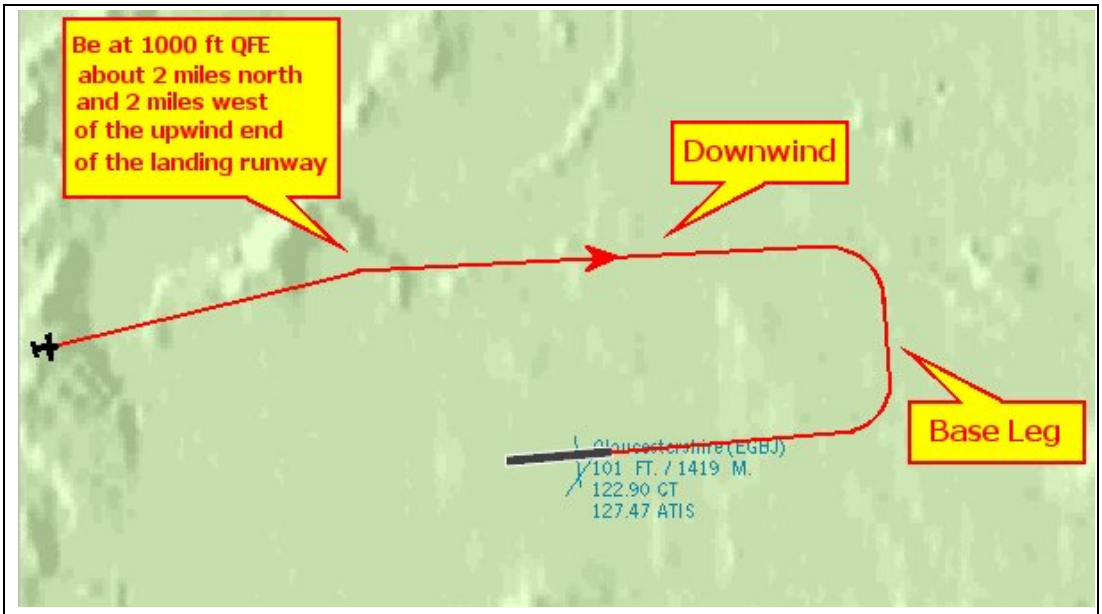


Left Hand Downwind Join for Gloucestershire Runway 09

You may think that I'm describing the procedure so simply that a child could understand it. Make no mistake, I am! You would be amazed how many pilots make simple errors such as approaching to land on the wrong runway.

2.1.2 The Right-hand Downwind Join

For runway 27 right-hand at Gloucester, again build the picture in your mind. Establish the mental image and confirm to yourself that the downwind leg is to the north of the airfield and on a heading of 090°.



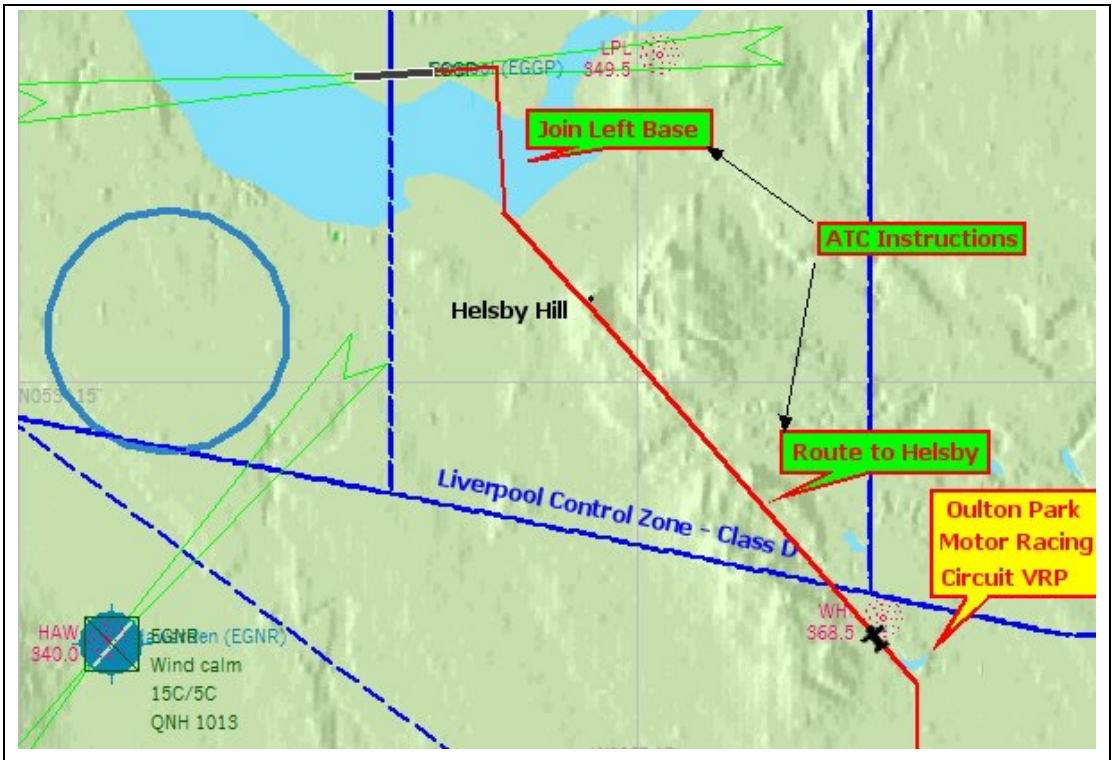
Right Downwind Join for Gloucestershire Runway 27

2.2 The Base Leg Join

Base leg joins are commonly used at larger airports where ATC wants the aircraft in the circuit for the minimum length of time. You will be given an instruction similar to "join left base for runway 27". If you are expecting a base leg join, then you must know where the joining position is in relation to the runway. The joining position is the same as it would be if you were flying the circuit and were on the downwind leg about turn onto the base leg. Remember from exercise 11, that the position at which you turn base leg is with the downwind end of the runway at a position to 45° behind you.

Put another way, the base leg joining position is 45° away from the downwind end of the runway, and at a distance from the runway of about 3 miles. You will approach this position on a heading 90° to the runway direction or up to 30° either side of this heading. If you approach the base leg joining position from an angle more nearly aligned with the downwind leg, or with the final approach track, you could confuse other aircraft and air traffic control as to your intentions. That is why joining on base leg should be done as nearly as possible at right angles to the runway.

You should be ahead of me by now and know that a left base join will require a left turn onto final and a right base join will require a right turn onto final.



Left Base Join for Liverpool Runway 27

In the diagram above, the whole of the approach is shown, from the point of entering the Liverpool Control Zone at Oulton Park Motor Racing Circuit (obvious from the crescent shaped lake which is there in the default scenery and shown on the map above). The left base join is actually only the last bit from the south bank of the River Mersey, over Hale village on the north bank (not shown), then turning onto final for runway 27.

2.3 The Straight In Approach

You may think that the easiest way to approach an airfield is straight on the runway centreline, the straight in approach, so simple in fact that a diagram isn't necessary! However, straight in approaches can be surprisingly difficult, requiring constant judgment of height and distance using only the visual clue of the runway itself – the "runway picture". For new pilots, this judgement can be very difficult and it is not an approach which is highly recommended. A straight in approach is rarely offered at a busy airfield,

This judgement of height and distance is helped by a simple rule, which was first mentioned in Exercise 13a, section 5 - as you descend towards the runway select an aiming point approximately one third down its length and keep that the point in the same position on the windscreen all the way to the

flair. Remember too, that in the light aircraft you control your descent speed by adjusting pitch attitude, and your rate of descent by the application or removal of power in small increments.

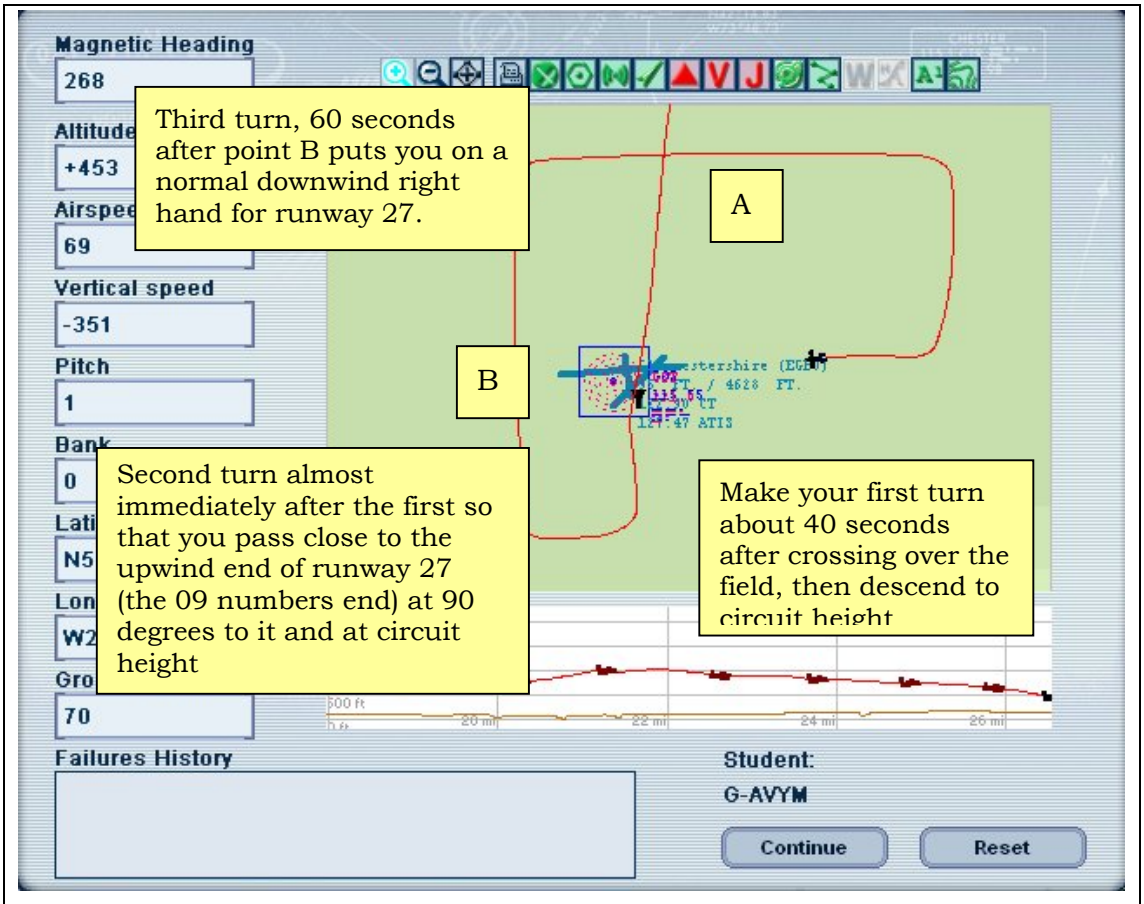
2.4 The Overhead Join

The overhead join is the commonest approach to a small relatively quiet airfield. However, it is rarely used at busy airfields surrounded by controlled airspace and used by large passenger aircraft. For many pilots it is the most difficult manoeuvre to do well, so we need to spend some time describing how to go about it.

2.4.1 Approaching Gloucestershire Runway 27 from the North

You always descend to circuit height on the dead side, which in this case is on the far side of the runway.

Runway 27 has a right hand circuit, so the procedure is as shown below.



A Good Overhead Join flown in FS9 for Gloucester Runway 27

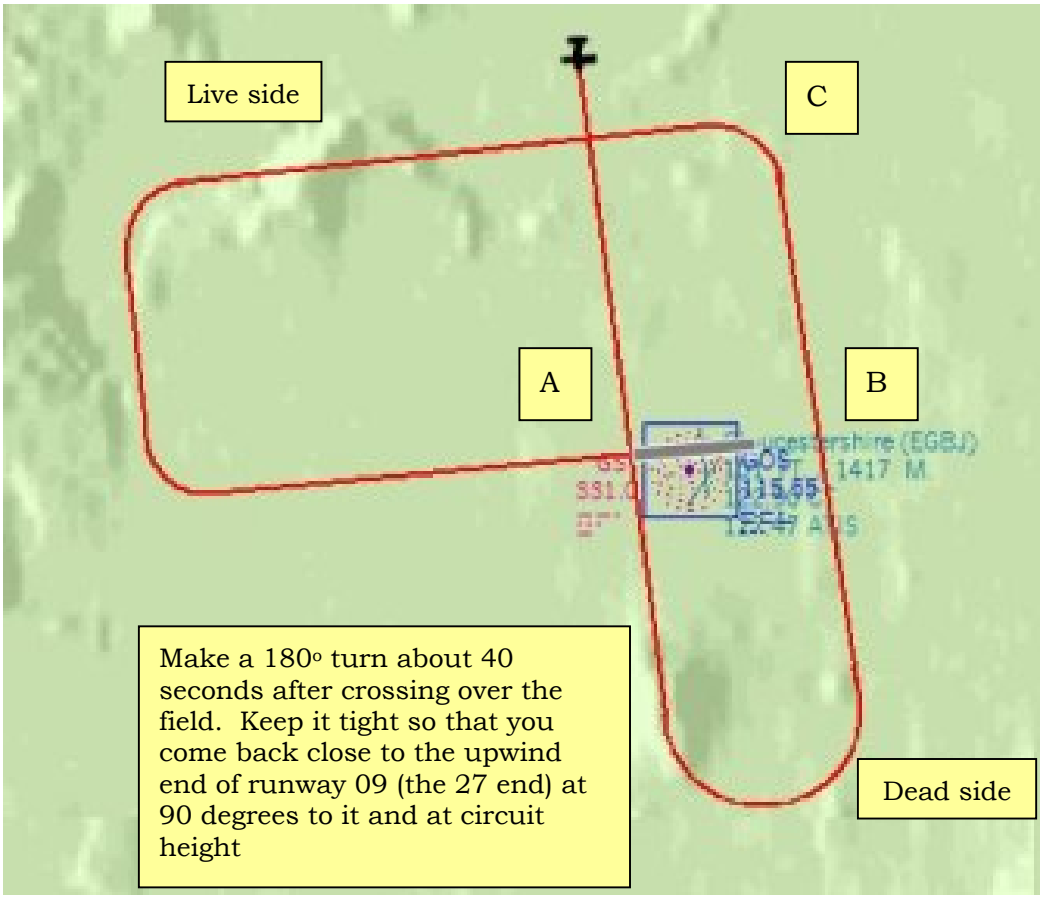
The aircraft should approach point A as near to 90º to the runway as reasonably possible at 2000 feet +- 50 feet on Gloucestershire's QNH, and maintain that altitude as you overfly the airfield.

Note that with a right hand circuit all turns are to the right and you keep the runway on the right at all times. Only descend to circuit height on the "dead side". The "live side" is always the side on which the downwind leg lies.

At point B, you should be able to look down and see the 09 numbers close to your aircraft. Notice in this example, the pilot has a slight tendency to drift towards the runway on base leg – a common fault.

2.4.2 Approaching Gloucestershire 09 from the North

Remember that you always descend to circuit height on the dead side, which in this case also is on the far side of the runway because the circuit is to the north of the field. The procedure is as shown below.



Overhead Join from the North for Runway 09

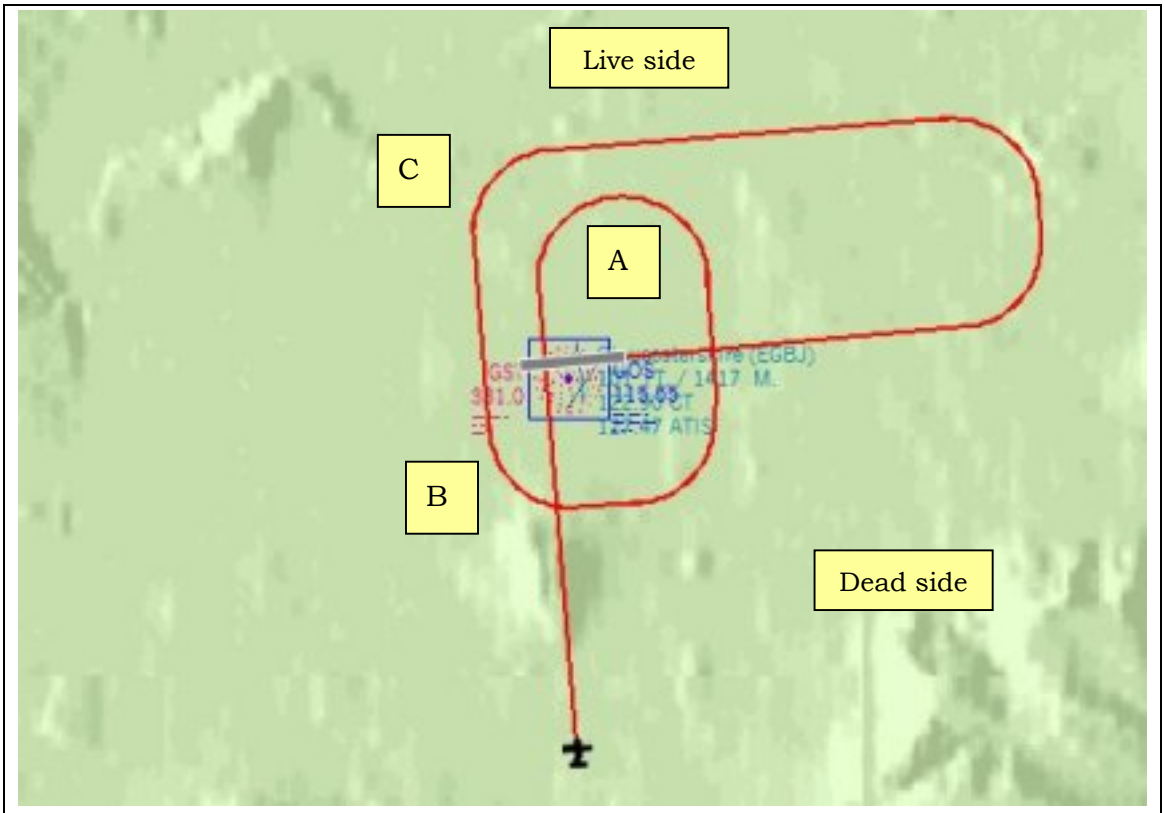
Once again, the aircraft should approach point A as near to 90° to the runway as reasonably possible at 2000 feet +- 50 feet on Gloucestershire's QNH, and maintain that altitude as you overfly the airfield.

Note that with a left hand circuit all turns are to the left and you keep the runway on your left at all times.

Necessarily therefore, you will cross the runway centreline at point B somewhat east of the end of the runway. After the 180° turn start the descent to circuit height so that at point B, you should be able to look down and left and see the 27 numbers. At point C, you turn left onto the normal downwind leg at circuit height.

2.4.3 Approaching from the South - Runway 27

You always descend to circuit height on the dead side, remember, which is on the south side of the runway for Gloucestershire's runway 27 right hand circuit. So you have to overfly the field then return to the south side before starting any descent to circuit height.



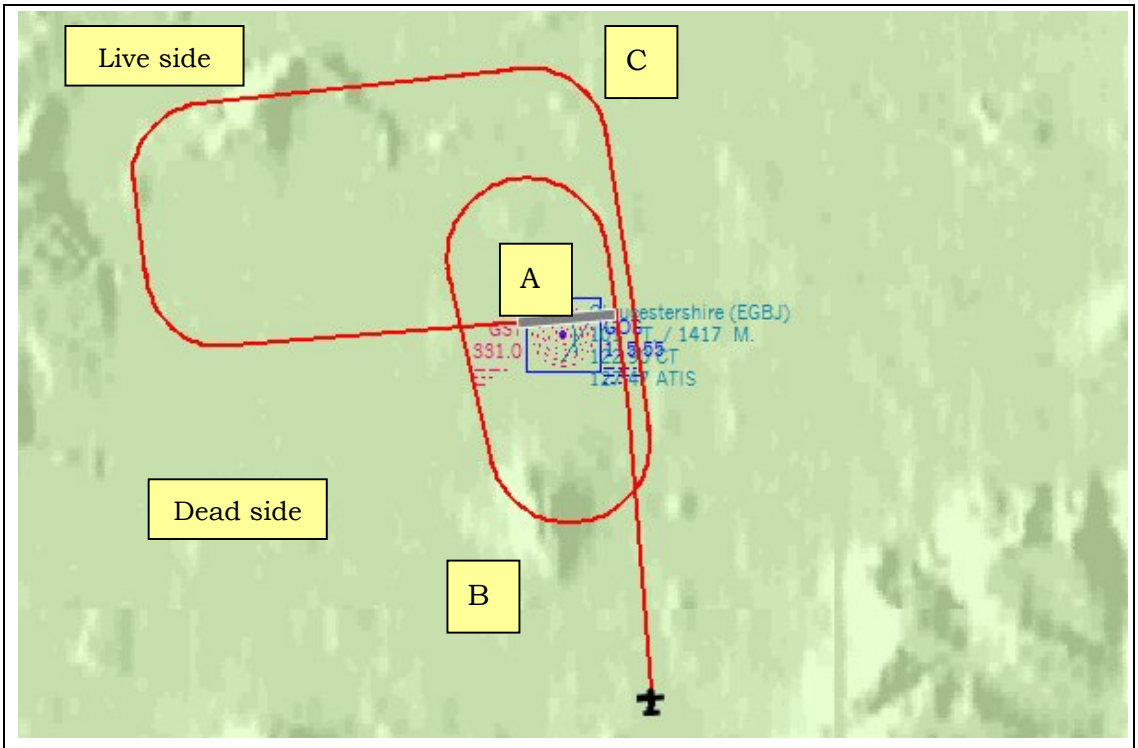
Overhead Join for Runway 27 from the South

At point A, about 40 seconds after crossing over the field, make a 180º turn. Keep it tight so that you come back as close to the 27 numbers (the eastern end of the runway) as possible, and at 90 degrees to it. You now cross to the dead side again, after which you turn right again and descend to circuit height, turning again at point B to cross the 09 numbers (the western end of the runway). By the time you have reached the position where you turn downwind, at Point C, you have flown a complete 360º round the airfield. This will always be the case where the dead side is between you and the runway.

For this reason, wherever possible when approaching an airfield where the dead side is between you and the runway, a downwind join is simpler. If ATC initially gives you an overhead join, you are quite within your rights to ask for a downwind join. Be aware though that traffic conditions may mean, for example, that the ATCO needs you to take that extra time joining overhead in order to provide separation between you and another landing aircraft ahead of you.

2.4.4 Approaching from the South - Runway 09

The approach for runway 09 is pretty much a mirror image of the approach to runway 27.



Overhead Join for Runway 09 from the South

At point A, about 40 seconds after crossing over the field, make a 180º turn. Keep it tight so that you come back as close to the 09 numbers (the western end of the runway) as possible, and at 90 degrees to it. You now cross to the dead side again, after which you turn right again and descend to circuit height, turning again at point B to cross the 27 numbers (the eastern end of the runway). By the time you have reached the downwind position at Point C, you have flown a complete 360º round the airfield. This will always be the case where the dead side is between you and the runway.

It is these manoeuvres involving 180º turns that confuse and disorient new pilots, and with only a computer screen instead of the ability to look around in 3 dimensions, disorientation is much more likely in Flight Simulator. The only solution is a lot of practice and a good mental picture of the flight pattern and where you are any time during the procedure. In addition the 180º turns have to be judged to stay within the ATZ boundary, and according to the length of the runway.

It can be calculated that at 100 knots and a bank angle of 17º, the theoretical diameter of a180º turn is 1.6 nautical miles or 2,570 metres. So for Gloucestershire's 27/09 length of 1421 metres, the turns need to be quite tight, but do not exceed 30º angle of bank. Steep turns at altitudes below 3000 feet or below are not permitted as there is an enhanced risk of the aircraft entering an unrecoverable spin if mishandled in that situation.

There is only one way to perfect joining procedures and that is to practice them. You can switch on tracking on the Map menu in FS9 and FSX, so you can see afterwards how you got on. It also useful to record the flight so that you can look at it again with a critical eye. Either the built in recording facility or the excellent and more versatile Recorder for FS may be used for this purpose. See http://www.fs-recorder.net