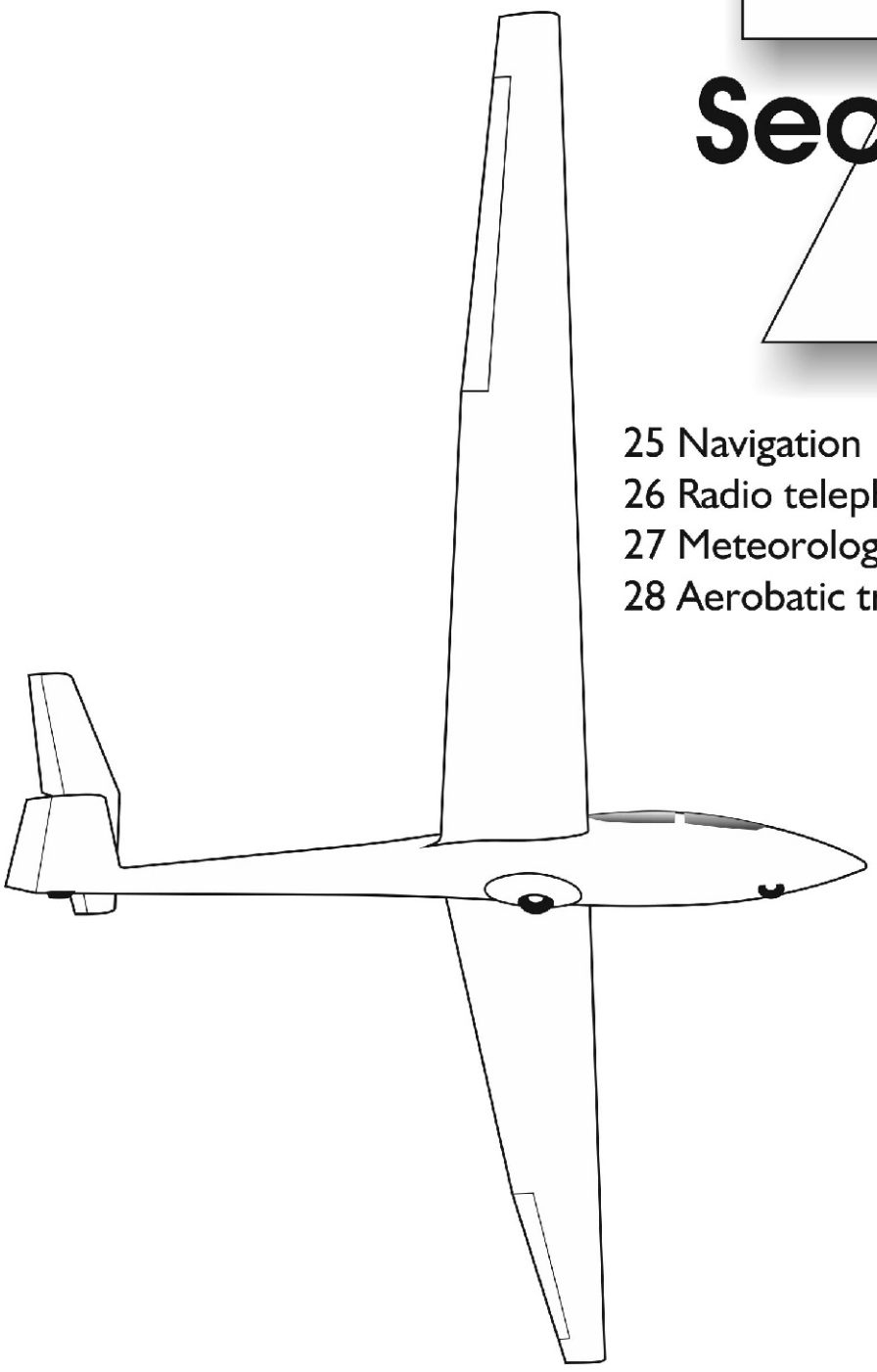
Section 7



25 Navigation
26 Radio telephony (R/T)
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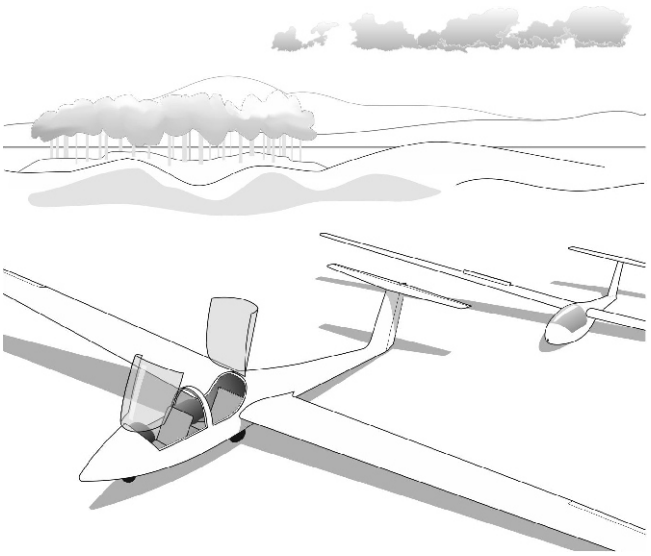


25 - NAVIGATION

This section is written with both instructors and their trainees in mind, and aimed at providing high quality navigation training for the latter; especially those about to embark on their Bronze and the cross country endorsements and on to their first solo cross country. It is split into five sections;

- (1) teaching the UK airspace structure including temporary airspace
- (2) planning a gliding cross country
- (3) use of charts and GPS
- (4) airborne navigation training
- (5) sending a trainee on their first cross country

UK Airspace and the AIP

UK Airspace is split into many different classifications, but there are two broad groups; the airspace you find on the 1:500,000 chart, and temporary airspace communicated by NOTAM (NOtices To Airmen). The definitive resource containing all the information you'll ever need, is the Aeronautical Information Package (AIP), found on the AIS (Aeronautical Information Service) website. The AIP covers classifications, altimeter setting procedures, details of all danger, prohibited and restricted areas, details of parachute dropping sites, charts of airspace and gliding wave boxes, and much more. It is worth delving into - lots of it applies to glider and motorglider pilots. In addition to the data on the AIS website, there is also much to be found around the edges of the 1:500,000 chart.

NOTAMs, which are in UTC and not BST, can be found on the AIS website (search for 'AIS NOTAM' in Google). You'll need to login, but it's free to register. A NOTAM decode is also available on the AIS site. Although the only 'official' source of information is the AIS website, it currently uses a 'text only' presentation that is particularly difficult to interpret and easy to misread. There are several alternative, unofficial, systems offering graphical representations. Whichever you use - take care. Before you start to rely on them, you need to be very familiar with the software and any quirks it has, and also confident about where the data comes from.

NOTAMs from the AIS website cover all short duration events or temporary changes to airspace etc. If you have checked the NOTAMs the night before flying, and wish to confirm that nothing major has changed that will affect your flight, you can call the AIS information line on 0500 354 802. This will list all major Temporary Restricted Areas, Airspace Upgrades, and Emergency restrictions on flying, possibly in the vicinity of an accident or incident. This line only supplements the information available on the website. It is not a replacement for it.

Altimetry.

There are a few ways of keeping yourself laterally clear of airspace; not least using the chart and the features to keep an eye on your proximity to airspace. We can also use a modern GPS moving map with the airspace marked on it to aid awareness of airspace boundaries. Vertically though, things are more complicated, with a confusing choice of reference levels for altimeter settings. The three in general use (see the grid below and figure 1) are all important, helping a pilot understand height above ground, or the airfield height in relation to airspace or separation from other aircraft.

Reference	'Q' Code	Phraseology
Airfield	**QFE**	Height
1013.2	**QNE**	Flight Level, or just Level
Sea Level	**QNH**	Altitude

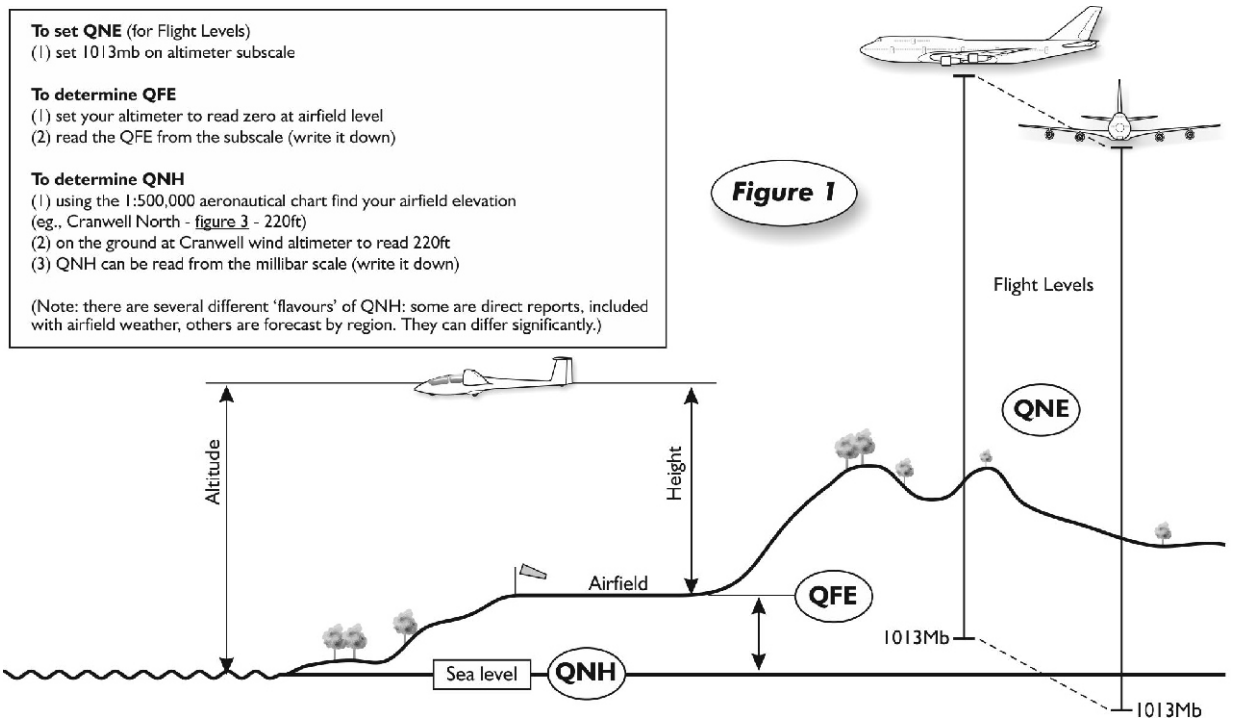
The BGA Bronze exam includes realistic questions which test a pilot's understanding of this issue. Many pilots find a diagram like figure 1 to be essential.

To set QNE (for Flight Levels)
(1) set 1013mb on altimeter subscale

To determine QFE
(1) set your altimeter to read zero at airfield level
(2) read the QFE from the subscale (write it down)

To determine QNH
(1) using the 1:500,000 aeronautical chart find your airfield elevation
(eg., Cranwell North - figure 3 - 220ft)
(2) on the ground at Cranwell wind altimeter to read 220ft
(3) QNH can be read from the millibar scale (write it down)

(Note: there are several different 'flavours' of QNH: some are direct reports, included with airfield weather, others are forecast by region. They can differ significantly.)



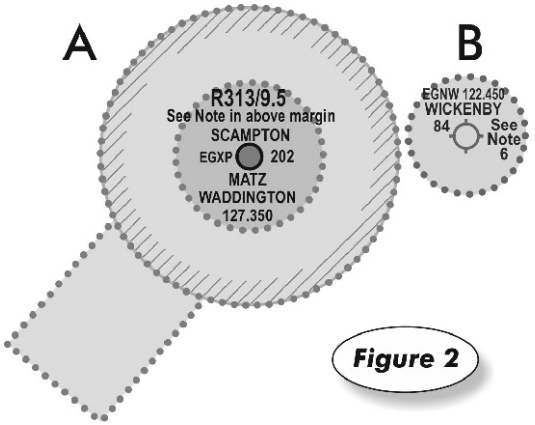


Figure 2

From a practical point of view, trainees must be able to manipulate and understand the altimeter subscale to help them keep clear of relevant airspace. There are, however, some simple rules which can help keep pilots out of trouble, especially with airways. Most, but not all airways operate on Flight Levels which float up with increasing atmospheric pressure, and down when it decreases. So, when climbing on a low pressure day, set 1013 early. If you remain on QFE, having taken off from a high airfield, it is possible for an airway to easily be 2000' or more lower than your altimeter indicates. Watch out!

Airspace classifications

Each of the different classes of airspace has rules attached. These can be found in the UK AIP (AIS website), and are summarised in the BGA's Laws and Rules. Every pilot must know the rules for the airspace he uses; most glider pilots spend the majority of their time in class G.

How to teach airspace awareness

One of the best and most practical ways to teach airspace and its numerous classifications is to use a 1:500,000 chart as a study aid. It can also be used as material to test a trainee's knowledge, by getting them to identify different map symbols and then asking five main questions:

- 1) what does the symbol/area denote?
- 2) can we fly in it?
- 3) how can we find out if it's active or not?
- 4) how high is the top or bottom of the area?
- 5) on what altimeter setting? QNH? QFE? QNE?

Figure 2 above provides a couple of examples:

- What is symbol A? A restricted area. Can we fly in it? Not when it's active. We can see from the map symbol that we can telephone Waddington before we go, or on 127.350 if we have an RT licence to obtain information. How High is the area? 9.5 means 9,500' above sea level (QNH), not above ground. When R313 isn't active it reverts to a standard MATZ.
- What is symbol B? An ATZ. What's the ATZ's radius and how high does it go? 1.5NM and 2000' QFE. Can we fly in it? At the very least we must speak to the airfield. For some permission is a requirement; see Laws and Rules.

There are many other examples one can use as teaching aids. Figure 3 on the opposite page illustrates both the flat map of the area to the south and south east of Scampton - which has a number of active airfields with MATZs (what are they?) - and a 3D view of the same area.

How about NOTAMS? Again, a practical method is to ask similar questions of an example day. Why not keep a printout of a day that was more complicated than most so that you can use it to pick out particular examples. Don't forget to make sure that if your pilot is to self brief, that he knows how to get the data off the web without help.

An important if little mentioned aspect of navigation is consideration for other users of the airspace. Something may well be legal, but doing it may cause problems. It is not illegal, for example, to pass through an extended centre line of an airfield with advisory ILS (used for instrument approaches), but lingering there to thermal is a bad idea unless you have permission from the local ATC.

Planning for a cross country in a glider or gliding motorglider

Meteorology

Before we start any sort of planning, we need to consider what is achievable and safe. This is based on the Met for the day, which is not the subject of this section. Suffice to say that there are a lot of resources out there, not least the F214 and 215s on the Met office website. Let's say for the purposes of this section that this is going to be a reasonable day that an experienced cross country pilot may plan for a 200Km flight.

NOTAMS

Having checked the weather, we will be aware of possible directions and distances. At this point it's probably the correct time to have a look at the NOTAMS to ascertain if there are any further restrictions which are not marked on the chart. Be sure to give your trainee adequate clearance from important restricted airspace. Have you briefed a different task if adverse Met is encountered? Has your NOTAM brief covered those areas as well? It's essential to mark Temporary Restricted Airspace or other relevant NOTAMs on the chart, even if it's not in the direction your trainee is going; they may change their minds.

Altimetery

Its always a good idea to get into the habit of writing down QNH and QFE on the chart or somewhere else handy. This will provide for a ready reference when needed on route, and perhaps on your trainee's triumphant return. QFE is essential for working out final glides.

Route

Based on the above, a route needs to be selected taking into account permanent and temporary airspace. Consideration needs to be given to proximity to airspace given the accuracy of a trainees navigational skills and the cloudbase on the day.

Badge flight considerations

It's obviously disappointing for a trainee to complete a badge flight when it is rendered invalid after you/they realise they have not followed the rules for claiming the flight. The FAI sporting rules do change from time to time to encompass changing glider performance and GPS recording technology. The Sporting Code is available online and gives the detail of what's required for badge flights.

R313 SCAMPTON

(Red Arrows Training) Restrictions are in force during the notified times, see UK AIP ENR 5-1, and when notified by NOTAMS. Information by radio to Waddington App. 127·350MHz. Non Radio Pre-Flight clearance, Tel:- ATC Waddington 01522 727451/727452.

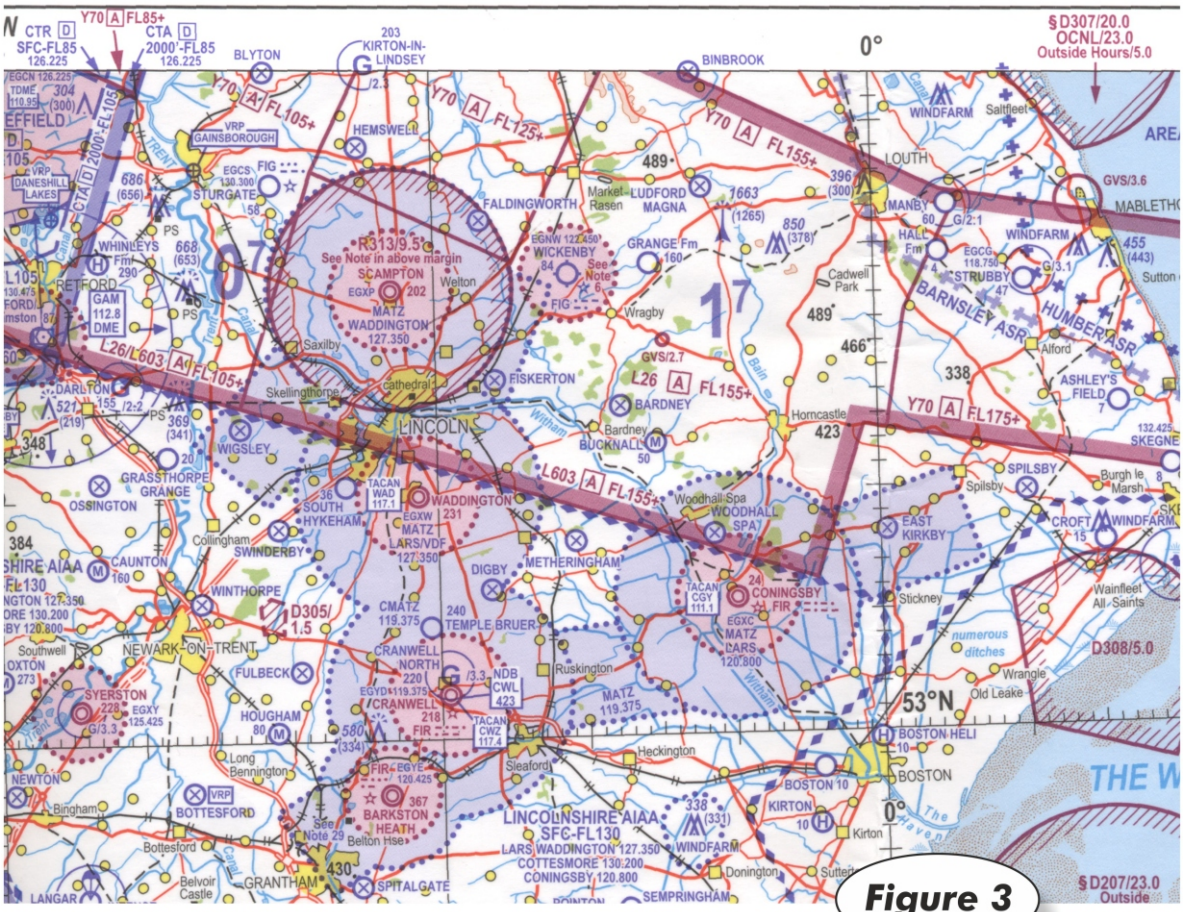
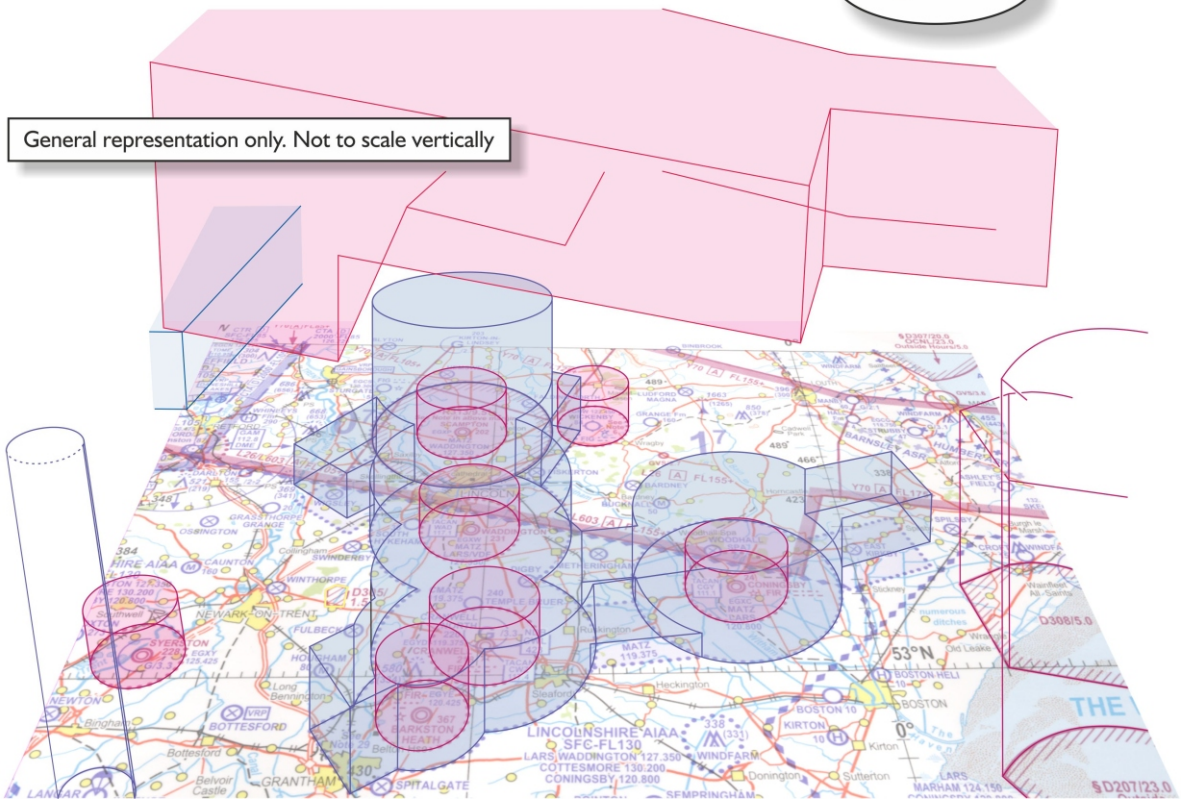


Figure 3



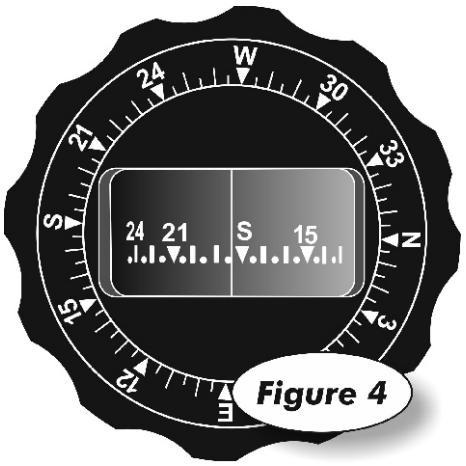


Figure 4

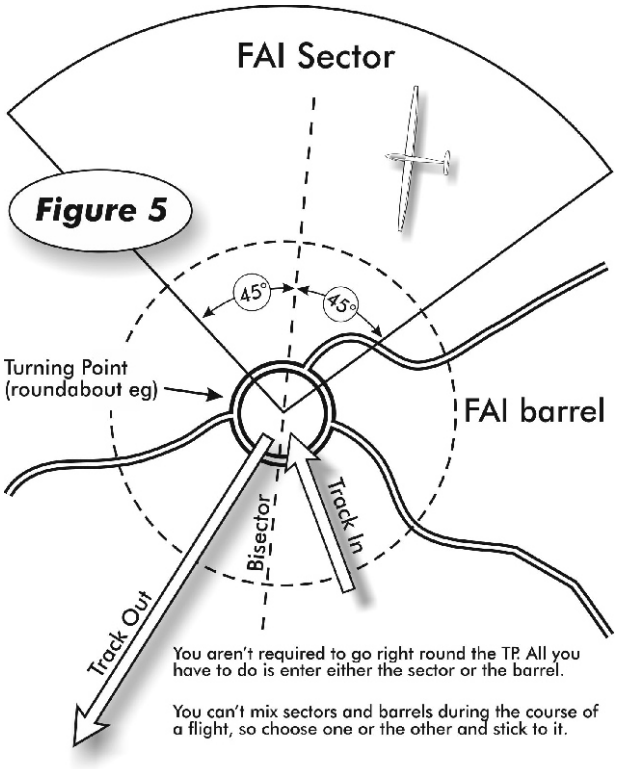


Figure 5

You aren't required to go right round the TP. All you have to do is enter either the sector or the barrel.

You can't mix sectors and barrels during the course of a flight, so choose one or the other and stick to it.

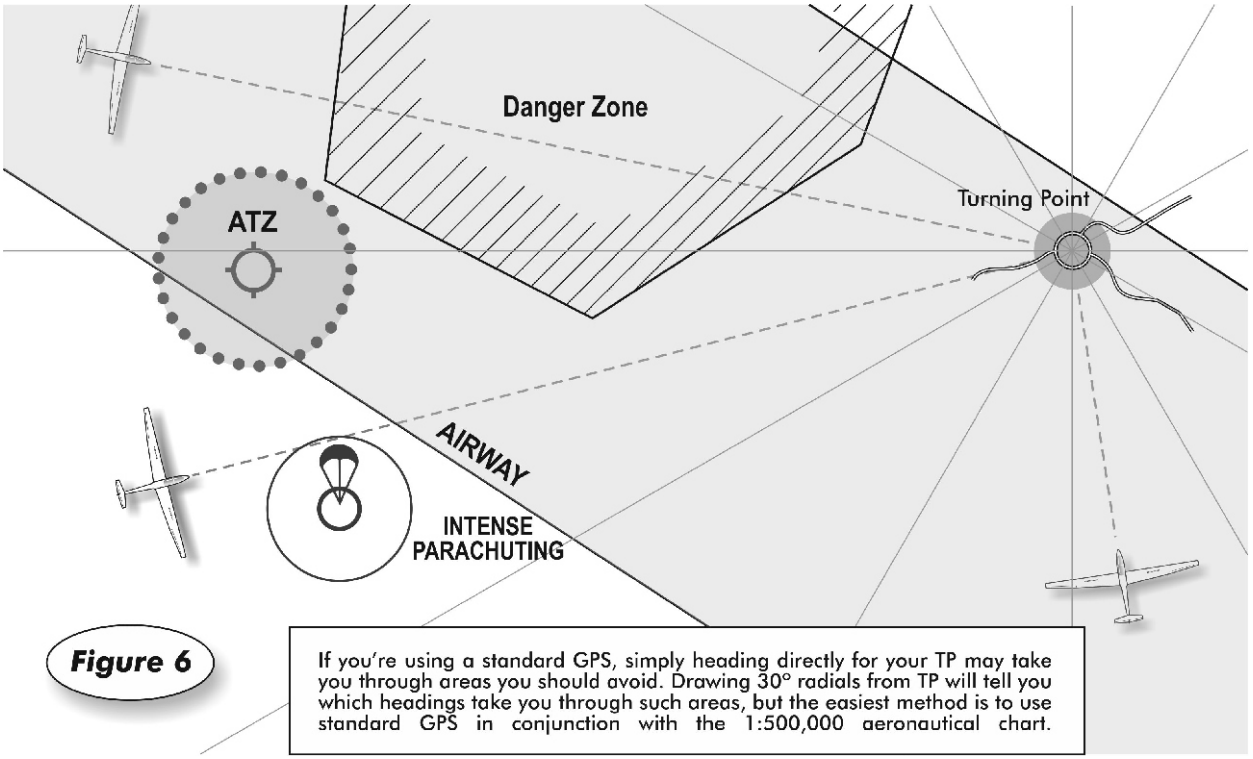


Figure 6

If you're using a standard GPS, simply heading directly for your TP may take you through areas you should avoid. Drawing 30° radials from TP will tell you which headings take you through such areas, but the easiest method is to use standard GPS in conjunction with the 1:500,000 aeronautical chart.

Broadly speaking, most performance flights must be declared, even duration in some cases. For any distance flight, there is likely to be a requirement to show a start in some way, and of course there are varying methods of proving that a pilot has rounded a turn point (500m barrel or 90 sector - figure 5). For some flights there is a requirement to finish within a particular height band, and there is, of course, the 1% rule for Silver distances.

Just to clarify the 1% rule, if a pilot flies exactly 50km, and lands in a field that is the same height as the airfield, that pilot can only launch to 500m (because that's 1% of 50,000m or 50km). 500m X 3.281 = 1,640ft. They cannot take the 'classic' 2000ft launch. If they did they would need to land 61km away. Of course, if they are flying out and returns, or triangles, the rules are different. Refer to the FAI sporting code handbook.

Navigating with Chart, Compass and GPS

Something about Charts

It is a legal requirement to carry charts suitable for the intended flight. There are many charts to choose from, but a motoring map certainly isn't one of them. Charts are usually classified by scale and description ie., 1:500,000 (half million) Aeronautical (figure 3) and 1:250,000 (quarter million) Topographical. The UK is covered by three 1:500,000 charts, which overlap slightly and show all Controlled Airspace, Danger Areas, Restricted Areas, Prohibited Areas, MATZs, Airfields (used and disused), and many other features. Anything of a temporary nature is not shown - you need to refer to the NOTAMs for this sort of detail. Each 1:500,000 chart has an extensive legend and narrative which provides information about all the symbols and features displayed. The 1:250,000 chart has a less extensive legend and narrative, and the scale means that eight of them are needed to cover the UK. It is highly unlikely that you will ever need to purchase them all.

The 1:500,000 chart is essential as they show all relevant airspace; the 1:250,000 only shows airspace up to 5000'. However, some pilots like the level of detail found on the 1:250,000 chart. These charts show more detail of airfield layouts and every curve in every road. They also show country roads, so can be useful for landouts. However, for most navigational purposes (particularly when visibility is good) they contain too much detail.

It is important to have the latest issues. The latest chart will show any recent alterations to controlled or restricted airspace - information which is essential to avoiding infringements. All the charts mentioned, apart from the road map, have a Latitude and Longitude Grid, but the 1:250,000 also shows the Ordnance Survey (British National) grid. Only Latitude and Longitude grids gives the direction of True North. [Information on amendments and updates is available in the 'Airspace' section of the CAA's website *www.caa.co.uk*].

Folding a chart can be a bit of a black art. Suffice to say that there are sections on how to do it in some of the popular cross country books. It is best if a trainee doesn't have to re-fold a chart during flight.

When navigating, it's best to study features on the chart and relate this to features you see ahead (or in the direction of your track). It is sometimes easy to make what you see ahead fit what's on the chart, particularly if you aren't quite sure where you are. This leads to obvious navigational blunders.

About the compass

The magnetic compass (figure 4) may seem like an outmoded method of working out your heading, but it is still useful. In a strong wind, especially flying slowly, your GPS track can be very different from your heading. In wave, with a strong headwind it is possible to fly any track over the ground you like, while heading in almost the same direction! Therefore the compass is still useful to orientate oneself with surroundings.

It is also a backup navigation device in the not entirely unlikely event of a GPS failure.

Operation

True North is a fixed point related to the earth's axis of rotation. It's not much good for navigation because, unlike the Sun, it can't be seen. By contrast, Magnetic North can be seen at all times, if only by magnets and magnetic compasses, but they have their drawbacks. For example:

- over the years Magnetic North wanders slowly and randomly around the Geographic (True) North Pole
- the Earth's magnetic field is weak and easily swamped by local fields created by ferrous (iron-based) materials in the glider's structure, or the instruments, or electrical circuitry. The resulting errors are called Deviation Errors. They are compensated for by adjusting small inset magnets there for that purpose.

Variation is the difference between Magnetic and True North. Variation changes. The current (2010) Variation is West. All aviation maps show the Variation in degrees and minutes at different latitudes - usually alongside hatched diagonal lines at the top of the map. The aeronautical charts also include the date when the Variation was exactly as stated. Tracks and headings are usually expressed in terms of degrees Magnetic (M), rather than degrees True (T).

The Earth's lines of magnetic force converge at the magnetic poles. There is a 3 difference in Variation across the widest part of the UK, from Harwich to St David's Head. In Southern England this has some small effect on long cross-country legs which lie largely east/west, but the earth's curvature exacerbates this problem the further north you go.

As well as being subjected to deviation errors, magnetic compasses are affected by manoeuvring accelerations, though by how much and with what result depends on the type of compass. Bohli compasses are relatively unaffected, whereas the standard panel mounted compass seems to make no sense if you circle, and takes a few moments to settle down once you've levelled out. They are accurate only in straight, unaccelerated flight. Nonetheless, even during a turn their bizarre behaviour follows a predictable pattern, and in principle you could still use it to roll out onto approximate headings.

Using the Sun

Just like a magnetic compass, the sun helps us to point in the desired direction. It is even more reliable, never needs adjusting, operates just fine when you're turning or changing speed, and similarly fears nothing of flat batteries. It is utterly predictable. For example, it will indicate south west at 1500hr GMT on day 3 of the 2050 Nationals. It is however defeated by overcast. It is hardest to use when very high, such as Southern England in mid-summer, but can be literally in your face when wave soaring.

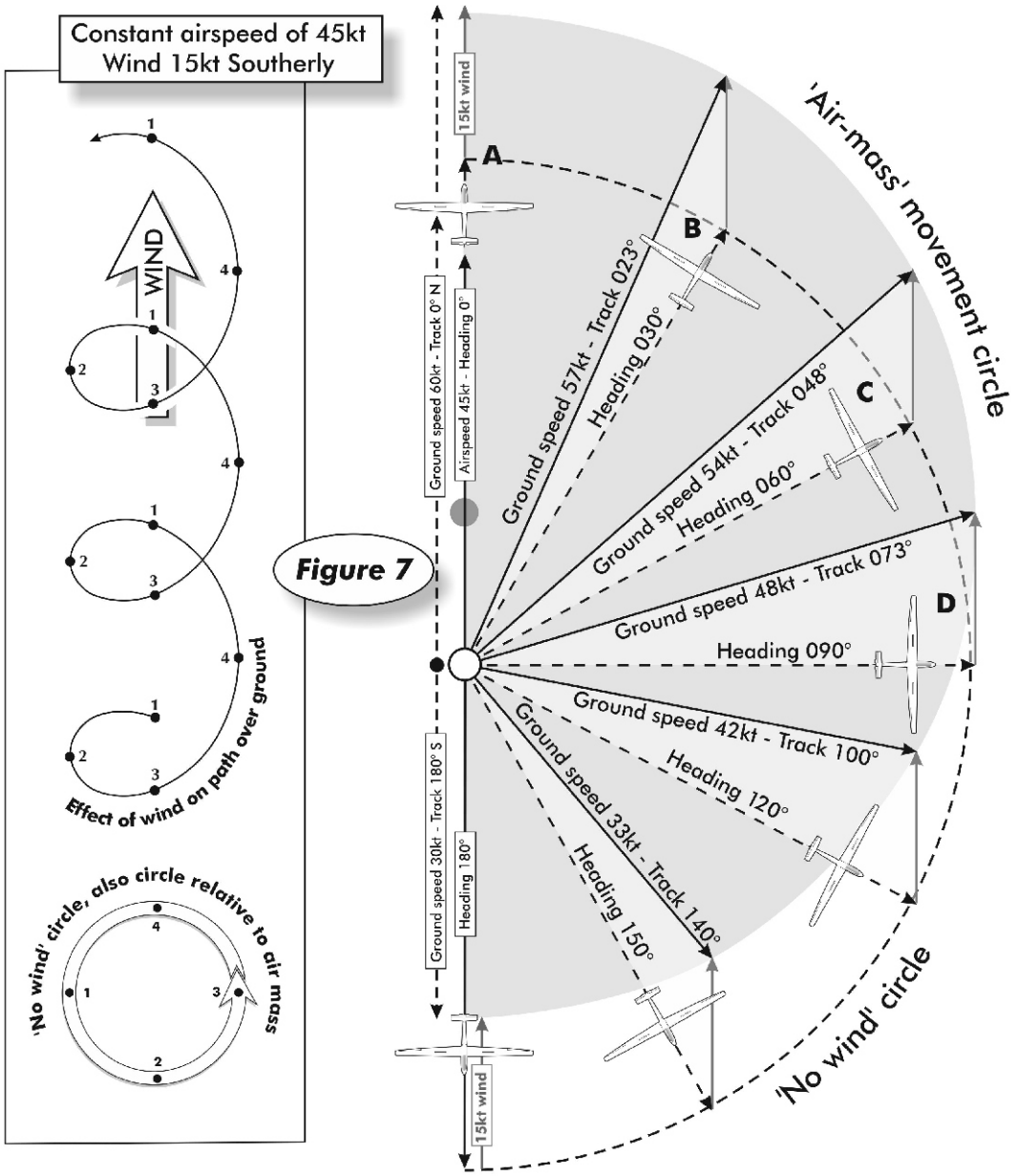


Figure 7

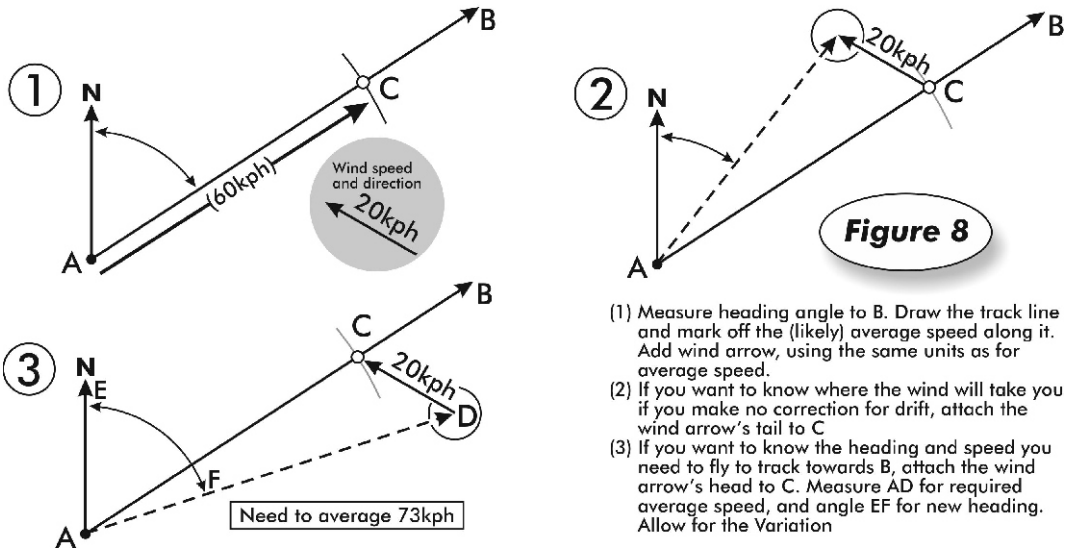


Figure 8

(1) Measure heading angle to B. Draw the track line and mark off the (likely) average speed along it. Add wind arrow, using the same units as for average speed.
(2) If you want to know where the wind will take you if you make no correction for drift, attach the wind arrow's tail to C
(3) If you want to know the heading and speed you need to fly to track towards B, attach the wind arrow's head to C. Measure AD for required average speed, and angle EF for new heading. Allow for the Variation

Very coarse navigation hint; because many glider cross countries take place on summer afternoons, during most of the time a trainee is navigating the sun's position can be considered to be in the south to south west(ish) quarter.

About GPS

GPS is now an almost universal tool for airborne navigation. The unfortunate truth is that many pilots rely almost exclusively on their moving map. They may carry a chart only to comply with the letter of the law, but it is referred to less often than is ideal. Pilots that do this are at a great disadvantage. It is all too easy to misuse your PDA/PNA and end up turning off airspace or other vital information when you will really wish you hadn't! There is a solution

- keep your chart handy and use the GPS to update your position on your chart. A glance every few minutes will serve to convince you that you are clear of airspace and on track, and you have your GPS as a backup in case you miss something.

Moving maps

There are many options available to put a moving map onto a PDA or car navigator (PNA). Glider pilots love their gadgets, and there are many different variants of devices and software from which to chose. In the author's experience, however, they do seem to lock up and require messing about with reasonably often. This leads to pilots panicking because they have come to rely in the gadget, and then becoming completely lost when the problem, whatever it is, can't be resolved. If you can find a reliable system, however, these gadgets are wonderful for keeping pilots out of controlled airspace and on track. Its important to have the latest airspace file.

GPS without moving map

Standard GPS seems to be falling out of favour within gliding, as these units simply compare track and bearing to a waypoint. While this will always point you at the waypoint (airfield or turn point), it does not tell you your location as you make progress, unless you draw distance radials and bearings to the waypoint. (figure 6). This means that if you rely on it, GPS can take you straight through controlled airspace to your waypoint. Not what you want! If you can find a reliable moving map system, these are more useful. Equally, if you only have the standard GPS it isn't difficult to use it in conjunction with the paper map which the law requires you to carry. At least you'll then know where you are, where you're going, and what to avoid en-route.

Bringing it all together

Correcting for drift

Drift is the effect of the wind on a glider's track, as described in chapter 9. The difference between track and heading is greatest when the wind is at right angles to the heading. The effect on the glider's ground speed is greatest when the glider is heading either directly into wind, or downwind. Figure 7 shows how the wind affects a glider's track over the ground. The spiral on the left of the figure shows your course over the ground when you circle and inevitably drift away downwind.

The right hand section of the figure shows heading and track in no wind conditions - the dashed circle and dashed lines - and heading and track when there is, in this case, a 15kt southerly wind - the greyed circle and the solid lines. The glider is assumed to have started from the white circle, and flown at a steady 45kt in a dead straight line through the air mass, along one or other of the various headings. When the air mass moves, as it does when the wind blows, the glider is carried along with it, and this creates drift, which is the difference between **heading** (direction in which the glider is pointing) and **track** (direction in which the glider is moving over the ground).

When calculating drift corrections, make a few initial 'guesstimates' on the ground, before take-off. It is possible to use the wind triangle method, but this is best done before a flight. The wind triangle is a scale drawing done using a pencil, a rule, and a protractor, and requiring no arithmetic (figure 8). It's not as difficult as it might look from the figure. The only real complication is deciding which units of measurement to use.

Cross country flights are not predictable in anything other than the broadest sense, but taking time beforehand to work out drift corrections does give some guidance for the flight, and will help 'find you' if you get lost.

Teaching trainees how to navigate while having sufficient knowledge of airspace, along with how to use charts and GPS, is a complicated subject that will likely require more than one practical demonstration.

Motor glider instructors are faced with a dilemma. Accurate simulation of soaring conditions ie., lots of circling, takes a lot of flight time and so is expensive for the trainee. On the other hand teaching power style navigation with much emphasis on headings and times would similarly waste a glider pilot's money. Glider techniques must be taught while expense is minimised.

Most pilots still flight plan on a chart, but some use computerised methods on a PDA or a PC. You now know where the airspace is, you have the weather and NOTAMS, so can plan something in a particular direction and length. Start by identifying turning points and your home airfield (you can print out a list of turning points and their descriptions from the web). Draw lines on the chart, and check proximity on route to airspace. Remember that if you are struggling, you will be drifting downwind. Do you have enough leeway from controlled airspace if that happens? Mark airspace that is likely to be problematic with a red pen to make it stand out. Write the track directions on the chart in case the GPS fails, and perhaps also mark distances to the goal, so that a rough calculation of a final glide can be carried out. Draw a wind arrow on the chart based on today's met', so you'll know which side of the track to favour and which way you'll drift when struggling. Remember to note QNH and QFE and any other useful information on an out of the way bit of the chart.

Find the likely cloudbase (normally forecast but surprisingly easy to work out) and consider airways over or near the route. Note their bases, taking care to distinguish between altitudes (QNH) and levels (1013), and be clear about which pressure setting you intend to use. Remember that use of QFE, or QNH on low pressure days can lead to dangerous misunderstandings about flight levels.

Flying

Training a trainee to fly a glider cross country is a complicated affair. We will concentrate in this section teaching the navigation part in a motorglider, which is a great tool for teaching in all sorts of weather.

Before getting airborne it is important that the trainee understands what he is responsible for during the flight. It is

usual to start off by talking the trainee through how you would navigate, using ground features and headings, and how to use the chart and GPS together. Normally the MG instructor will do the take-off and landing, manipulate the throttle and engine controls, and be responsible for fuel management. Perhaps your trainee will be in charge of flying and navigation between takeoff and landing. It may be a collaborative effort. Throughout, the MG instructor must never let his own navigation and handling slip.

Make time before launch to assimilate all the information you and your trainee has in front of you. That way you can make a positive start to your cross country. Know a ground feature to head for without having to resort to the chart or GPS on the first bit of the first leg.

Finally we find ourselves airborne with our trainee. We can relax, confident that we have planned the flight well, and we don't have to worry about missing anything.

Point out relevant features to use for navigation, and how those features change as we make progress. If in a motorglider:

- wherever appropriate simulate thermalling, and the differing heights associated with thermalling across country
- use ground features to mark the edges of controlled airspace and emphasise the importance of staying clear.
- make sure the trainee doesn't micro navigate round the country;
  - try to use large distant landmarks
  - point out the use of the compass
  - fail the GPS for a leg and show the trainee that it is perfectly feasible to continue by using the chart
  - try to get the trainee lost at some point, and make sure they can find themselves again using the chart alone.

If possible, use the GPS unit that the trainee is likely to use on their first cross countries. This may mean that you have to learn how to use it first.

It might help (views differ on this) to orientate the chart in the direction in which you are heading. The place names may then all be upside down, but at least the chart will bear a more direct relation to the world outside. It can be easier, after a bit of practice, to keep the chart 'North up' whatever your heading.

WHAT TO DO IF LOST

Reading a map isn't a difficult trick once you know how, and some people are naturally much better at map-reading than others, but it does require practice. The true test of map reading ability is to be able to find yourself again when you are well and truly lost. Look at the world and fit that to the map, rather than try to fit the map to the world.

Advice to trainees

First, you have to admit that you are lost. If you don't, and flounder on hoping, perhaps, that some voice from above will tell you the way, then you will probably stay lost. Having decided that you are lost:

- check the compass heading when flying straight. Have you been going more or less in this direction since your last fix? A fix is when you last knew exactly where you were. A series of errors could mean that the last fix is wrong, and that you've been 'lost' for quite a while. Don't automatically assume this is so.
- your last fix is likely to be behind you, depending on any crosswind component, if your course has been more or less constant. Have a look.
- how long since that last genuine fix? 10 or 20 minutes?
  - If you've maintained a fairly constant heading since then, work out roughly how far you've flown in the time; half a mile/minute is a good rule of thumb. On the map, locate your last fix. Project a line from it, along the heading you believe you've been flying, for the distance you think you've flown (allow for drift)
  - you should be somewhere within a fuzzy circle, radius approximately 10% of the distance flown since the last fix, centred on the end of your projected line.

If this is within or near controlled airspace, either land if there are suitable fields, or fly a suitable course to get you quickly out of the area.

There is good help available, if you call for it, on 121.5. It is designed for pilots who are, or may be lost; the controllers are well used to fumbling radio calls, and welcome the training. Even better, it is utterly free. Right from the first transmission, a call for help demonstrates that a pilot is being mature about his problem. Best of all is the fixing service; given nothing more than your transmissions, they have the technology to work out where you are. If you are happy with the radio, 'London Centre' is their call sign. Call and tell them that you are lost and need assistance.

(Sorry Scots, this fixing service is available over England and Wales only. Still, 'Scottish Centre' are also waiting, on the same frequency north of the border, with all sorts of help available).

If you are well clear of controlled airspace:

- look around for a prominent landmark ie., a lake, a large town, hills etc. Note a clear, secondary feature and its relation to the first.
- use the position of the Sun to help orientate yourself.
- look at the map and attempt to locate the first feature - at approximately the right distance from the 'fuzzy circle', or perhaps within it.
- still looking at the map say (eg), *if that is Northampton I'm looking at, then I should be able to see a motorway to the West of the town, and a large U shaped reservoir to the North* - one of these could be your secondary feature. Remember that what you are able to see will depend on the visibility, your altitude, and the direction from which you are looking at the main feature.
- if the features are visible, and in their correct relation, make further checks to be sure. For example, there should be a river and a number of small lakes to the South of the town.

If none of the features check out in relation to each other or the map, look out at the features once again (or choose different ones), and then go back to the map and attempt to make another identification, following through the steps as before.

Use of the radio

An R/T licence is not a requirement for cross country flying or to use gliding frequencies (details from Laws and Rules). Indeed, radio invokes a significant increase in a pilot's workload. Possession of a licence, however, can help a pilot access extra airspace and airfields. Occasional unlicensed calls made to achieve safe landings have not been known to cause complaint. (See chapter 26 for more detail)

Sending a cross country endorsed pilot on a Silver distance attempt

After all the training received above, your prospective silver distance pilot should be well prepared to take on this challenge. In practice however, it is possible that considerable time has passed before attempting this solo cross country. If you have any doubts, it's as well to refresh the candidates skills as appropriate.

Before sending your pilot off, please consider the following check list:

- Is the trainee Cross Country endorsed?
- Is the weather suitable and the cloudbase high enough?
- Is the trainee personally prepared with all the kit required?
  - food / water / phone / clothing / sunglasses / hat?
- What are the field landing conditions like?
  - has the trainee practised field landings at this time of year?
- Adequate experience on aircraft type?
  - have they flown the type sufficiently often to get it into a reasonably small field if required?
- Local club rules complied with?
- Have they checked the NOTAMS?
  - are they aware of those that may affect their route, or be relevant if they stray off track or decide to do something different?
  - as a final check - AIS phone line on 0500 354 802
- Maps marked and airspace considered?
- Logger on?
  - and do they know the sporting side of the flight starting/turn-points etc.
- Where are the car keys/ trailer readiness/ crew?
- Does the club have a Search and Rescue book so the duty instructor knows who are flying cross country and approximate directions?
  - has your pilot signed it?
  - does he understand the system?

COMMON DIFFICULTIES

Can't see it!

Getting lost is very easy. Pre-solo and early solo pilots can be directly over their home site in conditions of near perfect visibility, and still not have the faintest idea where they are. Poor lookout, or simply not keeping track of where they've been for the past half an hour, is part of the problem. A few of the items that contribute to not keeping track, at least for pre-solo pilots, are:

- the workload is already high. Centring, finding a thermal, keeping out of everyone else's way etc etc. By comparison knowing where one is assumes a lower priority - if it figures at all. This applies whether the trainee/pilot is solo or not
- in a two-seater the trainee simply assumes that because you are in charge you must know where you are, so there's no need to duplicate the effort!
- less excusably, you may be talking and advising too much, and so are effectively doing everything.

As part of their lookout, encourage trainees to orientate themselves in relation to the site. Local landmarks with distinctive features - a curved lake, perhaps, or a church, or a particularly long and straight stretch of road through a large wood, and so on - should be pointed out; in particular how they lie in relation to each other. Map reading (relating what is visible on the ground to what is on the map) should then be a relatively straightforward extension of the situational awareness developed by observing the local area. Don't be surprised if it isn't.

The most obvious but not always remarked point about relating the world to a map is that the world is neither flat nor particularly symbolic. One of the few times when you genuinely see the map's point of view is when you are turning and can look straight down; all other views are more or less oblique. Assuming limitless visibility for the moment, these are the some of the results:

- as you descend, the view flattens and foreshortens. The opposite happens as you go up. In either case, the apparent distances and angles between navigational features change (figure 9). Note in particular that the right angle corners of the map view are only so when the 'map' is seen from directly above. The more oblique the viewpoint, the less these angles look like right angles. Trainees may not recognize them when they see them
- the lower you are, the more restricted the area you can see. The horizon is closer. Distant objects can be obscured by nearer ones (which can mean that you are very low indeed)
- tall objects, such as masts, become more obvious as you get lower, while wide flat objects like airfields and towns get less so.

Trainees may also miss or even misidentify navigational features because:

- in conditions of good visibility they tend to look too far away for mapped features. When the visibility is poor they tend to look too close
- like the 1:250,000 map, the real world can contain too much distracting detail. Unless something is very obvious it may simply get lost in the general visual clutter
- cloud shadows can hide good navigational features completely. Whole towns can disappear. This is particularly likely if the level of visual contrast is very high - for example, when you are looking from an area of bright sunlight into one of heavy shadow. The same problem can occur if the level of illumination is very low, when, say, dusk is approaching and everything gradually turns into a black and white film, and/or there is total and dense cloud cover. In general, looking out from a dark area into a brighter one is not a problem. In some circumstances sunlight may pick out unmapped features (acres of greenhouses, location anywhere) which divert attention from less arresting but more navigationally important features
- the trainee is trying to fit the map to the ground. This can lead to the conviction that an airfield, for example, which is north of an east/west railway line on the map, is the one visible to the South of the same, or a similar feature
- they are already completely lost.

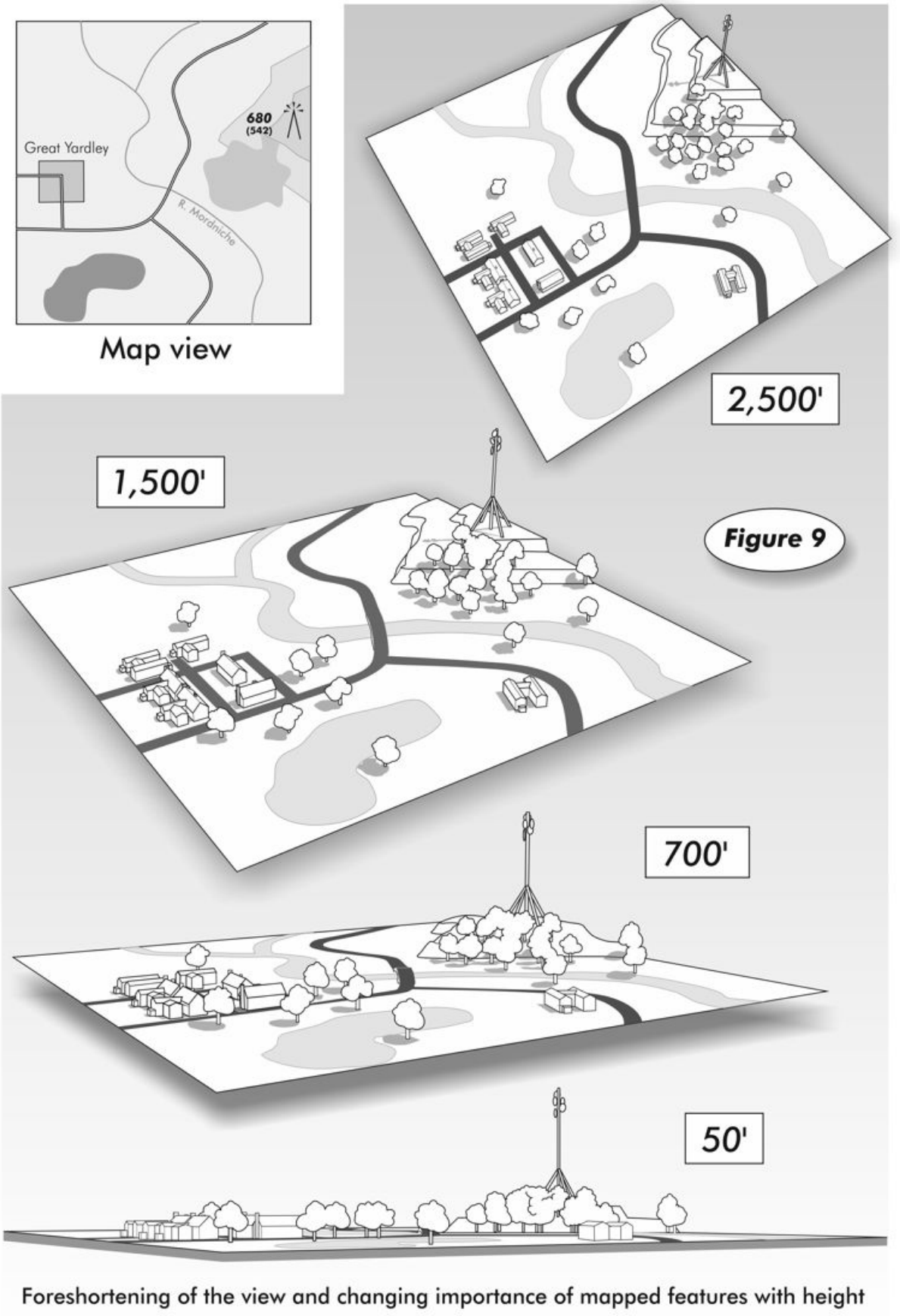


Figure 9

Foreshortening of the view and changing importance of mapped features with height

