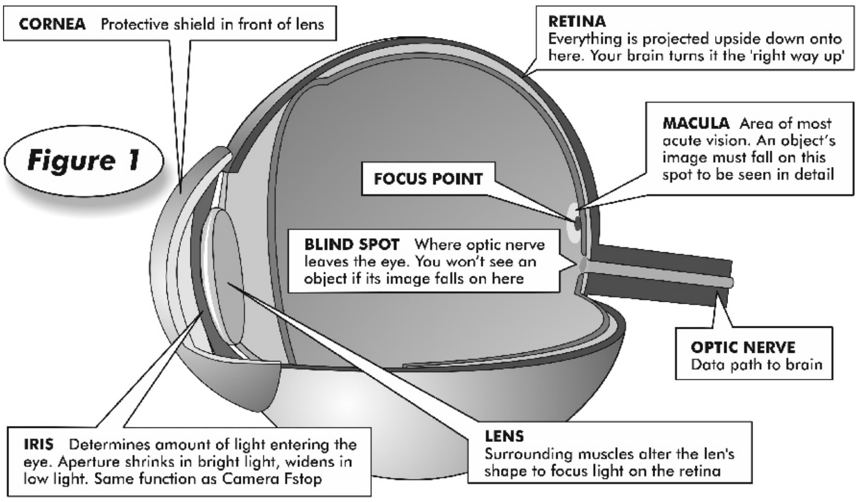
5 - LOOKOUT

The chief cause of mid-air collisions and air-misses is failure to see other aircraft soon enough, or at all. How many times have you been surprised by the closeness of another glider, or seen a pilot sail by with his eyes fixed on something in the cockpit?

Mid-air collisions are serious, and even a seemingly light and glancing contact with another aircraft can result in major structural damage - perhaps even incapacitating damage to the pilot. The glider may become uncontrollable, or suffer progressive and not necessarily instantaneous structural failure. The lower the collision's altitude, the slimmer the chances of a successful bail out, and if the glider starts gyrating it doesn't take much of an increase in G to pin even a young and fit pilot into the cockpit.

Given the above, it makes very good sense to cultivate habits that reduce the risk. Like any habit, good lookout needs instilling right from the start. Trainees who fail to acquire it early on find it very much harder to acquire later. This is why Lookout appears before the chapter on the Effects of Controls. No-one's lookout is 100%, but anyone who isn't doing it well, or at all, increases their own AND everyone else's level of risk; a point that needs emphasising. Your trainee's lifespan may be affected by how you teach the early lessons, but how you teach lookout might ultimately affect yours.



Since we use our eyes all the time, the obvious question is 'why bother to teach trainees a skill they already possess?' Regrettably, there's little to show that we necessarily use well what we may or may not use a lot (take sex and food, for example), and human vision is hobbled by an unhelpful combination of psychological and physiological factors whose effects are much more critical in the air than they are on the ground.

An awkward message

Lookout/scan strategies must make due allowance for our various limitations. However, it isn't easy to talk realistically to trainees about these limitations without mentioning the very high risks involved in ignoring them, and whilst there is no point in beating about the bush on the subject, tread carefully. Many hear the message as 'gliding is dangerous', but in the context it is 'people' who are dangerous, and that includes them. They will react to this not always welcome message according to how they understand it, and either:

- fail to see that what you're saying has anything to do with them, and ignore it or just switch off. (I have this arrangement which protects me!) This 'other planet' reaction is unfortunately quite common
- become rather anxious and be put off; this is the most likely, understandable, but usually temporary reaction. (I sort of realise I won't last forever, but please don't keep reminding me)
- understand the message and act upon it, not react to it. (If I've got any say at all in the matter, I'd like to last as long as possible).

Whatever the response, risk is everyone's lot in life, and pretending that things are different neither changes the facts nor magically protects anyone from harm.

Eye and brain - the visual system

The basic setup

The human visual set-up is that of a predator, not prey. Our eyes are at the front of our heads, like owls and tigers, and not at the side, like pigeons and mice. For the predators the practical result is good depth perception, in 3D.

Our visual field is divided into three main areas. The first is concentrated in a very small oval shaped arc subtending about 3°, and centred in the direction of our gaze - rather like the narrow beam of a searchlight (see figure 2 overleaf). To see an object in any detail we have to look directly at it so that its image falls on the macula - an area at the back of the eye where the light receptors are most densely packed. Just below the macula, the optic nerve - the data cable to the brain - dives through the back of the eye. This is the 'blind spot', (figure 1 opposite). Any image which falls on it is effectively invisible, even if the object is right in front of you.

Both the central area and the second and far larger area immediately surrounding it, are in 3D because each eye sees the same object from a slightly different viewpoint. Within limits, depth perception in the central area is good. The resolution of the second area is lower than that of the central portion, and detail poorer. The third and peripheral area marks the edge of our visual field and would seem redundant, given that vision here is very poor and 2D, but it is particularly sensitive to movement.

While the central processor is undoubtedly the brain, the eye itself part-processes visual data before sending it, so to speak, 'down the pipe'. Exactly how the complete system works is far from being well understood. Current explanations, as you'd expect, make heavy, obsessive, and possibly inappropriate use of computing analogies. As analogies go, they are quite handy, and make it easy to talk about the visual system in terms of 'processing' and 'data'. Nevertheless, don't make the very common mistake of thinking that such things 'belong to the brain', or 'take place in the eye', as if they somehow belonged to someone else. They all belong to you, and so do the results.

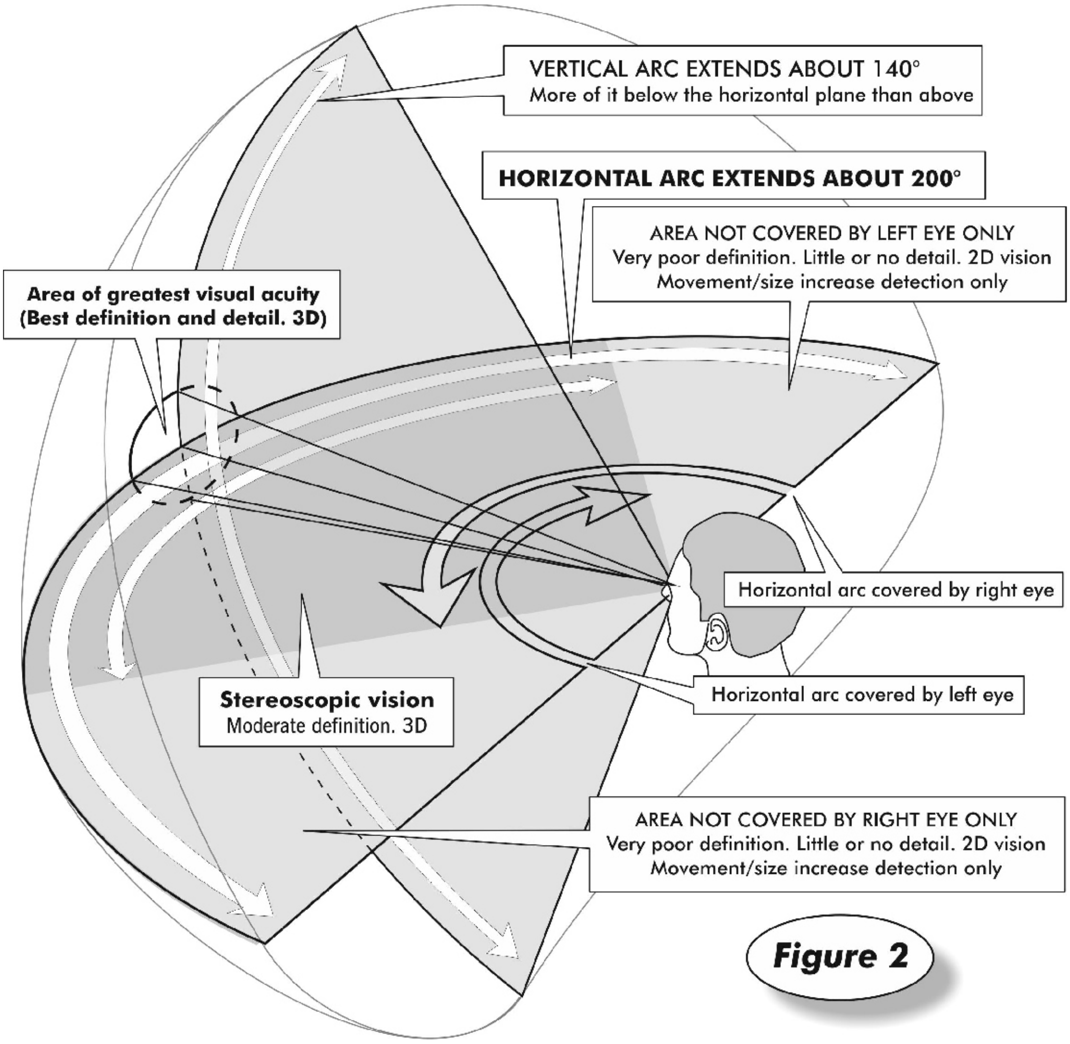


Figure 2

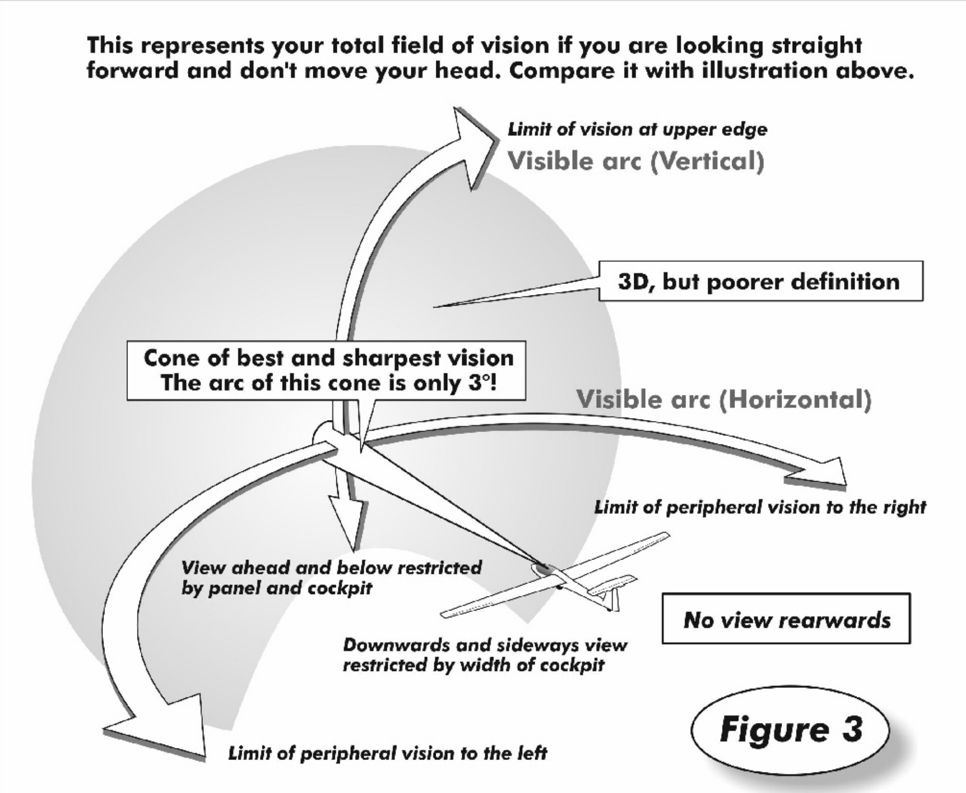


Figure 3

Getting the right information is one thing. Interpreting it correctly is another

The computing phrase 'garbage in, garbage out' applies equally to human perception, and the entire visual/sensual system is vulnerable to input and interpretation errors, some of which are very subtle. 'Garbaging' has two main causes:

- (1) **biological afflictions** such as fatigue, inappropriate emotion, illness, age, alcohol and medication, etc. The next chapter gives more detail, but someone who, in effect, can't be bothered (whatever the cause) can receive good visual data - i.e. they see everything they need to see - and then do nothing about any of it
- (2) **corrupt or ambiguous visual data**. If the canopy is scratched and/or dirty, or visibility is bad, or both, then you'll see less than you would otherwise, and the less you see the more likely you are to misinterpret whatever visual data does manage to squeeze through to your brain. This can hugely increase the risk of a mid-air.

It would appear that the brain requires a certain minimum level of data inflow in order to stay in touch with what's going on around and about - total sensory deprivation leads to hallucinations - and if visual input is very low, data from another 'service' such as the balance mechanism in the ears, can assume far greater importance than normal. Getting 'the leans' (vertigo) while cloud-flying would be an example of this. Equally, severe pain, acute discomfort, or even panic, can totally obliterate every other input, thoughts of sensible self-preservation included. What's more likely is that something far less dramatic, be it physiological or psychological, consistently erodes the pilot's ability to pay attention to the whole picture.

Unfortunately for pilots, humans are adapted for life on the ground, and because the aerial environment is not the one for which our eyes evolved, it is not rich in the appropriate visual clues and cues. Those for depth perception, approach of objects etc, are either less obvious to us in the air, or missing.

For example, when a car approaches us down a road, we work out its position and approach speed by reference to its known size (it's a Porsche), how rapidly that increases in relation to the surroundings (what stands behind or in front of it?), plus a number of other very strong perspective clues - which include the vanishing point, shadows, haze and colour cast, and the car's observable level of detail.

Figures 5 to 7 on the next page provide some examples. A World War Two military glider, an Airspeed Horsa, was used in figure 5 because most of us have little or no idea of its size. Were it to be replaced by an AS-K13 or an AS-K21, we'd know exactly where it was in the picture; which indicates that expectation and experience count for a lot (it's a K13, I've seen them before, and I know exactly how big they are in relation to the average house ....), and so on.

In the air apparent size is a major visual clue, and when we don't know how big an object is we have to rely on its relative position as defined by the shadow on the ground, and some weak and rather ambiguous perspective clues. When we're high up, of course, a ground shadow may not be visible. As a conflicting aircraft approaches the perspective effects become stronger, along with the clues provided by the detail level (the paint on the nose is peeling). Jumbo jets are a good example of not seeing quite what you think you're seeing. Even now, when they are familiar, it's very easy to get the scale completely wrong and actually 'see' a smaller aircraft, fairly close, and not going all that fast.

Outside the narrow cone of greatest visual acuity, our vision is geared largely to detecting movement, and signalling 'LOOK AT THIS!', but these alerts only work well if:

- (1) the pilot is already paying attention to his surroundings
- (2) the object is moving in relation to the background
- (3) the object grows in size - which amounts to the same thing as (2)-, and
- (4) it stands out from the background.

Airborne objects are particularly difficult to spot if they are:

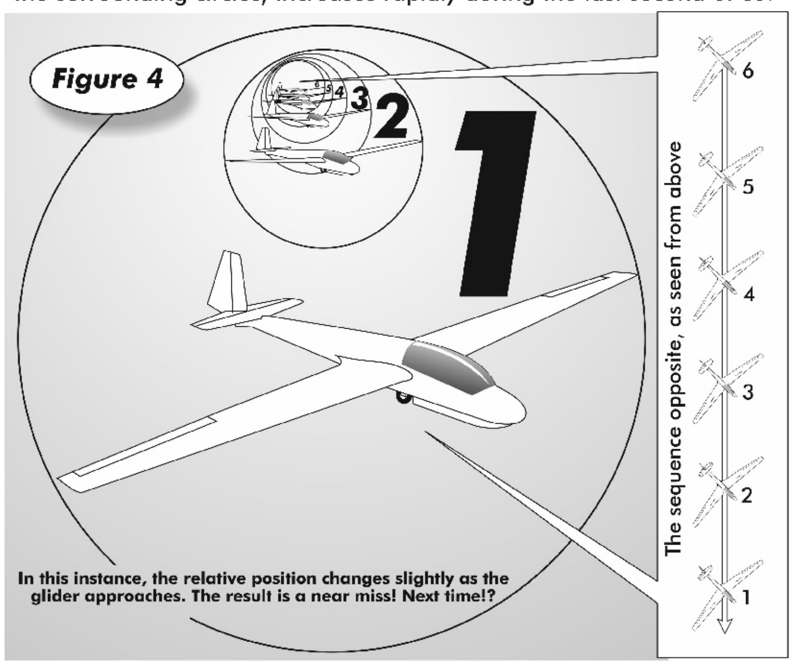
- on or near the horizon, and
- maintain the same relative bearing to us.

Though the major 'distance' clue is apparent size, as described, it is the rate at which that increases or decreases which tells us whether an object is closing on us, going away, or staying at the same distance. The 'gotcha' here is that if we're not paying attention when an object maintaining the same relative bearing comes towards us, its image size on our retina only starts to increase at a rate sufficient to trigger a 'LOOK AT THIS!' response when the object is just about to hit us, or pass perilously close (figure 4, below).

None of this is to suggest that we won't or can't see an object when it's a long way off, just that if we aren't consciously looking we're far less likely to spot it.

The eye also does two things which seem contradictory. First; what literally excites the visual system is changing rather than constant stimuli. Our eyes help create this by constantly making lots of tiny little movements; a kind of visual 'fidgeting'. If this is suppressed (staring very hard can do it) the input doesn't change and the eye eventually stops responding. Second; if we

Note that the conflicting glider's apparent size (represented by the surrounding circles) increases rapidly during the last second or so.



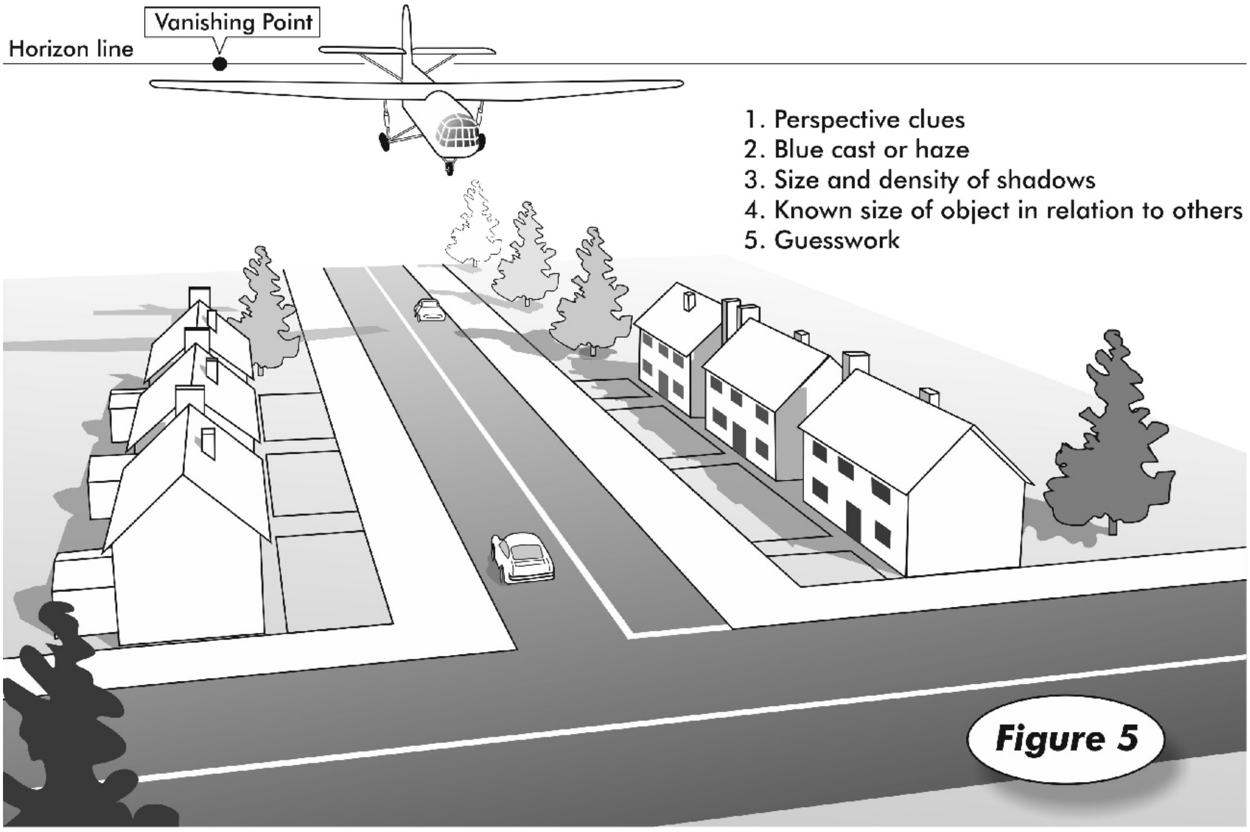


Figure 5

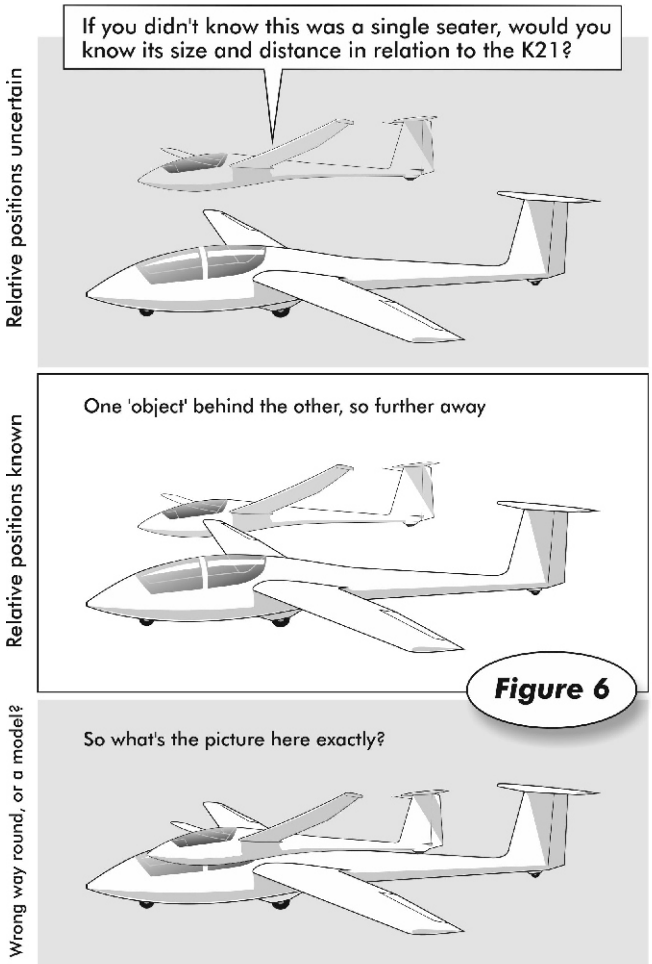


Figure 6

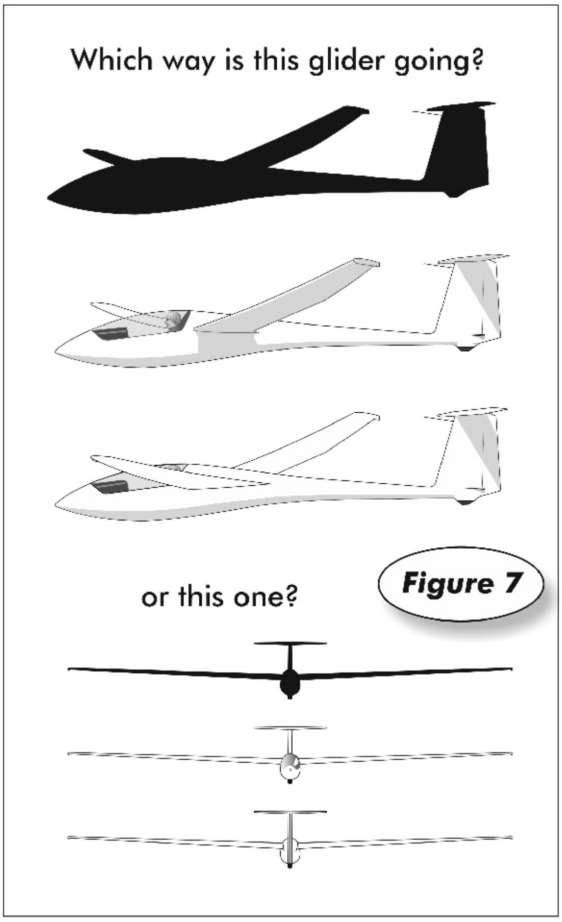


Figure 7

shift our gaze quickly more than a few degrees, our visual system registers very little that's recognisable. We think we're seeing 'things', but only because our eyes keep stopping briefly (fractions of a second), to lock onto interesting blurs and blobs. In effect, our eyes 'stutter' across any scene. A useful scan pattern has to cover a sufficiently large area relatively quickly, but must have resting points where we can focus onto approaching 'things' in order to find out what they are, and whether they're dangerous or not.

In certain conditions the visual system can go into idle, and we then get what is known as *empty field myopia*. We think we're looking way ahead, but our eyes have relaxed and are focussed on a spot only a few feet in front of our noses, and we don't see anything further away than that. The fact that empty field myopia is not obvious to us makes it particularly dangerous. The worse the visibility, the more likely it is to happen, so it is important that the pilot periodically focuses on the most distant ground objects visible.

Eyetraps and 'I' traps

Though the eye has to stop moving in order to register anything, it is can far too readily come to a grinding halt on, say, an instrument. The variometer is one of the chief targets, followed by the ASI, and, to a lesser extent, a GPS unit, a speed to fly director, or even the yaw string. In the circuit it may be the altimeter. Any of the above can become an eye-trap, and any of them can kill you and probably someone else as well. Trainees have the additional problem that their understandable anxiety about the stability and safety of aeroplanes in general - gliders in particular (no engine!) - makes them hang every hope of survival on the instruments. It's worth pointing out that this may not have quite the result they intend.

The above causes apart, it is also very easy to be psychologically blind. Something important can go unnoticed simply because it either wasn't what we expected to see, or we didn't want to see it. When we do finally notice, a measurable time is needed - sometimes seconds, not milliseconds - to work out exactly what it is, or what's happening, or both. To this has to be added the time to work out what to do, and the further time required to get the glider to do it. If you add all that lot up, given even the most favourable circumstances, it can take many seconds before you start to move out of harm's way.

A daydreaming pilot staring out into space is a prime candidate for a mid-air, but so is the one who has made too many unsupported assumptions about what's happening around and about. These assumptions can range from the egocentrically daft 'Nobody is going to hit ME' - they may not intend to, but they still can -, to the terminally rash 'It's obvious. I can't see the other glider because it has left the thermal and by now is miles away'. On the other hand, it could be right up your tail, and flown by someone who left his guide dog behind (it gets airsick).

LOOKING OUT

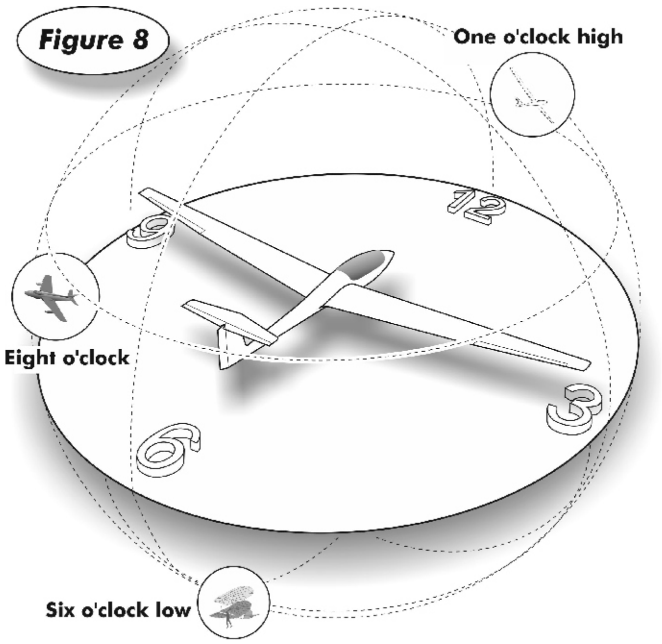
Using the Clock

In two-seaters, clock terminology is a useful way of quickly identifying the location of a potential threat. Teaching it to trainees who are only familiar with digital watches may prove difficult, but in any case it can take a bit of getting used to.

Imagine your glider is fixed at the centre of a clock face, oriented as in figure 8, opposite. Three o'clock is off the right wing, nine o'clock off the left wing, with six o'clock behind you. Points in between are relative to the respective hours. Half hours are never used; not only is that degree of accuracy not required but it takes slightly longer to say 'half past eight' than it does 'eight o'clock'.

Though a clock face is two-dimensional, the sky is not. You can be hit by anyone from any direction; a light aircraft descending from several thousand feet above you to land at a farm strip, or an aerotow combination climbing out from way below, to name but two possibilities. The 'hours' by themselves don't cover these situations, so 'high' or 'low' are added to the clock position, depending on whether the aircraft is respectively above or below you. For example, *Four o'clock high* or *Four o'clock low*. If the other aircraft was at the same level, you'd just say *Four o'clock*.

Figure 8



The Scan Cycle

Theoretically, equal attention to all areas would be the most effective scan, but only when the risks are truly random; in other words, when you've no idea from which direction a threat will appear. In practice, some areas hold more risk than others. Sitting outside an ATZ, off the end of a nearby active runway, increases your risk from that direction, but won't automatically make it zero from everywhere else! Likewise, using a cloud street increases the risk from ahead - closing speeds with other gliders can exceed 150kts - but also from above and below.

Whatever the scan pattern, it has to be adaptable. Since the areas of highest risk change during a flight, depending on where you are and what you're doing at the time, flexibility of mind and a capacity to think ahead are attributes every bit as useful as good eyesight.

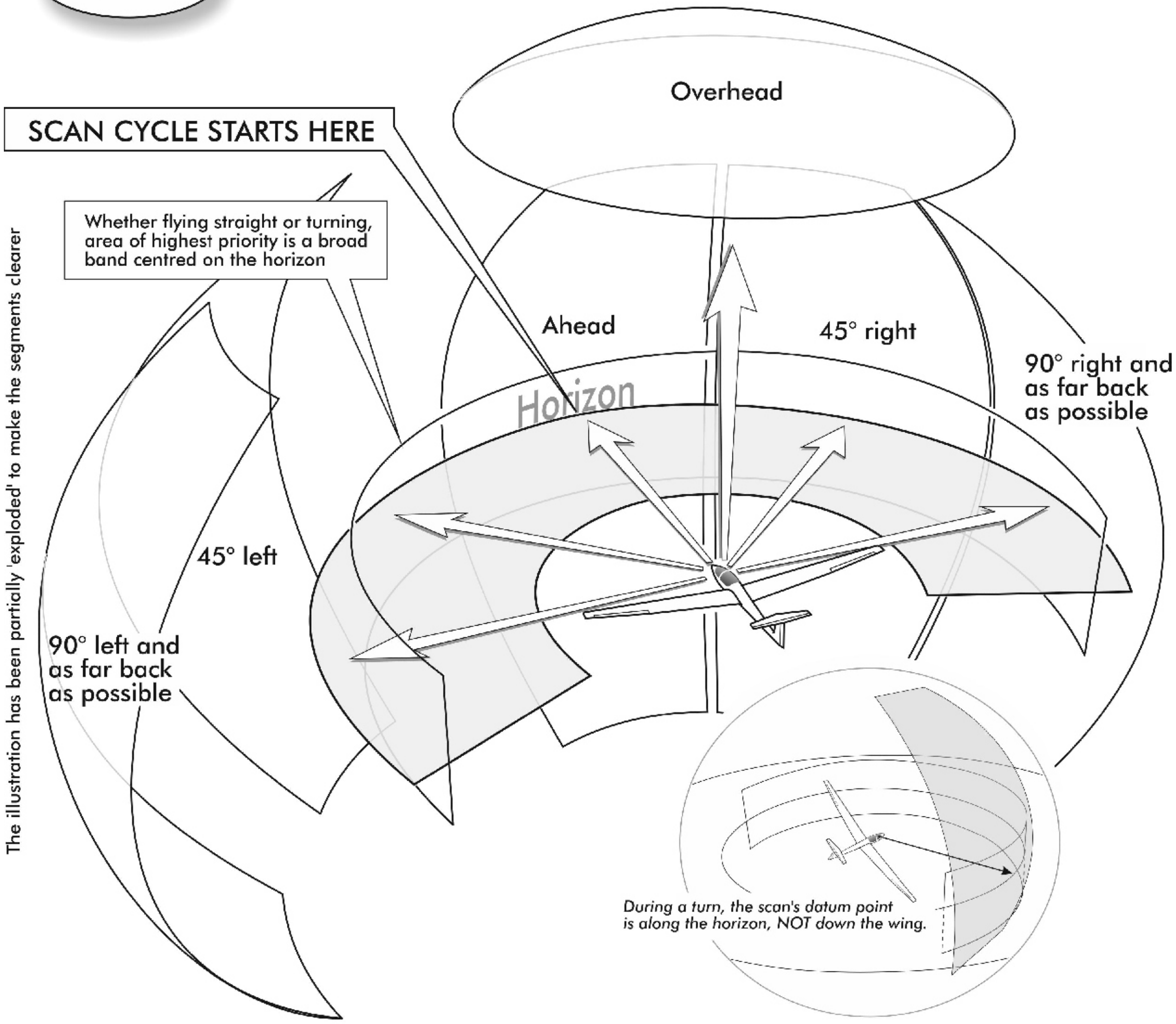
The basic pattern of the Scan Cycle is:

- **lookout**
- **attitude**
- **instruments.**

Where to look - basic pattern

In straight flight attention has to be directed forwards (twelve o'clock), but the whole area from seven o'clock through to four o'clock (or as far back as you can see on each side) needs

Figure 9 THE SCAN CYCLE: Lookout Attitude Instruments



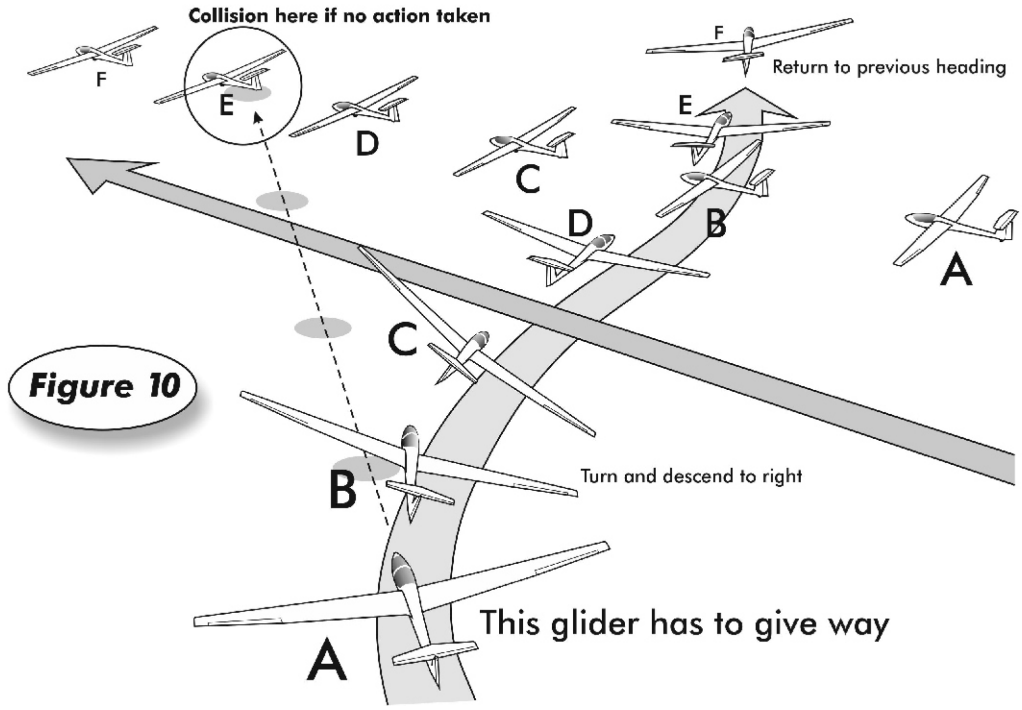


Figure 10

scanning, both above and below the horizon. Directly overhead needs checking regularly.

Begin the scan by looking far ahead, over the nose. Focus on the most distant objects visible. Check the attitude, and look above and below the horizon. The total area which needs to be scanned is large (figure 9), so merely looking ahead is not sufficient.

Glance briefly at the instruments (this could be included with the initial check on the attitude), then look to one side or the other about 45°, refocus on a distant object on the horizon, and scan the associated segment. Neither the attitude nor the instruments should need checking at this point, so shift your gaze to 90°, and scan that segment. (The front seat pilot of a two-seater will have a far wider field of vision than the rear-seat pilot and will need to look round more than 90°). After looking as far back as you can, look directly overhead, then forwards to check the first segment again, and the attitude and the instruments. Continue the scan at the 45° and 90° points on the opposite side, as far back as possible, then overhead once more - and so on.

RULES OF THE AIR

- ☐ **6.3** The aircraft which has the right of way shall maintain its course and speed, according to the following rules:
  - **Converging.** When two aircraft are converging at approximately the same altitude, the aircraft which has the other on its right shall give way.
  - **Head-on.** When two aircraft are approaching each other head-on, or approximately so, each shall alter course to its right.
  - **Overtaking.** Overtaking aircraft shall at all times keep out of the way of the aircraft which is being overtaken by altering course to the right, provided that a glider overtaking another glider in the UK may alter its course to the right or left.
- ☐ **6.4** Whereas aeroplanes shall when converging give way to aero-tows and gliders, and gliders shall give way to balloons, it is nevertheless the responsibility of all pilots at all times to take all possible measures to avoid collision.
- ☐ **6.7** Aircraft following roads, railways or other lines of landmarks in the UK shall keep such landmarks on their left.

Exactly where you look within each segment is a matter for argument, but in terms of the scan pattern, you are focussing at the right distance and then relying on your visual system's ability to pick out 'off-centre' objects which are moving relative to the background. In principle an uninterrupted scan with no attention paid to anything else would be the best, but you need to pay attention to other things every now and then, and in any case, there are practical objections to constantly having to swivel your head here, there, and everywhere. Whatever the pattern adopted, if you are to see anything at all it must have a number of 'stop and look' points, and whilst it doesn't need to be done continuously, it **must be done regularly and frequently**.

The scan pattern described is an idealised one, and should be regarded as an elastic framework rather than a pattern to be rigidly adhered too. The first and most important point is to have a scan pattern that covers everything that needs to be covered. The second point is that the pattern should become so ingrained that the pilot will continue to look out even when tired, which is one occasion when it tends to get forgotten.

Scanning just before and while turning

The view directly backwards from most gliders is non-existent, and the position of the wing often doesn't help. Before turning, say, to the right, look round and well back to the left. This is not the obvious way to look for a right turn, but you don't want to turn your back on an approaching aircraft which you may not be able to see again until you've turned through nearly 180°. Having looked left, briefly check the attitude and speed, then look right, where you're going to go. Assuming it's all clear, look ahead again and initiate the turn. The process is nowhere near as long winded in reality as it seems on the printed page!

Once established in the turn, adopt the scan so that, in this case, its centre is displaced to the right. Attitude checks are still 'straight ahead' in relation to the glider, but the centre of your scan will now be off to one side (figure 9, small inset). What was previously the overhead part of the scan is now a look in the direction of the turn.

When turning, look along the horizon and treat that, rather than looking down along the wing - which in a decent turn will be way below the horizon - as the centre of that segment of the scan.

If very steeply banked say, to the right, anything to your left may be underneath you, and invisible. Before rolling out of a turn, check below the raised wing as well as ahead, or, alternatively, check ahead about 90° before you intend rolling out.

Collision avoidance

The obvious response to an imminent collision is to manoeuvre out of the way. Exact head on collisions are rare and most gliders have relatively low rates of roll, so, despite what the rules say (box above), what you can do may depend on the circumstances and, to a degree, on what the other aircraft does. In the case of an aircraft going in your direction at exactly the same altitude, and converging from the right, the rules oblige you to give way. One possible response, again depending on the circumstances, would be a diving turn towards them (figure 10, facing page) so that you pass below and behind. It's worth noting that in this case the aircraft that's giving way has the other in view all the time. Had you turned left (OK in some circumstances) you would have turned your back on the other aircraft, and increased the chances of being run down from behind by the same aircraft.

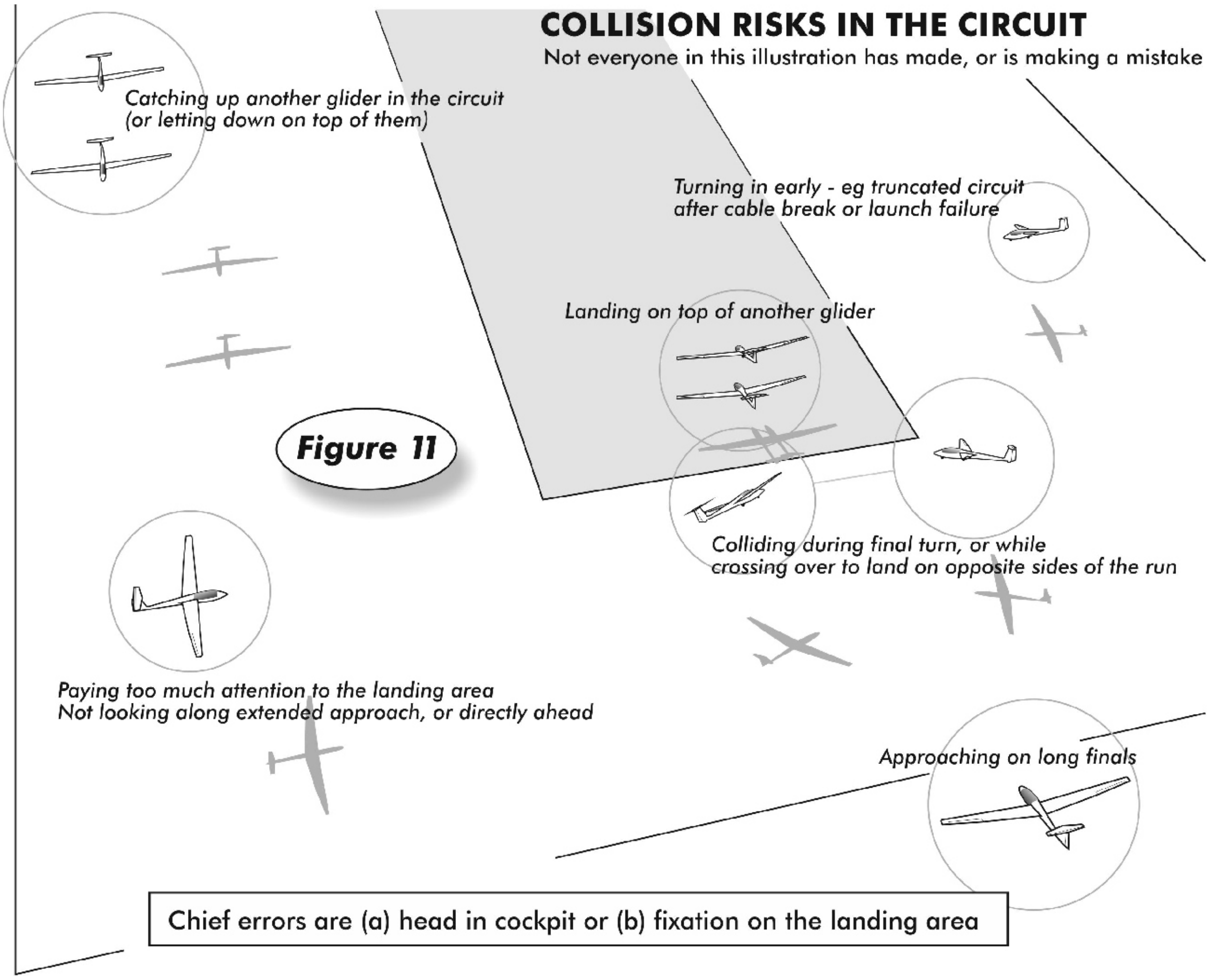
Given that many gliders have less than sparkling rates of roll, the only options in a head-on situation where you don't see each other until the last second, may be up or down, which is 50:50! If you both go the same way, tough. Encourage trainees to try and engineer things so that they never have to bet their lives (or yours) on odds like that.

Every pilot, power or glider, will have read the Rules of the Air, no doubt, but they won't apply them if they haven't seen you, so don't assume they have.

Should you have just avoided one collision, try not to be so relieved that you stop paying attention and collide seconds later with someone else. Watch out for gaggles, particularly if the gliders are quite close together. They may be taking more notice of their neighbours than of anyone coming the other way!

PRE-FLIGHT BRIEFING

The emphasis of the pre-flight briefing should be on the practical rather than the theoretical aspects of lookout. Some of the more theoretical/technical aspects have been described because it is important that you, the instructor, understand why processes we take for granted have their limitations,



particularly in the air, and very often aren't anything like as accurate as we believe.

BRIEFING POINTS

Areas of risk

Risk is everywhere and variable, but the degree posed by aircraft which you spot, as against those which you don't (easily the most dangerous) can be difficult to judge. There is an important element of 'thinking ahead' to lookout, so check the position of other aircraft regularly, even if they seem to be going away. They could change course and come back. Assess whether the risk is reducing, remains the same, or is increasing. If it stays constant or starts to increase, take appropriate action to reduce it.

As far as other gliders are concerned, flying/thermalling in gaggles, running a ridge or in the circuit, are all times when the risk is higher than normal, and good lookout is very important. The closing speed between a glider and a military jet could be 400kt plus, but despite the understandable notion that something faster must be riskier, the biggest threat to gliders is other gliders. Furthermore, most collisions aren't head-on, but when one aircraft converges on another from the rear quarter. It is extremely important, therefore, that **every** pilot maintains a good lookout.

The aircraft that will hit you is often the hardest to see

- if it is on or very near the horizon
- if there is insufficient contrast between it and the background
- if the relative angle between it and you remains constant, and the aircraft is approaching. This won't be at all obvious until it starts to increase in size (see figure 4).

Most collisions occur when the workload is already high

Workload is relative, and depends to some extent on the pilot's level of experience. A pre-solo pilot's workload can be very high when thermalling, and go into overload when the thermal is crowded and/or other pilots join.

The increased risk in such situations may not come from lack of lookout, but from the trainee's lack of ability/skill in handling the glider. You, the instructor, will be familiar with the environment, but the majority of early trainees certainly won't. They can find it difficult to assess any collision risk realistically. So, even if your trainee sees every other glider in the vicinity and tells you where they all are, don't assume that he won't then collide with any of them.

Situations where the relative speed of the potential victims is constantly changing can mask a risk, and make last minute avoidance of a collision much more difficult. An example would be two gliders thermalling at more or less the same level, but with the centres of their respective circles not coinciding [see illustrations in chapter 24].

Lookout in the circuit

The important points to remember about the circuit are that traffic density is likely to be high, your altitude isn't, and most importantly, everyone is heading for more or less the same spot.

- one purpose of the circuit is to set up an orderly traffic flow and reduce the collision risk, but the close proximity of other aircraft will increase a pilot's workload. If everyone flies circuits in the same direction, closing speeds are likely to be low, but aircraft in a pilot's 'peripheral' area of vision will then converge quite slowly, by stealth, as it were. Circuit collisions are most likely when a pilot's attention is 'eye-trapped' by looking for too long at the landing area from, say, the low key point [chapter 14], or just before the final turn (figure 11 opposite)

- on the base leg, remember to look away from the airfield, along the approach line, for anyone creeping in on long finals. Look straight ahead also for gliders approaching on an opposing circuit. They can be very difficult to spot if they are just above the horizon and against a background of cloud. The direction of the Sun can also be critical.

- if your club requires use of radio in the circuit don't assume ever radio, yours included, is working. Not hearing anyone doesn't mean that nobody is there.

Two pairs of eyes are better than one

Regrettably the above heading isn't always true. What can happen in two-seaters is that one person either consciously or unconsciously allocates 'look-out' to the other, and then, because 'someone else is doing it', stops looking out themselves. The other person might well be thinking the same thing. If you want your trainee to do the lookout, say so. Check periodically that they are doing it!

Some practical precautions

Allow for the blind spots of other aircraft. If they are ahead of you and moving in the same direction, they won't see you at all. It's your responsibility not to run them down. Likewise don't get too close, particularly if above and behind, just in case they suddenly pull up into lift.

The only effective method of scanning below and behind is to turn or weave, which isn't energy efficient during the glide, nor always practical. Though the risk from below is relatively small, check there every so often, perhaps by doing an elongated S turn. Don't forget to look directly above you, particularly when about to enter a thermal.

When descending rapidly with airbrakes out, do so in a series of S turns, or circling; either is usually safer than letting down in a straight line, dependent, of course, on the exact circumstances.

When thermalling, always try to position yourself so that you can see as many of the other gliders there as possible, and they can see you. Since early trainees often find it very difficult to turn accurately and keep a good lookout at the same time, the instructor needs to be particularly vigilant.

If you wear a hat (an essential item in hot weather and during long flights) make sure that the brim doesn't obstruct your view. Baseball caps are not acceptable.

Don't use knee-mounted equipment. In 1998 knee-mounted GPS units were reckoned to be a significant contributory factor in two fatal mid-air collisions. GPS equipment should be mounted as high as possible on the instrument panel or canopy frame, but not in a position which seriously obstructs your view.

ADVICE TO INSTRUCTORS

At first the trainee will not know where to look and focus, what there is to see, nor how often to look. For these reasons, lookout is part of every lesson and attention needs to be paid to it at all times. Emphasise it, but not to the detriment of everything else. Initially the workload associated with keeping a good lookout and flying the glider will be high. Be patient. You may have to accept temporarily a lower standard of flying accuracy. After early struggles, your trainee will learn to lookout relatively effortlessly, and his flying accuracy should then improve.

Car drivers have deeply ingrained scanning habits which are OK on the road, but not always helpful in sporting gliding. A driver's scan is inevitably concentrated in a relatively small arc directly ahead, and involves minimal head movement. Trainees who drive, particularly the older ones who've been doing it for a long time, often find it difficult to look all around, partly because you seem to be contradicting all the good advice they ever had about in-car lookout.

One aid to good lookout is to make sure trainees get into the habit of flying by attitude. During the middle part of the flight there's no reason why they should spend more than a fraction of their time looking at the instruments. It's not as if gravity is going to pack up suddenly. Time freed by using attitude leaves more for scanning, and every second counts!

If a trainee fails to look out prior to turning you should immediately prevent the turn, and say something like, *I have control! Do you know why I have stopped you from turning?* The message you are trying to get over is that *looking out before turning is as necessary as moving the stick*. Prompt as necessary, but don't allow the turn unless the trainee understands why you stopped it. As against that, don't fly off into the sunset as you wait for the penny to drop.

You won't know if any of your trainees are really looking out unless they tell you what they can see, or take deliberate avoiding action. Even if they are moving their heads, it may be all they're doing. Likewise, they may be swivelling their eyes and head swiftly and continuously, but seeing nothing because they aren't stopping to look. Ask them to tell you when and where they see other aircraft. If they can master the 'clock' terminology, so much the better for both of you.

Lookout should be a considered and regular process, not an occasional and haphazard glance out of the cockpit when there's nothing better to do.

Do not allow poor lookout to go unremarked.

SUMMARY

One pre-flight briefing won't be enough to make trainees aware of all the problems associated with lookout, so continual reference must be made to them throughout training. To repeat the main points:

- make due allowance for the limitations of eye and brain - include your own psychology (certain types of behaviour are extremely risky)
- check yourself:
  - your eyesight and mental and physical condition
  - wear glasses if you need them, and carry a spare pair to the same prescription. If flying with trainees who needs glasses, insist they have a spare pair handy so that the habit is established early on
- minimise the time you have your head in the cockpit:
  - make sure canopies are clean. If necessary, clean them before you fly. If the sun is in the right direction and the canopy is dirty, wet or misted, you may be completely blind
  - compensate for the glider's blind spots. They aren't that small!
  - plan ahead
- fly by attitude wherever possible, and appropriate
- the scan cycle is
  - LOOKOUT
  - ATTITUDE
  - INSTRUMENTS
- scan the entire visible area in an orderly fashion (45° segments, or smaller) and don't forget to look overhead
- in a turn make the central part of your scan in the direction of the turn, along the horizon and not down the wing
- never rely on radio to tell you where everyone is
- remember that traffic density in the circuit can be high and everyone is heading for more or less the same spot

Lastly, don't lookout to the exclusion of everything else!

COMMON DIFFICULTIES

Failure to move the head. Encourage the trainee to scan by moving his head rather than just shifting his eyes. When the trainee moves his head it is more obvious that something is being done. You will still have to get him to tell you where other aircraft are, to be quite sure he really is looking.

Looking down the wing in turns can lead to disorientation and poor speed control. Given that the likeliest threat when thermalling with other gliders, say, is along the horizon, the trainee is looking in the wrong direction. Remind the trainee that he should be looking outside, not 'Looking out'. Once the difference has been pointed out, speed control and coordination will also improve.

Failure to lookout before rolling into a turn is extremely dangerous. Take control immediately and prevent the turn. This action emphasises lookout's importance. Ask *Why did I stop you from turning?* Only when the trainee has given the correct reply, and actually looked out, should you let him recommence the turn. If this happens just before the final turn, don't wait for illumination, take control.

Failing to look about before rolling out of a turn is just as dangerous as the above, all other things being equal. Same remedy.

