LOOKOUT

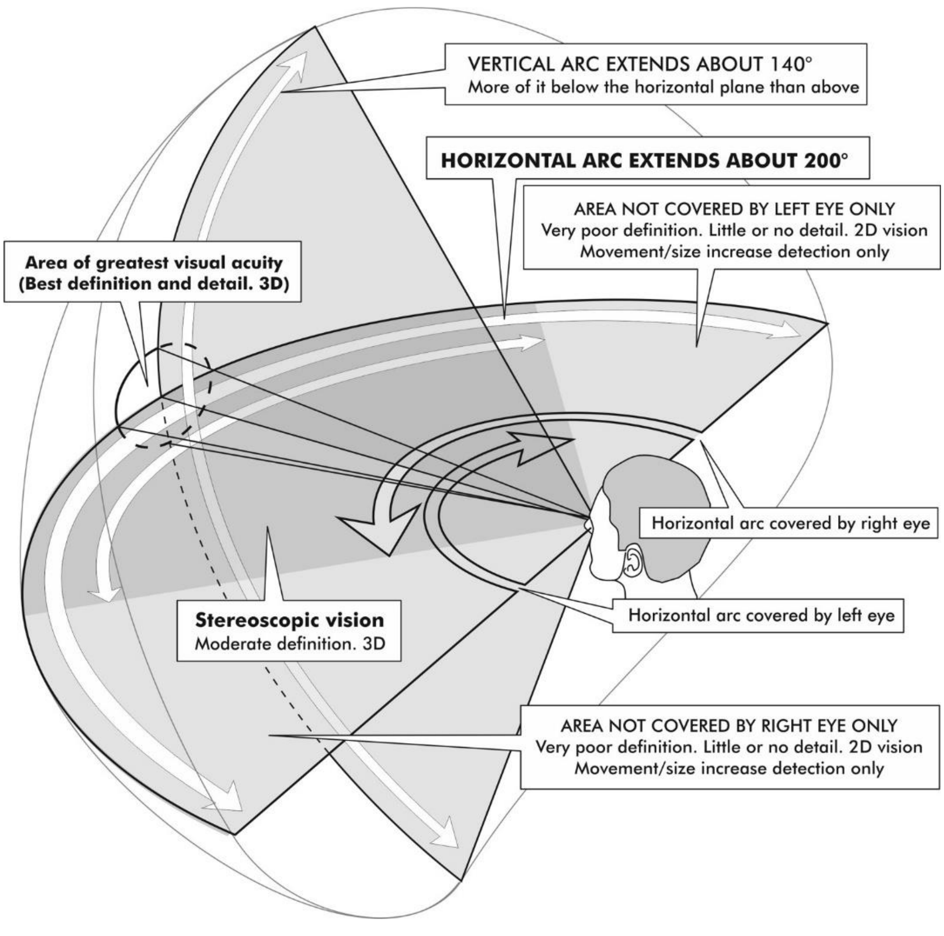
The chief cause of mid-air collisions and air-misses is failure to see other aircraft soon enough, or at all. Mid-air collisions are serious, and even a seemingly light and glancing contact with another aircraft can result in major structural damage - perhaps even damaging the pilot. The glider may become 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 all that, it makes very good sense to cultivate habits that reduce the risk. Like any habit, good lookout needs to be instilled right from the start of glider pilot training. No-one's lookout is 100% perfect, but anyone who isn't doing it well, or at all, increases their own AND everyone else's level of risk. You should expect your instructor to emphasise lookout in every aspect of your training and not be apologetic about that! This leaflet aims to provide some basic lookout theory.

Human Limitations

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.



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'. 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.

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:

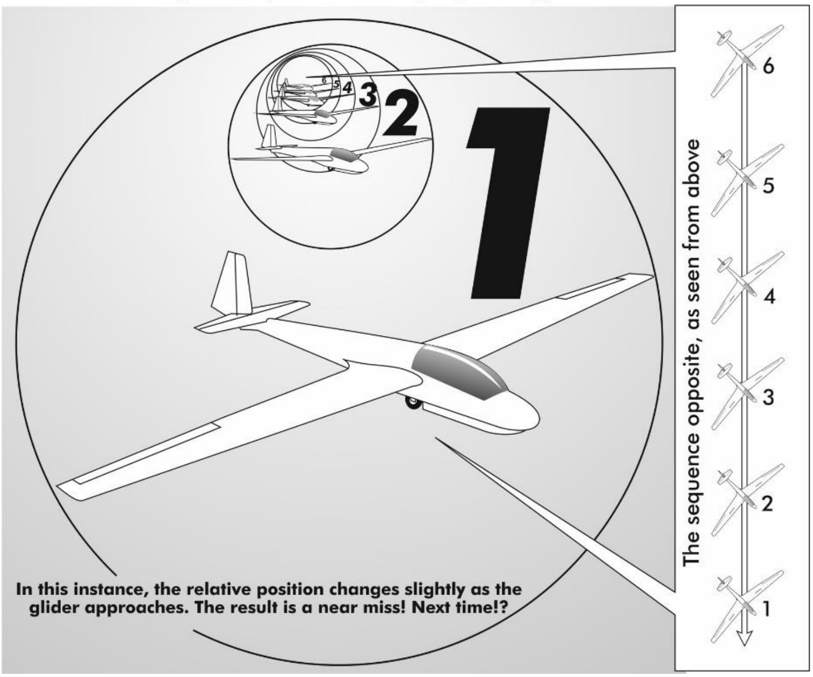
- the pilot is already paying attention to their surroundings
- the object is moving in relation to the background
- the object grows in size and it stands out from the background

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.

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



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 re laxed 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 my pia is not obvious to us makes it particularly dangerous. The worse the visibility, the more likely it is to hap pen, so it is important that the pilot periodically focuses on the most distant ground objects visible.

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.

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.

So how do we mitigate these human limitations to ensure that we do lookout effectively?

The Scan Cycle

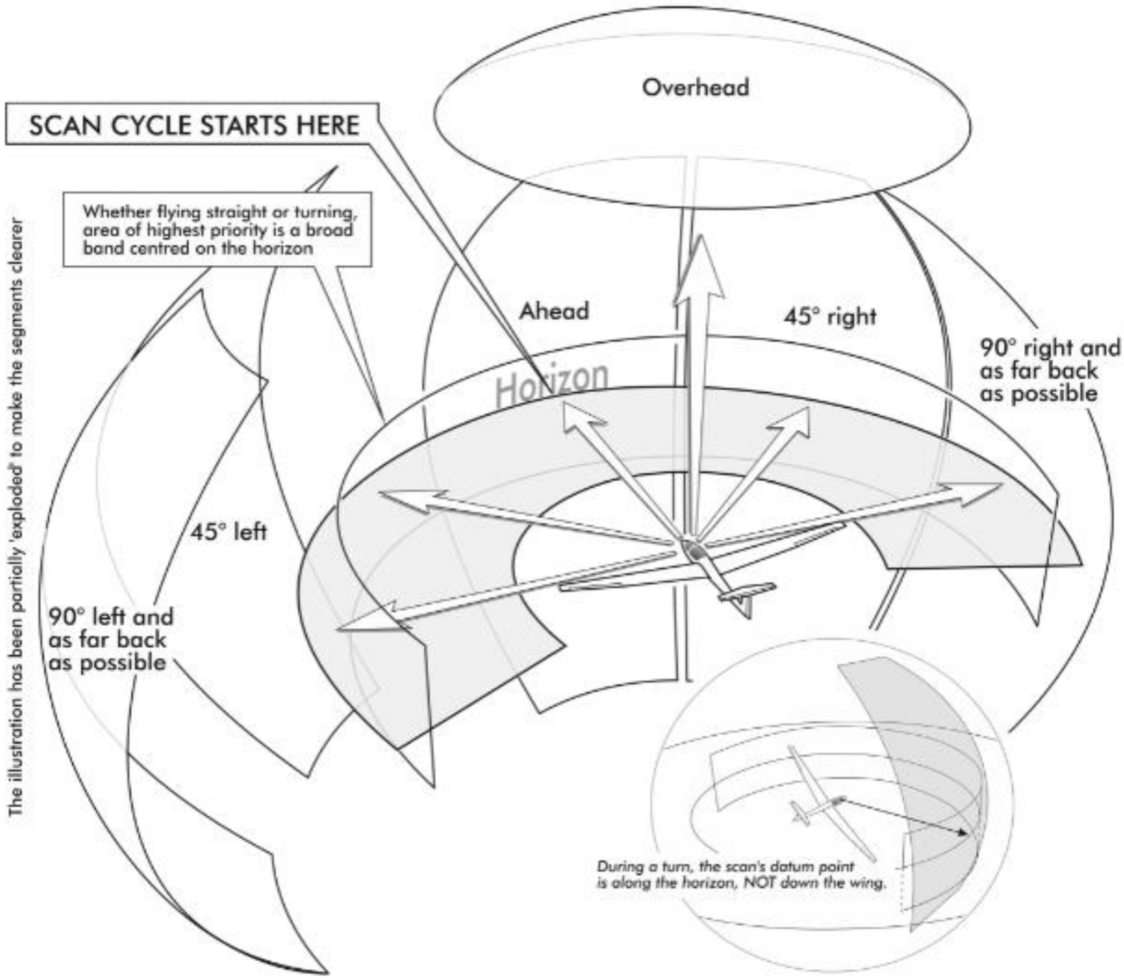
Theoretically, equal attention to all areas would be the most effective scan, but only when the risks are truly random; in other words, when you've no idea from which direction a threat will appear. In practice, some areas hold more risk than others. Whatever the scan pattern, it has to be adaptable. 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 look out, attitude, instruments.

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, 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. 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.

Whatever the scan 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 cycle is adapted to deal with turning the glider. Your instructor will advise. Probably the key point here is that you must carry out a lookout scan before turning, with particular focus on the sky you are about to turn into.



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 you will continue to look out even when tired, which is one occasion when it tends to get forgotten.

Lookout Tips

- make 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
- minimise the time you have your head in the cockpit:
- make sure canopy is clean. If necessary, clean it 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
- use the scan cycle 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 or FLARM to tell you where everyone is
- remember that traffic density in the circuit can be high and everyone is heading for the same landing area

Collision Warning Technology

FLARM, which is commonly but not exclusively used in gliding, works by calculating and broadcasting its own future flight path to nearby aircraft also equipped with FLARM. At the same time, it receives the future flight path from surrounding FLARM equipped aircraft. An intelligent motion prediction algorithm calculates a collision risk for each aircraft based on an integrated risk model. When a potential collision is calculated, the pilots are alerted with the relative position of the intruder, enabling them to avoid a collision. If your club uses FLARM, your instructor can explain more including how to respond to a FLARM warning.

FLARM showing another FLARM equipped aircraft on a potential collision course.
The FLARM unit is indicating that the other aircraft is left of the nose and higher.

FLARM is a helpful tool for prioritising the lookout scan and as a last-minute warning in the event of not seeing an impending collision.

However, it's very important to recognise that not all gliders are FLARM equipped, that most powered aeroplanes are not similarly equipped, that there are inherent limitations particularly when flying on ridges and in wave, and that technology can be distracting if we allow it to be.

You MUST maintain an effective lookout scan at all times.