

SAFE SEPARATION

The BGA Safety Team looks again at the dangers of mid-air collision

Before the introduction of FLARM a decade or so ago, around one UK glider pilot per year was killed in mid-air collisions. Of the 29 such glider pilot fatalities that our records show in the 32 years to 2007, nearly three-quarters were in collisions with other gliders, and only two fatalities came about from collisions with traffic unrelated to gliding operations. Collisions with gliders also led to two parachutists, a light aircraft pilot and a tug pilot losing their lives.

In the 16 years from 2008 onwards, a glider pilot and two aeroplane pilots have lost their lives in collisions between gliders and light aircraft, but FLARM seems to have been remarkably effective: only a single glider pilot has lost their life in a collision with other gliding-related traffic, and of all the collisions in that time, only two have involved pairs of FLARM-equipped aircraft. That there were any at all reinforces that FLARM is not, and can never be, a perfect cure: it cannot predict how pilots will manoeuvre, and in order to limit false alarms it must tolerate quite close encounters.

THERMALS

While such low numbers prevent statistical significance, it may be suggestive that the two glider-glider fatalities occurred in thermals. Of the 51 glider-glider collisions for which we have records, 27 occurred in or joining thermals. This is the phase of flight in which gliders fly closest to one another, and in which a small change of flight path can change a safe, stable situation into paths that will converge just seconds later.

In most cases, the gliders that collided were turning in the same direction in the same thermal, and in many cases we know that the pilots had been aware of each other until shortly before the collision. Ideally, two gliders at the same height will circle at the same rate and maintain diametrically opposite positions [1], allowing the maximum separation and, crucially, keeping each pilot within easy sight of the other. However, if one

STRAIGHTEN
UP & FLY
RIGHT



Aircraft following the same track may be in each other's blind spot if one is above and behind the other. Like these light aircraft, gliders have collided this way on approach and between thermals (AAIB)

glider turns more quickly than the other, or changes its track to seek stronger lift, both separation and visibility can be compromised.

Logger records sometimes allow us to reconstruct the colliding gliders' paths and deduce what each pilot would have been able to see, and we usually find that at least one of the gliders was positioned where the other pilot's view was obstructed by the glider airframe. In some cases, such as when one glider was above and behind the other, neither pilot had a clear view [2]. Without knowing the position or heading of the other aircraft, it's hard to know what avoiding action to take in the few seconds available following a FLARM alert.

One problem when thermalling is that the relative positions of two gliders can appear fairly static for a number of turns, causing pilots to become less vigilant at monitoring changes of relative position in the thermal. Motorists experience a similar effect when a speed restriction causes dense traffic in all lanes to move at roughly the same speed.

Another problem seems to be a common misunderstanding of how to adjust your spacing in a thermal, for it is not intuitive that slowing down will increase the rate of turn (because your circle gets tighter) [3]. If you are creeping up on another glider, you should reduce bank or speed up; conversely, to catch up with another glider, slow down or turn more steeply [4]. Never turn inside another glider, or allow your nose to track ahead of any part of it [5], and beware that a glider that appears to be leaving the thermal could just be exploring for lift.

Of the 27 collisions in thermals, four occurred when a glider was joining and the arrangement of gliders in the thermal was not yet established. A joining glider, approaching at speed through sink, may be on a trajectory to collide with a thermalling glider, even though it has the energy and intention to pull up to a safe vertical separation as it enters. Pilots should be mindful of the effect the consequent FLARM alert may have upon the pilot of the established glider, who may not have sight of the approaching aircraft [6].

COMPETITIONS

Competing gliders naturally tend to bunch together in thermals, and track together in between, with no pilot wanting to let another pull far ahead. It thus comes as little surprise that competition flying carries an elevated collision risk, with eight of the 16 glider-glider collisions over the past 20 years occurring during competitions. Fortunately, while they caused catastrophic damage to some of the gliders, the collisions generally occurred high enough for pilots to bale out, and only one fatality resulted.

Competition collisions are, of course, a worldwide problem, and two collisions at the 2017 World Gliding Championships prompted the development of a tool to analyse logger traces to determine the frequency and circumstances of close encounters [7] and identify pilots who are more tolerant of risk. The tool appears to be effective, and in many cases contrite pilots seem to have been unaware of how close they were flying.

CIRCUITS

Circuit patterns are designed to deconflict aircraft with similar intentions at a busy phase of flight, and it's important that pilots follow them as far as circumstances permit. An aircraft should not normally cut in front of another in circuit but, without an engine, gliders may have no choice. In such circumstances, it's crucial to maximise separation by turning early, expediting the descent and landing long. Bear in mind that, once you have overtaken the other aircraft, you will no longer be able to see it. Use of the radio can help situational awareness.

While some circuit collisions occur because of departures from the standard pattern, at least two collisions have occurred when one glider inadvertently descended onto another at the same phase of the same circuit. Particular care is needed when there are alternative routes to the final approach, such as opposite circuit directions or a join from long finals.

RIDGE AND WAVE

A handful of collisions have happened during ridge and wave flights, when a number of soaring gliders have to share a limited region of airspace. Ridge-soaring rules are designed

to mitigate the collision risk, but a busy ridge is always a hazard, especially if it overlaps with the airfield circuit. Vigilance is essential.

While FLARM should work as advertised during ridge and wave flight, it will give the bearing of a collision threat relative to the aircraft track, which may be quite different from its heading.

CRUISE

Collisions predominantly occur between aircraft pursuing the same activity: circuits, soaring, the same competition task. The 'big sky' principle generally works otherwise – collisions in the cruise are very rare – but it also means that aircraft can approach from any direction in any orientation. Occasional weaving manoeuvres can allow you to check your blind spots while presenting a varying view to nearby aircraft. Electronic conspicuity systems can alert other pilots and bring unnoticed aircraft to your attention.

If there are airspace or weather constraints, or gliders are flying the same routes between turning points or thermals, then head-on encounters become more likely; and the high closing speed and lack of relative motion make approaching aircraft harder to spot. In such circumstances, bright canopy or fin-mounted flashers may make the threat aircraft more obvious. The latest LEDs are very bright, and several manufacturers offer installable systems.

While technology can help, the key ways to avoid mid-air collision are disciplined flying and vigilant look-out. In all cases, remember that the aircraft you can see may not be the only one to present a collision threat, or the one that triggered your FLARM.

Tim Freearge and the BGA safety team

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■ The BGA's Managing Flying Risk [8] provides further advice about avoiding mid-air collisions.

[1] Keeping safe in thermals, S&G (June/July 2019)

<https://tinyurl.com/flyright2419>

[2] AAIB, G-KADS and G-CLXG (2024)

<https://tinyurl.com/flyright2420>

[3] In a steady turn, the rate of turn in turns per minute is given by $60 g \tan \theta / (2\pi v)$, where θ is the bank angle, v the speed and g the acceleration due to gravity, in SI units.

[4] Mike Fox, How to position yourself when thermalling with another glider, <https://tinyurl.com/flyright2421>

[5] Kevin Atkinson, Aim Higher #24: Gaggle Flying, S&G (April/May 2024)

<https://tinyurl.com/flyright2422>

[6] Airprox report 2020102 (2020)

<https://tinyurl.com/flyright2423>

[7] John Wharington, Analysis of mid-air close encounters in gliding competitions and proposal for a penalty based remediation, FAI (2017)

<https://tinyurl.com/flyright2424>

[8] BGA, Managing Flying Risk – collision avoidance

<https://tinyurl.com/flyright2425>

PREVIOUS 'FLY RIGHT' ARTICLES

- The perils of distraction (Apr/May 19)
- Keeping safe in thermals (June/July 19)
- Why it is good to think ahead (Aug/Sep 19)
- The effects of wind gradient (Oct/Nov 19)
- A fun but safe introduction (Dec 19/Jan 20)
- Stop the drop (Feb/Mar 20)
- Avoiding upset (Apr/May 20)
- Backroom boys (June/July 20)
- Cockpit muddle (Aug/Sep 20)

- Safe rotation (Oct/Nov 20)
- Cockpit remedies (Dec 20/Jan 21)
- COVID currency (Feb/Mar 21)
- Eroded margins (Apr/May 21)
- A good lookout (June/July 21)
- Trouble with turbos (Aug/Sept 21)
- 'Hopefully' is not an option (Oct/Nov 21)
- Act when the launch fails (Dec 21/Jan 22)
- Time to solve a knotty problem (Feb/Mar 22)
- RTFM: Read the flight manual (Apr/May 22)

- Startling events (June/July 22)
- Collision risks (Aug/Sep 22)
- Winter hazards (Oct/Nov 22)
- Swiss cheese (Dec 22/Jan 23)
- An expensive mistake (Feb/Mar 23)
- What's changed? (Apr/May 23)
- Aerotow eventualities (June/July 23)
- Problems with probabilities (Aug/Sept 23)
- Winch nuances (Oct/Nov 23)
- Heart troubles (Dec 23/Jan 24)
- Inadvisable turn (Feb/March 24)
- Partial failures (Apr/May 24)